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Message from the Editor-in-Chief

The Online Journal of Science and Technology (TOJSAT) reflects rapid development on diffusing valuable researches from interdisciplinary fields through academic papers. The journal aims to underline the significance of merging academic disciplines and different practices in the field of science and technology. In this respect, selected papers from the field of science and technology need to be original, different practice on the base of qualitative and quantitative researches, especially mix approach.

As this issue promotes how the journal is developing as regards its vision and mission, there are valuable researches and their studies that contributed to the journal. Therefore, I would like to thank to editorial board, reviewers and the researchers for their valuable contributions to the journal and this issue.

July, 01, 2012
Prof. Dr. Aytekin İŞMAN
Editor-In-Chief

Message from the Editor

Dear Readers,

Now, we have reached the third issue of second volume. It is one of the fast developing journal which covers all subject areas of Science and Technology.

In this issue of journal, selected papers such as Myco and Phyto Remediation of Heavy Metals from Aqueous Solution; The Effect of Monks in the Hungarian Urban Design and Landscape Forming; Character Level Authorship Attribution for Turkish Text Documents; From Minimum Tillage to No Tillage, Reaction of Waha, Variety of Drum Wheat in Algerian Semi-arid Region; The Shell Characteristics of Land Snail Eobania Vermiculata from Croatia will be published.

Next issue of the journal will cover the final issue of the second volume presented in International Science and Technology Conference, 2011.

July, 01, 2012

Prof. Dr. M. Şahin DÜNDAR

Editor, TOJSAT

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Adaptation Measures in EIA and Risks Management:
An Overview of the Legal Framework in Pakistan

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Abstract: This paper aims to discuss the development of Environmental Impact Assessment (EIA) in its historical perspective, and, its status of implementation and effectiveness in the existing legal framework in Pakistan. EIA emerged as a popular discipline in response to widespread ills, associated with environmentally unsound development pursuits in the past. The human environment witnessed serious manifestations due to persistent neglect of the natural environment in agricultural and technological revolution; especially after WW-II. The UN conference on the human environment in 1972 was the first commitment at the international level to adopt the principles of environmental conservation in development strategies. Realizing its obligations, Pakistan embarked on new institutional and legal measures for environmental preservation in 1983. In order to strengthen EIA system, the first environment ordinance, 1983 has undergone many changes to the existing Pakistan Environmental Protection Act, 1997. The changes are worth discussion in the context of growth in the number of EIA reports, and strengths and weaknesses of the current IEE / EIA Regulations, 2000. The conclusion and suggestions summarizes the prospect of EIA in the country beyond the legal cum institutional reforms to political commitment, capacity building and public involvement in the specified steps in EIA studies.

Keywords: Environmental Impact Assessment (EIA), human environment, Initial Environmental Examination (IEE), prospect, public participation

Introduction

This part summarizes the historical background of EIA, as adopted to mitigate the harmful effects, and, their subsequent unfavorable alterations in the environment due to environmentally-unfriendly development projects / programs. The tool of EIA provides an elaborate picture of the future scenario that may arise due to project implementation and offers assessment of various alternatives available, with varying levels of mitigating measures for offsetting adverse impacts on the natural vs human environment.

History of EIA

The history of Environmental Impact Assessment (EIA) is, in fact, as old as the history of development of human civilisation (Ali, 1993). Although, the safeguards of the surroundings of humankind has always been the focus of concern through the long history of development of human civilisation, the terms _"environment" and "Environmental Impact Assessment" have been referred to most frequently, recently after the widespread adverse consequences of development during the last 3-4 decades. Historically, man has always altered the natural world in his pursuits of food, resources and comforts (Ali, 1993). The early impacts were emerged due to agricultural chemicals to achieve maximum yields and avert damages to agricultural produces to meet needs of the faster population growth. Before the industrial revolution, the inorganic chemicals like Sulphur before 1000 B.C and Arsenic in 79 A.D were used against pests (Ali and Siddiqi, 2000). After the industrial revolution in the 18th century, the use of various chemicals and the consequent waste, posed considerable threats to environmental quality. Other chemicals such as mercuric chloride in year 1705 and copper sulphate in year 1800 were discovered to be useful for widespread use in agricultural fields (Horsefall, 1956). In 1850 rotenone and pyrethrum (Ali and Siddiqi, 2000) and Bordeaux mixture in 1882 were discovered and brought into use (McCallan, 1967).

The discovery of DDT by Muller in 1939 was considered a welcome addition to chemical stock till 1960s, after which it was banned almost in all developed and many less developed countries due to its broad spectrum nature, persistence in the environment and bio-accumulation in living organisms. Mellanby (1970) has described the role of DDT in WWII, and suggests that it was the widespread use of DDT which helped the western powers to win the war. According to Curi (1983), EIA has become popular in 1970s, but in reality it was an activity performed under different names since the human history. Curi interestingly quotes the example of Adam (Peace be upon him) and Eve (Peace be upon her) in Paradise, when Eve made a very rapid EIA. The older approach towards EIA is

similar (Fortlage, 1990). Fortlage has given an example from 1548, when a commission comprising of chief assessors and other investigators was set up to examine the effects of the Wealden iron mills and furnaces in Kent and Sussex. The wide-scale public interest and concern for the present state of environmental safeguards as through EIA tool was aroused by Rachel Carson's book "Silent Spring" (Carson, 1962) published first in 1962 in USA and then in UK in 1963. She succeeded in showing the people how their land and lives were getting affected by the large scale and indiscriminate spraying of pesticides.

From this beginning arose public concern for the environment; and eventually pressure by the public and environmentalists forced state and federal authorities in USA to exert some control over the release of toxic chemicals into environment (Fortlage, 1990). As a result two bills were introduced to the US congress in 1969 to establish a national policy for the environment, which were later amalgamated into the National Environmental Policy Act (NEPA), which became law on 1st January, 1970. President Nixon issued Executive Order 11514 in March 1970 to implement the provisions of NEPA (Departments of the Environment & Transport, 1978). However, in view of the author, the principles of environmental assessment were accepted internationally at the United Nations conference on the Human Environment held on 5th June, 1972 at Stockholm (UN, 1972); wherein the serious concerns for environmental preservation, later on, led to the generation of the significant publication of "World Conservation Strategy" by IUCN, UNEP and WWF in 1980. Since the Stockholm conference, a number of industrialised countries have adopted EIA procedures. The Netherlands has been a driving force in the development of the state of the art of EIA in Europe. In mid seventies, the government announced its intention to submit legislation designed to create an EIA requirement. Consequently the Dutch government finally introduced its bills on EIA into parliament in May, 1981 (Moltke, 1984). According to Petts and Wood (1999), the Netherlands had in fact already put its EIA system before the European Community Directive on EIA; that was adopted in July 1985 (Wathern, 1988). The EC Directive requires for a formal review procedure of EIA reports ((European Commission, 2001). Canada, Australia, and Japan for example, adopted EIA system in 1973, 1974, and 1984 respectively. According to Turnbull (1984), there has been a slow growth of interest EIA in UK. In 1976 the Royal Commission on Environmental Pollution gave the direction that developers should provide an assessment report of air, water, waste and noise pollution arising from certain developments.

Many less developed countries have also been quick in adopting EIA procedures. Columbia became the first Latin American country for adopting EIA in 1974. In Asia and the Pacific, Thailand and Philippines have long established procedures for EIA. Thailand adopted National Environmental Quality Act in 1975, and made EIA mandatory by 1978 (Sudara, 1984). In Philippines, EIA was promulgated as part of a Presidential Decree on environmental policy; Korea adopted a mandate for EIA in December, 1979 and put into effect in January, 1980; while Brazil adopted the National Environmental Policy Law in 1981, which mandates the EIA (Lim, 1986). Pakistan adopted the first Pakistan Environmental Protection Ordinance in 1983, which requires environmental assessment for development projects (GoP, 1983), however, it was replaced with the current most comprehensive act called Pakistan Environmental Protection Act (PEPA), 1997 (GoP, 1997). The Article 50 of the Constitution of the Islamic Republic of Iran has provisions for environmental protection and clause 82 of the Law of Second Five-year Development Plan (1994-1998) and the Clause 105 of the Law of the Third Five-year Development Plan (1999-2003) puts EIA obligatory for major development projects (*eiairan website*). A number of nations in Africa, including Rwanda, Botswana and the Sudan have the experience of EIA (Klennert, 1984). The United Nations Environment Programme (UNEP) has provided guidance on the assessment of development proposals and so to level the way for adopting EIA (UNEP, 1980) and supported research on EIA strengthening in developing countries (Ahmad and Sammy, 1985). In view of the recognition of EIA, laws have been enacted in many countries, including the less developed, to facilitate public involvement and expert consultation in the EIA process (Jennifer, 2008).

EIA and Risk Management

The role of EIA as an adaptive strategy for the management of risks (Noble, 2000), associated with a proposed project on the natural and human environment can be explained by the definitions and the procedures adopted for the conduct of EIA studies. EIA being relatively new discipline, there is a range of variation regarding the EIA definition and approach towards procedures / process from country to country and amongst the academicians and scholars. Therefore, it is important to note that there is no general and universally accepted definition of EIA (Clark, 1984). However the authors have established EIA as an effective planning and management tool (Hollick, 1981; Samarakoon and Rowan, 2008; Snell and Cowell, 2006, Wathern, 1994; Wood, 1993, and Polonen et al, 2010).The procedure involves a systematic approach towards examining all the relevant parameters of the environment. Most of the authors have evaluated the role of EIA for providing "with project" and "without project" situation to the decision makers and explores a number of alternatives to minimise the adverse impacts. The concept of alternatives has been elaborated by Blanchard (1974), while Hopkins et al., (1973)

emphasises the description of present conditions, alternative actions (including engineering options, design options, location options and current action), description of probable adverse impacts and description of mitigating actions for offsetting the adverse impacts and the potential risks.

According to OECD (1979), EIA is comprised of five essential elements; in which the element (iv) is particularly on the assessment of different alternatives to minimise the unfavourable impacts. According to Garner and O'Riordan (1982), EIA plays its ultimate role for economic development by describing the repercussions of proposals on bio-physical process, social processes and cultural norms; thus aiding decision making process to avert the potential disasters associated with development proposals. Turnbull (1983), in discussion of "The Role of EIA in Decision Making" has described its function as to generate and make available information on the environmental implications of a particular plan or development project. Studying solely the essential elements or contents of EIA, one can easily reach the conclusion that EIA is the only option left to protect the environment while achieving economic development by giving the basis for making a sound decision. Motayed (1980) has advocated this approach for investigating a large number of alternatives and feasible sites for power plants and also a "Weighting-Scaling" technique for the evaluation of alternatives, in order to eliminate the problems and complexities; arising due to subjectivity in the assessment. Pearce and Turner (1990) have submitted considerable findings for sound decision making. The Tyldesley and Associates (2005) have highlighted the role of EIA from the UK experience, and its further usefulness / added value in a comprehensive survey in Netherlands (Scholten, 1997).

The elements / contents of EIA discussed above are no less convincing but Ahmad and Sammy (1985), has suggested more explicit format of EIA, especially for the developing countries. The EIA procedure and the resulting contents suggested by them is comprised of:

i) Preliminary activities including,

    _identify decision maker(s), taking decision on the fate of the project.

    _select a coordinator for the EIA study

    _decide on work allocation by the specialist experts

    _write description of proposed action

    _review existing legislation (about environment, other resources and   land acquisition etc)

ii) Impact identification (scoping)

iii) Baseline study

iv) Impact evaluation (quantification)

v) Mitigation measures

vi) Assessment (comparison of alternatives)

vii) Documentation

viii) Decision making

ix) Post auditing

The step (v) above, is especially considered in EIA, which is comprised of different measures to eliminate the adverse impacts altogether or to minimise their intensity to tolerable levels. The last component of EIA devises plan for monitoring / post auditing of the environmental impacts during the construction and operation phase of the project.

Material and Methods

The materials and methods used for this paper are comprised of the following research tools:

- Literature review of books / journals and government documents
- Compendium of the Pakistan Environmental Laws, including IEE / EIA Regulations, 2000
- Pakistan Environmental Protection Agency and EPA's EIA Registers
- Interviews with officials of Federal and Provincial Environmental Protection Agency, Khyber Pakhtunkhwa (EPA-KP)

Results

Legal Framework

The first umbrella cover to environmental assessment system in Pakistan was provided under the "Pakistan Environmental Protection Ordinance, 1983" (GoP, 1983). The ordinance, although incomprehensive in scope and application, was the first commitment at the state level to ensure environmental safeguards in development pursuits. The ordinance required for environmental impact statement (EIA) under section 8 and outlined the necessary process under subsections (1-5) of section 8. The ordinance focused primarily on industrial operations and unspecified public waters.

The perceived technical lacunas were overcome with the existing legislation of "Pakistan Environmental Protection Act, 1997" (PEPA, 1997), which is highly ambitious to incorporate preventive and curative measure for the promotion of sustainable development in the country (GoP, 1997). The Act is comprised of 34 sections and consist 45 definitions of environment related concepts / activities to help avoid technical ambiguities / confusions in its implementation. Besides, properly defined powers and functions of Pakistan Environmental Protection Council, a policy formulating body under section 3-4, Pakistan Environmental Protection Agency, Islamabad along with the respective provincial Environmental Protection Agencies have been established under section 5-8 of the Act.

IEE and EIA System in Pakistan

The section 12 of the 1997 Act provides for IEE and EIA of development projects, which is detailed further under subsection (1-7). The public participation has been made mandatory during every review process of EIA under subsection (3), and is comparable with many developing countries such as Egypt, Tunisia, India and Srilanka (Nadeem and Hameed, 2008, Paliwal, 2006, Ahmad and Wood, 2002, and Zubair, 2001). Furthermore, there is requirement for maintaining Registers for IEE and EIA to be kept open to public for inspection at all reasonable hours under the subsection (7) of the Act. The Act has prescribed penalties under section 17, trial able by the Environmental Tribunals, established under section 20-21, and, the Environmental Magistrate under section 24. The non-compliance with section 12, relating to IEE and EIA is considered a major offence and is trial able by the Environmental Tribunals, with the power of imposing up to Rs. one million (approx. US $ 12,000) and in case of continuing contravention or failure, with an additional fine up to Rs. 100,000 (approx. US $ 12, 00) for every day during which such contravention continues.

The newly adopted IEE and EIA Regulations, 2000 (GoP, 2000) make the system more effective and strengthens EIA as decision making tool. The Regulations are detailed into 24 in number, and requires for IEE under Regulation 3 and for detailed EIA under Regulation 4. The Regulation 10 requires for Public Participation, which is further outlined into sub-regulations (1-6). There is a comprehensive Review process under Regulation 11; and, Monitoring requirement, as being considered essential to ensure compliance with the conditions of approval (Riffat, 2006 and Simoneit, 2005). The Monitoring system in Pakistan is provided under Regulation 19 to examine the implementation of the mitigating measures and any other unforeseen adverse impact on the environment. The Monitoring activity at present is weak as under the Regulations in vogue, it is the responsibility of the proponent of the project. This should be replaced with to be performed by an independent authority / consultants. The development projects have been categorised into Schedule I for IEE and Schedule II for EIA requirement. The categorization, however, is mainly based on projects' cost and capacity, which should be on the level of impacts and potential threats to the environment like China (Chen et al., 1999; Wang et al., 2003).

Implementation Status of EIA System in the Country

Since the first environment ordinance in the country in 1983, there has been growing recognition of the EIA tool to mitigate unfavourable impacts of development projects; and, to help pave the way for sustainable development. The data in table # 1 about the last nine years (2000-2008) illustrate a continuous increase in the number of EIA reports i.e. from 06 in the year 2000 to 109 in the year 2008, submitted to Federal and provincial EPAs for processing approval of EIA. This shows a progressive trend in implementation of the EIA system as 159 environmental clearance / NOCs were issued against 315 reports received for the purpose.

Table 1: Year-wise Implementation Status of EIA System in the Country (2000-2008)

S. #	Year	EIA Received	NOC Issued
1	2000	6	6
2	2001	6	6
3	2002	11	10
4	2003	12	11
5	2004	29	14
6	2005	28	15
7	2006	28	19
8	2007	86	33
9	2008	109	45
Total		**315**	**159**

Source: Pak-EPA, Islamabad (2009)
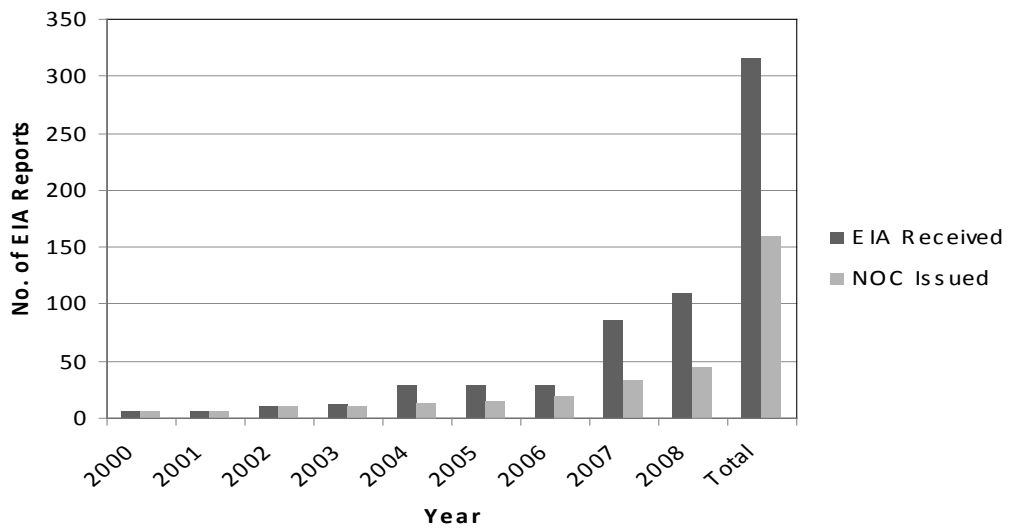
Figure 1: Year-wise Implementation Status of EIA System in the Country (2000-2008)

The province-wise status of IEE / EIA is as shown in table # 2.

Table 2: Province-wise EPAs' Performance statistics (2000-2008)

S. #	Pak-EPA	EPA-Punjab	SEPA	EPA-KP	EPA-Baluchistan	Total
1	19	202	45	34	15	315

Source: Pak-EPA, Islamabad (2009)

The statistics show that EPA-Punjab processed significant number of EIA reports during the period (2000-2008), followed by EPA, Sindh, KP and Balochistan as being based on the size of population, Annual Development portfolio and number of industrial units.
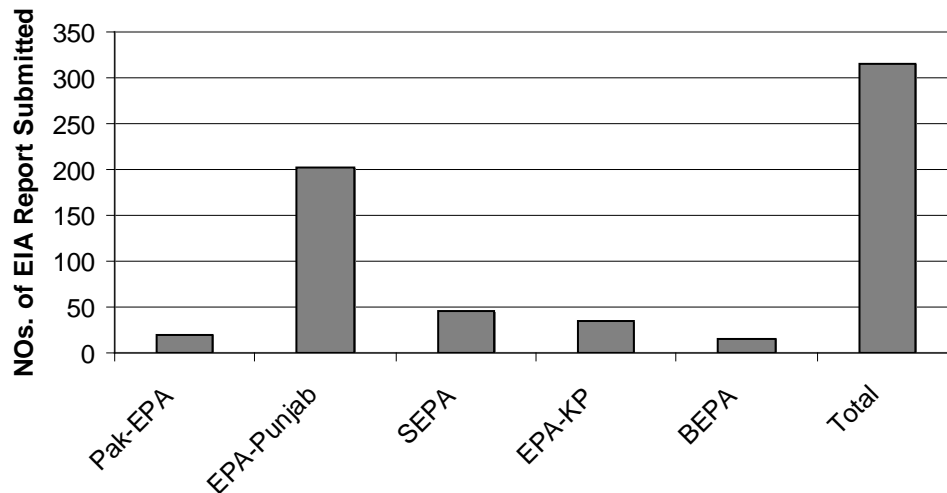
Figure 2: Province-wise EPAs' Performance Statistics (2000-2008)

Implementation Status in KP

The data about the last six years (2004-2009) illustrate a continuous increase in the number of EIA reports i.e. from 02 in the year 2004 to 07 in the year 2009; The highest number, however, of 14 EIA reports have been recorded for the year 2008, submitted to EPA, KP, for processing approval thereupon. This shows a positive trend in implementation of the EIA system as 21 environmental clearance / NOCs have been issued against 33 reports received for the purpose.

Table 3: Year-wise Implementation Status of EIA System in KP (2004-2009)

S. #	Years	EIA Received	NOC Issued	NOC not Issued	Under Process
1	2004	1	1	NA	NA
2	2005	3	3	NA	NA
3	2006	2	2	NA	NA
4	2007	6	4	1	1
5	2008	14	8	1	5
6	2009	7	3	1	3

Source: EPA-KP (2009)
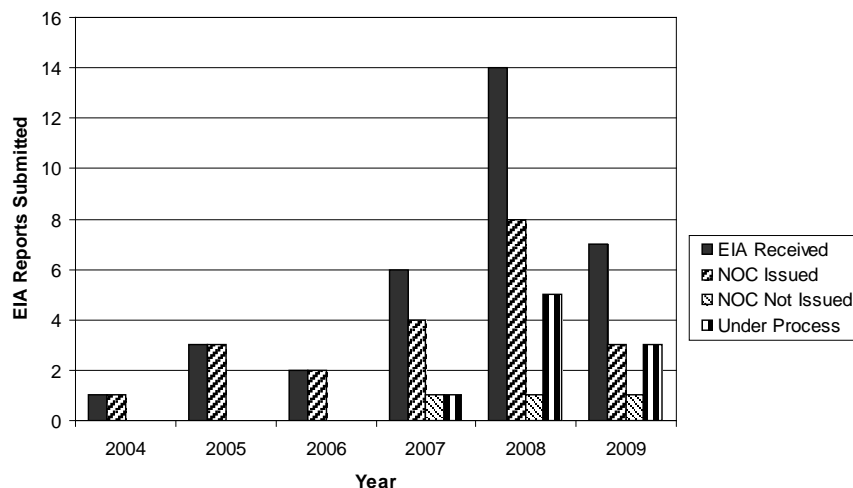
Figure 3: Year-wise Implementation Status of EIA System in KP (2004-2009)

The data show, almost, a consistent growth in the number of EIA reports, submitted to EPA, KP. The highest number is recorded for the year 2008; however, the decline in the year 2009 may be attributed to security situation arising out of large scale military operation in the province in war against terrorism.

Policy Challenges

Lack of Integration of EIA at the Planning Level

The existing EIA system needs a policy shift from using EIA tool at the project level to its use at the planning level / inception of the project, a term Strategic Environmental Assessment (SEA) often used. Under the existing system, it becomes mere compliance with the legal imperative rather to use EIA for offsetting adverse implications of the projects in terms of exploring alternatives and the least possible disapproval of the projects. The disapproval, especially of the public sector projects becomes rather difficult after the commitment of funds etc.

Lack of Co-ordination between the Line Departments

The existing PEPA, 1997 should assign overbearing responsibility to all the line departments to carry out IEE / EIA of their respective sectoral projects on their own, and must involve the Pak-EPA / provincial EPAs in the review / approval processes. This will contribute to highest consistent growth in the number of IEE/ EIA reports for projects approval.

Institutional Strengthening

The effectiveness of EIA is largely depended on proper institutional arrangements in a country. Many developing countries face the constraints of weak institutional capacity for doing EIA, and the following appraisal and review process (Nadeem and Hameed, 2008, Kruopienė et al., 2009, Clausen, et al, 2010).This study reveals that Pak-EPA / provincial EPAs are not adequately equipped with the monitoring and inspection capabilities in terms of the state of the art equipments, manpower and financial support. The effective enforcement of PEPA, 1997 and the Regulations, 2000 is largely dependent on the institutional strengthening in the country.

Lack of Public Participation

Public participation is considered as an essential requirement for the success and usefulness of EIA process (Ahmad and Wood, 2002, Annandale, 2001, Barker and Wood, 1999, El-Fadl and El-Fadel, 2004, Leu et al., 1996, Ortolano et al., 1987, Paliwal, 2006, and Wood and Coppell, 1999). Therefore it is an integral part of EIA in many developed and less developed countries (Barker and Wood 1999, Wenger et al., 1990) and a tool for the evaluation of EIA transparency (Wathern 1994).The past IEE / EIA reports in Pakistan show that the local communities are not involved in the EIA studies, the least during the impacts scoping (identification), impact evaluation and decision making. However, under the existing Regulations, 2000 (i.e. Regulation 10), there is a crude system of public participation in the form of public hearing during the review process, which carries many

shortcomings. The public participation must be comprised of involving local communities, environmental groups / associations and academia at all crucial stages of EIA, especially during the decision making process.

Political Clout

The existing political thought in the country is largely empty of extending the required support to translate environmental conservations into practice through institutional cum legal reforms and enforcement. Such situation prevails elsewhere in many developing countries (Alshuwaikhat, 2005, and Clausen et al., 2010). The political support can be heightened through vigorous campaigns, media attention and boosting green journalism in the print and electronic media.

Conclusions and Suggestions

The study shows that EIA is relatively a new multidisciplinary decision making tool in the field of environment, adopted in response to widespread adverse implications of the environmentally flawed development pursuits. Although, the importance and significance of the application of Environmental Impact Assessment (EIA) as decision making tool was realized in 1970s, its application is being promoted vigorously globally, including Pakistan, to eliminate / minimise the ill-effects of development projects on the natural and human environment.

Pakistan has passed through adopting legal and institutional reforms since the first ordinance in 1983 to the existing PEPA, 1997 and the recently adopted "IEE/ EIA Regulations, 2000". The PEPA, 1997 is more comprehensive and, sufficiently possessive of preventive and curative measures to prevent environmental degradation; and pave the way for environment friendly sustainable development. The non-compliance with Section 12, pertaining to IEE / EIA entails punitive proceedings against the violators in the form of imprisonment and fines, and therefore, the study has found a steady growth in the number of EIA reports submitted in the country. The highest numbers of reports have been submitted to Punjab province followed by Sindh. The Regulations, 2000 have consolidated the application of EIA tool in terms of projects categorisation, review process and public hearing. Although, the review and decision making process need further improvements to make the system more effective. The Act and the EIA system in the existing format is a welcome initiative, and, remarkably comparable with good EIA processes in many countries in the world. The environmental implications of the modern development continue to pose new challenges from time to time in Pakistan as elsewhere in the world. Nevertheless, Pakistan has been sufficiently consistent to pace with the global community in taking legal and institutional initiatives. However, to make the EIA system more responsive in the country, the following suggestions are underlined below:

➢ The EIA tool should be applied at the project's planning level to facilitate projects' financial and technical vetting vis-à-vis environmental acceptability and to help identify viable alternatives. This provision must be applied to projects preparation in all line departments of the Federal and provincial governments.

➢ The existing guidelines should be improved to make the procedure of EIA study cost effective and with the involvement of real experts for carrying out EIA studies. Further, the experts / consultants should be obliged to do public consultation / participation during the impacts scoping and evaluation. A code of conduct must be adopted for the EIA experts / consultants to use the EIA system for usefulness of both the project and environment.

➢ Amendments should be made to existing Review Procedure of the EIA reports, and the system must incorporate the local communities, media and academia during the review process.

➢ As EIA study is based on predictions, the actual impacts must be evaluated through a sound Post Auditing / Monitoring System in the Federal and provincial EPAs. This will help identify the gaps between the predictions and actual impacts of the projects and to act as an important feedback for future EIA studies; most importantly, for the timely intervention in wake of any unforeseen adverse impacts.

➢ The information sharing should be reinforced for accommodating concerns of all stakeholders and to ensure transparent / unbiased review of EIA reports, submitted to environmental agencies. Information sharing act as feedback for EIA experts / environmental agencies, and winning trust of the local communities about the utility of EIA system.

Acknowledgments

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Character Level Authorship Attribution for Turkish Text Documents

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Abstract: Individuals have their own style of speaking and writing. Style of a text can be used as a distinctive feature to recognize its author. In recent years, practical applications for authorship attribution have grown in areas such as criminal law, civil law and computer security. Recent research has used techniques from machine learning, information retrieval and natural language processing in authorship attribution. In this paper, Statistical Language Modeling is utilized in Authorship Attribution. Each author is represented with feature statistics. Letters, punctuations and special characters which build up the feature set are utilized to calculate the profiles of the authors.

Key words: Authorship Attribution, Character Level Method, Centroid Values, Centroid Vector, Document Vector

Introduction

The topic of the article is authorship attribution and this study aims to recognize authors of Turkish texts automatically. In addition, it can be utilized in different areas such as spam filtering, determining plagiarism cases, identifying author of program code and in forensic analysis. The output of this study will be classification of texts based on the authors, determining the authors with similar styles in writing and classification of authors depending on their styles. Similarity in the authors' styles is related to their cultural or geographical backgrounds. This situation makes us able to reach interesting information about the authors.

In authorship attribution studies researches have experienced different features such as function words, content words, character n-gram, word and punctuation marks profile etc. Their performances are changeable. While some of these methods give best results, some of them don't give because of preferred dataset. Stylistic and statistical methods can be utilized for authorship attribution. This study deals with the statistical methods in authorship attribution. Recognizing the author by statistical methods necessitates accurate expressions of numerical data.

In the proposed method; letters, punctuation marks and some special characters are added to the feature set individually. Feature set of this method is considerably small compared with the feature sets of other methods. In the character level authorship attribution, including the punctuation marks and special characters such as "space" and "enter", all characters that form the text are all members of the feature set. For this reason, no preprocessing step is required and we are able to work with raw data. And we can easily acquire this type of information. With the proposed character level method, we profit from the costly preprocessing steps. Proposed method uses centroid based classification algorithm which is a very successful algorithm in text classification as well as Bayesian text classification (Han & Karypis, 2000).

The rest of the paper is organized as follows. Next, in Section 2, we give briefly related works. Section 3 describes the character level authorship attribution. After that, Section 4 gives information about experiments and results, and finally Section 5 includes our conclusion that we have been able to achieve so far.

Related w-Works

The authorship attribution system is an application which aims to recognize the author of a text and it is in relation with different areas such as speech recognition, spam filtering and copyright. The studies on authorship attribution have been continuing since 19th century. In 1887 Mendenhall made first known study about authorship attribution and he used words as feature (Mendenhall, 1887). Zipf and Yule used statistical method for authorship attribution respectively 1932 and 1938 (Statamatos, 2008). In 1964 Mosteller and Wallace used Bayesian Analysis of 90 functional words to find authorship of "The Federalist Papers" (Mosteller &

Wallace, 1964). This study is accepted milestone of authorship attribution. After Mosteller and Wallace study, functional words were started to use in many studies (Koppel, Scheler & Argamon, 2008).

In 1990s, researchers started to use linguistic style for authorship attribution (Statamatos, 2008). Using linguistic style for text is called stylometry. Stylometry originates with the suggestion of Augustus de Morgan in 1851 that "it might be possible to identify authors because one might deal in longer words" (Morgan & Elizabeth, 1882).

In 2001 Grant and Baker described an approach known as Principal Component Analysis. This approach identifies which marker or combinations of markers are effective in discriminating the author of a text (Grant & Baker, 2001). In Baayen and his colleagues' study they proved that authors have 'textual fingerprints'. Statistical methods were used in their study and according the results discriminant analysis is a more powerful technique than principal component analysis. Using punctuation marks with function words and content words increase the classification accuracy (Baayen, Halteren, Neijt & Tweedie, 2002).

Vocabulary richness and repetition; word type frequencies and distributions; word, sentence clause and paragraph lengths and distributions; syntactic analysis, co-occurrence and collocations; and content analysis are the other valid criterions in authorship attribution. Diri and Amasyalı used these criterions to identify authors of Turkish texts and developed a new classification technique. In their study 22 of style markers figured out for each 18 authors and %84 success rate has been reached in average (Diri & Amasyalı, 2003). In 2007 Taş and Görür developed a new classification technique to identify author for Turkish texts. For identifying the authors, 35 of style markers have been figured out. Their experimental group consists of 20 authors and with the developed method they obtained a success rate of %80 in average (Taş & Görür, 2007). Grieve used thirty nine different types of textual measurements in attribution studies in 2007, with word and punctuation mark profile they reached best results, also 2-gram and 3-gram profiles give best results (10-author limit) (Grieve, 2007).

Character Level Authorship Attribution

Character level authorship attribution is an author recognition method which deals with individual characters that compose the text. Characters can also be utilized by the other author recognition methods. But in those methods characters are generally taken into consideration as combinations of characters not individually. In the proposed system, each character individually is a member of the feature set. Besides characters such as "enter" and "space" which can provide vital information about the author's style are also added to the feature set. Character level method is very effective technique for author attribution. Characters were also used in identification of languages and best results were acquired. Language identification studies with characters using centroid based model gave best results. Therefore, in this study character level features and centroid based model were used.

Feature selection which determines the feature set is a very important process. Dimension of the feature set is another important aspect for studies in author recognition. In some methods, such as n-grams and functional words, large feature set decrease the effectiveness of the authorship attribution system. For example, in order to recognize the author of a Turkish text by using the functional words method, all the frequently used words (adjectives, pronouns, adverbs, conjunctions…) are required to be added to the feature set. On the other hand, the feature set of character level model is quite smaller than other methods. Despite the small size of the feature set, features are very successful at representing the text. The other approach in authorship attribution is word level analysis has also some problems. While using word level analysis, morphological features is not important and when studying with some Asian languages which have no explicit boundaries researchers face with problems (Keselj, Peng, Cercone & Thomas, 2003), character level method avoids such problems.

By using individual characters instead of n-grams or functional words, the feature set would be limited with the letters and punctuation marks that are included in the alphabet. For the authorship attribution in Turkish text documents, it is possible to make a feature set consisting of 29 letters of Turkish alphabet and the punctuation marks that are most frequently used in the language. So, individual characters can be used in authorship attribution for real time applications where effectiveness has a vital importance.

When we examine texts from different authors, we find out that different texts of an author have similar character frequencies. Therefore, character frequencies can be utilized to find out the author of a text. Texts written by the same author as well as texts written by different authors have distinct character frequencies. But, while character frequencies of texts written by the same author are very similar to one another, the frequency of texts written by different authors has quite different character frequencies. This case constitutes the basis of the character level model. Hypothesis of our study is "Characters are discriminative markers for authors and texts can be classified due to the frequencies of characters that it includes. Owing to this, each text can be designated to the related group of its author."

Author's style can be used to identify it. This is the second basis of authorship attribution. For example; while some authors hardly ever use exclamation mark, some authors use the exclamation mark quite often, some authors use comma frequently because they like long sentences while some authors use dot more frequently by using short sentences in their writings. These kinds of details in the text have vital importance in authorship attribution.

A model is a simplified prototype of a system. When the character level authorship attribution is considered as a classification problem, the model of the system will consist of training and test phases. Character level model can be stated as follows.

d_i	i^{th} document in the corpus
fr_{ip}	the frequency of pth character in document i
d_{ip}	the relative frequency or n normalized value of fr_{ip}
$\hat{y}_i$	Represents authors of document (training phase)
x_i	Represents authors of document (test phase)
Cj	centroid value for j^{th} author
A_k	represents the average character frequency for k^{th} author
$a_{(T)p}$	represents the total usage frequencies of pth character
c_{ip}	represents the centroid value for p^{th} character in texts of jth author
m	Number of features

Table 1: Parameters

Each document has at least one author. The relation between the documents and their authors (authors are defined with numbers) is stated as follows.

$$D \longrightarrow \{1,2,..,k\}$$

In this study, characters are used as features of the documents, and feature values are the frequencies of these characters in the documents. Values of the determined features are generally presented by vector space model. d_i is represented with a document letter vector as below.

$$\vec{d}_i=(d_{i1}, d_{i2},..., d_{im})$$

Relative frequency (d_{ip}) is calculated in order to prevent errors caused by the length of the document. The relation between fr_{ip} and d_{ip} is as follows.

$$d_{ip} = \frac{fr_{ip}}{\sum_{p=1}^{m} fr_{ip}}$$

d_{ip} is the pth dimension of vector d_i. Each dimension of document vector represents frequency value of a character. The documents whose authors are unknown are represented by X and the document i is represented by the statement x_i. $\hat{y}_i$ is different from y_i because $\hat{y}_i$ is an estimated value, not an accurate value. It is inevitable to make clear the relation between $\hat{y}_i$ and x_i in order to find the author of a document. The equation :

$$\hat{y}_i =\underset{j=1...k}{argmax}(Sim(\vec{x}_i,\vec{C}_j))$$

can be used to show this relationship. Cj value is required for authorship attribution. Before centroid values, average character frequencies for each author have to be calculated. This process aims to find the average character frequencies of the samples. For example, after getting the character frequencies of 100 sample 1KB documents, we can obtain average frequency value for each author by calculating the average value of these frequencies. Average character frequency calculation is as below.

$$\vec{A}_j = \frac{1}{n}\sum_{i=1}^{n} \vec{d}_{ji}$$

Character frequencies for each author can be stated as A=(a_1, a_2,…,a_m). For the author with indice j, presentation of average frequency values by means of features is as follows.

$$A_j=(a_{j1}, a_{j2},…, a_{jm})$$

Following equations can be written where $a_{(T)p}$ represents the total usage frequencies of pth character for all the authors and c_{jp} represents the centroid value for p^{th} character in texts of jth author.

$$a_{(T)p} = \sum_{i=1}^{k} a_{jp}$$

$$c_{jp} = \log(a_{jp} *100/ a_{(T)p})$$

A function called Sim is used for finding similarity. This function is cosine similarity function. Function is stated in 3.9. When the denominator of this equation is removed, we can obtain text scores.

$$Sim(\vec{x}_i,\vec{C}_j) = \frac{\sum_{p=1}^{m} \vec{x}_{ip}.\vec{c}_{jp}}{\sqrt{\sum_{p=1}^{m} (\vec{x}_{ip})^2}.\sqrt{\sum_{p=1}^{m} (\vec{c}_{jp})^2}}$$

Experiments and Results

Data set, that was required for training and test phases of the character level author attribution system, was formed from the articles of a daily newspaper SABAH (www.sabah.com.tr). Articles of the authors who write about different topics such as politics, magazine and medical were preferred. Training set consists of 10 different texts written by 10 different authors and the test set consists of 10 sample texts for each author. The feature set initially consisting of 29 letters of the Turkish alphabet, has been extended to 42 features by adding punctuation marks and some special characters in progress.

Texts have to be presented by numerical data because classification algorithm is used in authorship attribution. For this reason, the frequencies of letters and punctuation marks in the texts are calculated. Characters are counted simply in order to find the frequencies of characters. As the raw data about the character frequencies can't help much, relative frequencies also have to be calculated. After reaching the relative character frequencies for documents, each document is represented by a document vector in document character space.

It is possible to consider the centroids as vectors that present the authors' characteristics. While centroid vectors represent authors, document character vectors represent the documents. Centroid values are obtained from the frequencies of characters which are used by each author. After getting the centroid vectors, similarities between test document and centroid vectors are examined in order to perform authorship attribution process. By applying test scoring method for similarity, it is possible to find the authors' scores of the test document from the dot product of document character vector and centroid vector. After the author scores for the test document are examined, the test document is classified.

Each author has its own style of writing and this is the main idea of character level authorship attribution. In this respect, each author expresses his taught and ideas with different words and different styles of sentences. An author's style makes us possible to recognize the author of a text. Character frequencies being able to let us recognize the author of a text will be the proof of character level method. High success ratio for the authorship attribution has been aimed. For this reason, different experiments have been held in order to find an optimum success ratio. These experiments aim to show that which numerical values should be used to represent the data and which similarity methods should be used.

It is possible to use average frequency and centroid values of texts for recognizing the author. But these experiments show that using centroid values more successful than using average frequency. The most important difference between centroid values and average character frequencies is the logarithm transformation. So, owing to the logarithm transformation high success ratio can be obtained with the centroid values.

Functional words method used besides character based method in respect of correct identification and performance. Accuracy rates are shown in the table below.

ID	Author	Functional words	Characters
1	Author1	%60	%90
2	Author2	%40	%90
3	Author3	%50	%60
4	Author4	%70	%100
5	Author5	%50	%90
6	Author6	%20	%60
7	Author7	%40	%80
8	Author8	%10	%100
9	Author9	%100	%90
10	Author10	%90	%100
Average Success Rate		%53	%86

Table 2: Accuracy Rates

It is examined from the results of the experiments made with the same dataset that character based method is more successful than functional words method. In this stduy 67 functional words were used. While the success ratio for the functional words method is 53%, this ratio is 86% for character based method. While character based method not required preprocessing step, functional words method requires this step. Preproceesing step which is a process applied to each article in the dataset neccessitates a lot of time. Besides, small feature set of the character based method makes it superior to the other methods with large feature set.

Conclusion

With this study, an authorship attribution system has been developed with a character level method and it has been compared to the preceding systems with functional words method. Each author in the character level authorship attribution system has been represented by centroid vectors. The author of a test document is identified after examining the similarities between the document character vector of the document and the centroid vectors of the authors. Cosine method has been used to find similarities.

Character based authorship attribution is superior to other methods in respect of performance and effectiveness. Small feature set, studying with raw data makes this method effective. In respect of correct identification and performance, character based method is the most appropriate and successful method for daily articles. For this reason, it is suitable for cases where performance is important. Character based method can be used in spam filtering or plagiarism detection because these processes are also performed by examining the characteristic features of a text.

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From Minimum Tillage to No Tillage, Reaction of Waha, Variety of Durum Wheat in Algerian Semi-arid Region

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Abstract: The cereal grain producing regions in Algeria are semi-arid characterized by climatic constraints such as frost, the sirocco and especially irregular rainfall their deficit coincides with the demand for the cereal. To address this deficit, increased production must be achieved by improving efficiency, by correcting the climate constraint. Several studies have been conducted with the aim of diagnosing the behavior of grain and develop technical routes for different regions of the country.

Our study is to compare three crop management practiced on durum wheat. The trial was conducted in the semi arid region of Setif. The techniques applied are conventional tillage (CT), the minimum tillage (TM) and direct drilling (SD).

The direct drilling gives good results with high leaf area and plant height which directly influenced the yield and its components. The length of the ear was very similar for both SD and CT techniques. For root development the SD has a tendency to expand horizontally in contrast to the TC and TM. The TM has a higher stomatal resistance than the TC and SD. From stage swelling the water content is high in SD. The technique of direct seeding promotes water retention especially at critical times. This shows the interest that can provide direct seeding in Algeria, where water shortages due to deficient rainfall is the main factor limiting cereal.

Key words: crop management, direct drilling, conventional tillage, minimum tillage, stomatal resistance, RWC, variety WAHA.

Introduction

According Arabi and Roose (1989), limited production is generally attributed to several factors, some beyond the control of man like climate conditions as irregular rainfall, the climate accidents as frost and sirocco at the end of the cycle of plant. The other factors controlled by the man can improve this production are application of new crop management.

The general approach adopted in this study is to compare three differents crop management: direct drilling, conventional tillage and minimum tillage to bring out the most efficient technique to saving water, adjusting and improving performance variety Waha.

Materials and Methods

The trial was conducted in the Experimental Station of the Agricultural Technical Institute average (ITMAS) located 3km south-west of Setif, at an altitude of 1081m. The latitude is 36 ° 9 North and 5 ° 21 longitude. The study area is characterized by a Mediterranean semi-arid climate with cold winters and hot dry summers. The cumulative rainfall from September 2008 to June 2009 was 369.7 mm. The rainfall peaked during the month of April with 77.5 mm and a minimum during the month of May with 3.4mm.

The soil of the experimental plot is clay to silty clay with a pH of 8.5. The plant material is a variety of durum wheat (*Eastivum durum*) the variety Waha. Our test was conducted on the same plot and on the same crop management of the previous year, on an area of 2340 m². The field is divided into 3 units; each unit has a different crop management, direct driling (DS) The conventional tillage (TC) and minimum tillage (MT). In each unit, the number of repetition of 4 has been adopted. Direct drilling was sown directly by a direct seed drill. The conventional tillage plot has been prepared by the moldboard followed by the Cover crop and the harrow. The minimum tillage has been using only the chisel and the harrow. Weeds were controlled using chemical herbicides. An addition of phosphate (TSP 46%) and nitrogen (ammonium nitrate 34.5%) were performed.

The notations and measurements were made during every cycle of the plant. For morphological traits we measured the following parameters: leaf area (LA, mm ²) with a planimeter at boot, heading and flowering stages. Height (H, cm) of the plant is measured from the soil to the base of the spike at maturity. The length of the ear (LE, cm) was measured at maturity, the barbs not included. The root development was studied by the implementation of soil profiles on the three plots (SD, TC and TM). The depth of each profile is 45cm, the roots are carefully removed from the ground and then photographed.

For physiological traits we measured stomatal resistance (Rs; s.cm-1) determined using a diffusion porometer type AP4. For each treatment we considered the upper surface of the middle part of the leaf. Measurements were performed every stage of culture. The relative water content (RWC) on water content was measured using the method described by Barrs and Weatherley (1968). RWC was measured in each phenological stage of culture. The weight of fresh leaf (Pf) and saturated leaf with water (Psat) and dry leaf (Ps) were measured and repeated 4 times. The number of plant is measured at early stage. The number of spikes (NE) and the number of grains per ear (NGE), the 1000 grain weight (PMG), grain yield (RTD) are measured at maturity. The statistical analysis was performed using the software Stat Box Pro Version 7.1.0; it focused on an analysis of variance, a comparison of averages by the test of Newman and Keuls at 5%.

Results and Discussion

The effect of management and phenological stages on the leaf area present was very highly significant. Comparison of average crop management has two homogeneous groups is conducted in the plant till the leaf surface which is higher with the 1712.96 mm ² compared to conventional work and work with minimum respectively 1414.83 and 1346.38 mm ² mm ². A highly significant effect was noted for the interaction of two factors (Table 1).
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Table1. Effect of crop management on the morphological traits of durum wheat inalgerian semi arid region.

Parameters	LE(mm²)	H (cm)	LE (cm)
Crop management (F1)			
SD	1712,96a	57,31a	5,50
TC	1414,83b	54,06ab	5,91
TM	1346,38b	52,31b	4,63
Phenologiaal stage (F2)			
Boot stage	1318,75b	-	-
Heading	1373,13b	-	-
Flowering	1782,29a	-	-
CV%	10,253	4,01	12,360
Proba F1	0,000***	0,029*	0,058 ns
Proba F2	0,000***	-	-
Proba F1xF2	0,005**	-	-
Average	1491,389	54,56	5,35

*,**,*** and ns =significant, highly significant, very highly significant and no significant
        a, b…= groups formed by the test of Newman and Keuls at 5%.

The evolution of leaf area, at boot stage, was the highest in direct drilling followed by conventional tillage then minimum tillage (Fig. 2). This is probably due to water retains in each crop management. Indeed, species arrive to reduce leaf area by water regime (*Onyibe, 2004*).
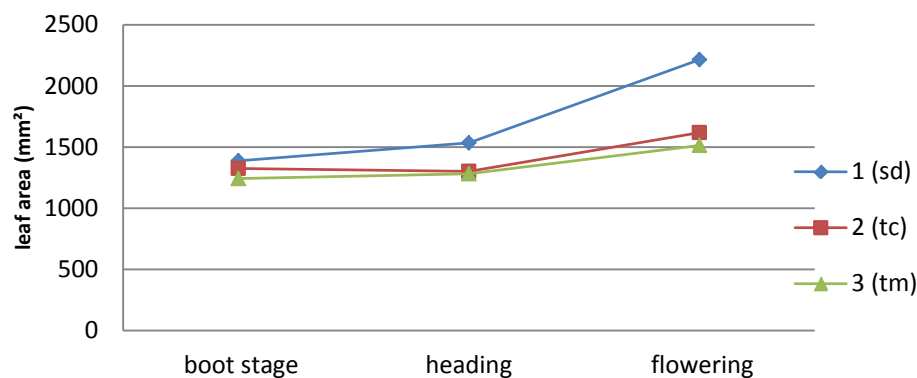
Fig. 1. Evolution of leaf area in different crop management

The height of stems shows a significant difference between the three crop management. Direct drilling presents the highest height with 57.31 cm above the minimum tillage with 52.31 cm and the conventional crop management with 54.06 cm. The height of Waha increases with the rate of rainfall and water supplies for irrigation (Ghouar, 2006). The length of the spike has not been greatly affected by the crop management.

On the ground (Fig.2), we see that roots tend to be developed horizontally in no-tillage because of the resistance of the soil which is quite important in not worked land. In conventional and minimum tillage, the roots tend to grow vertically or in depth in the soil which is till, that encourages deep rooting.
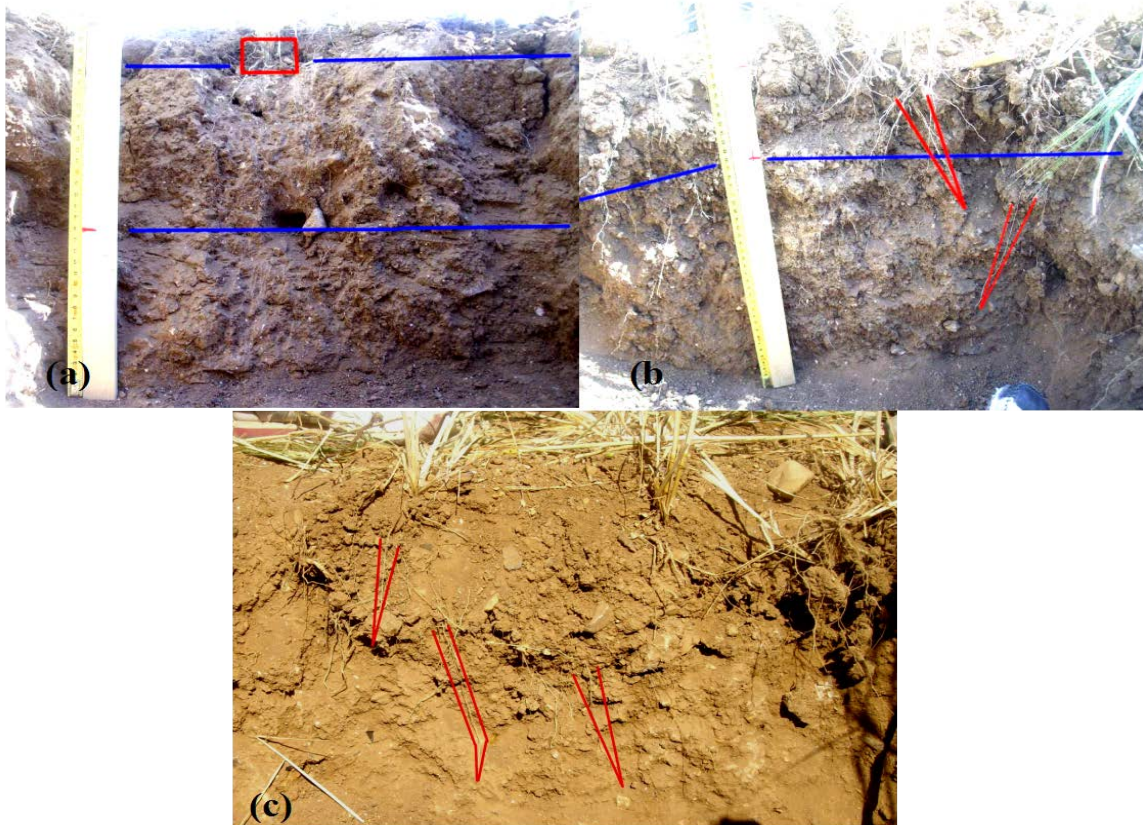
Fig. 2. Roots development in the three crop management conduced on durum wheat. *a: direct drilling, b : conventional tillage and c : minimum tillage. The blue lines are the limits of the horizons, the red arrows are the extension of roots.*

Table 2. Effect of crop management on the physiological traits of durum wheat in Algerian semi arid region.

Parameters	Rs (s/cm)	RWC (%)
Crop management (F1)		
SD	8,05 b	81,46
TC	9,12 b	79,19
TM	10,25 a	77,31
Phenological stage (F2)		
Boot stage	4,41 b	81,59
Heading	13,83 a	75,95
Flowering	14,85 a	71,31
CV%	13,643	9,947
Proba F1	0,000***	0,198 ns
Proba F2	0,000***	0,000***
Proba F1xF2	0,555 ns	0,677 ns
Average	9,140	79,320

*,**,*** and ns =significant, highly significant, very highly significant and no significant
a, b…= groups formed by the test of Newman and Keuls at 5%.

The stomatal resistance is very highly affected by the crop management and phenological stages (Table 2). Minimum tillage presented stomatal resistance highest with 10.25 s.cm^{-1} compared to conventional tillage and direct drilling (fig. 3). Flowering and grain milky stages noted highest stomatal resistance.
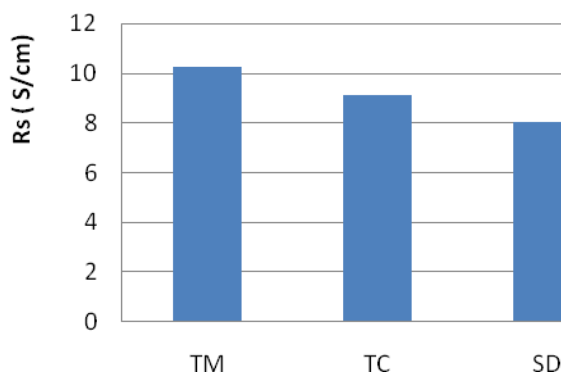
Fig. 3. Effect of crop management on the stomatal resistance.

This increase in stomatal resistance is caused by the closure of stomata which are opposed to the diffusion of water vapor and gases (Denden and Leumeur, 2000). The stomatal resistance was relatively low infrom tillering to boot stage, this is due to large amounts of rain and low temperatures recorded in April, which coincided with those stages.

From the boot stage to flowering, stomatal resistance increases rapidly for three treatments. These stages were held in the month of May when rainfall was the lowest (3.4 mm). Chartzoulakis et *al*. (1999) consider that the stomatal resistance increases with the degree of water deficit.

The relative water content was affected by the phenological stages and not by the crop management (Table 2). The conventional tillage gives a better result at the 3 leaves stage followed respectively by the minimum tillage and direct drilling. From the boot stage, direct drilling gives the best results followed by conventional and minimum tillage, this is due principally to: i) the water economy in the last stages of culture, the RWC of plants is based on the level of soil moisture (Kasraoui et *al*., 2004) and ii) the tillage allowed the conventional crop management a better use of depth water contrary with minimum tillage (no deep tillage).

Table 2. Average and statistical results yield and its components in relation to different cultural practices applied.

Parameters	NE	NGE	PMG	RDT
Crop management (F1)				
SD	462,00 a	23,67	36,37 a	40,33 a
TC	364,00 b	23,67	36,75 a	31,75 a
TM	336,00 b	20,83	31,10 b	21,72 b
CV%	13,778	13,517	3,364	23,761
Proba F1	0,003 **	0,215ns	0,000***	0,002**
Average	387,333	22,722	34,739	31,27

*,**,*** and ns =significant, highly significant, very highly significant and no significant

a, b…= groups formed by the test of Newman and Keuls at 5%.

Direct seeding has presented a high number of spikes with 462 ears / m². Conventional and minimum tillage have presented a lowest number of ears with 364 and 336 ears/m² respectively. This is related to the number of emerged plants in each technique. According to Kribaa (1992), a good water and nitrogen nutrition of wheat (Waha) leads to the achievement of good number of ears that can reach the thresholds of 423,2 ears/m².

The average fertility of Waha is at around 22.72 kernels per ear. Cultivation techniques have exceeded this average, except for minimum work. The highest number of grains per spike is the presented by the direct drilling or no-tillage and conventional tillage with 23 kernels per ear. The minimum tillage presented the lowest value with 20 kernels per ear. Fertility is determined from early tillering to flowering, the period when the growth rate is most important. According Couvreur (1981), the number of kernels per ear is strongly influenced by the condition of the vegetative especially its volume.

A very highly significant effect of crop management was noted on the weight of thousand grains. Direct seeding and conventional tillage provided a high PMG compared to minimum tillage (fig. 3). This difference may be due to the conservation of soil moisture in dry periods during grain filling, which has enabled them to complete the growth cycle and also a better grain filling (Belguerri et *al*., 2007). In wheat, the lifting stages, stem elongation and grain filling are considered key stages of development of major components of performance: the number of seeds/m² and weight of thousand gras.
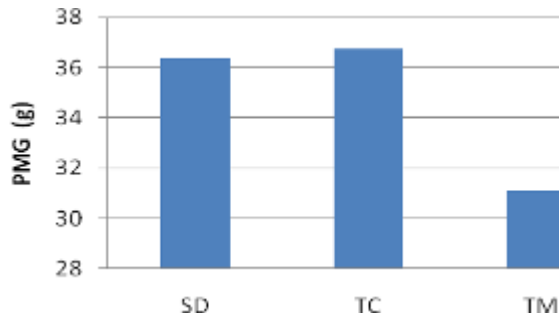
Fig. 4. Effect of crop management on the weight of thousand grains in Waha, durum wheat variety.

The yield shows a very high significant difference between the three crop management tested. We notated two homogeneous groups: the first group is formed by direct drilling and conventional tillage, the second group is formed by the minimum tillage. The no-tillage and conventional crop management showed a high yield with 33.23 q/ha for direct drilling and 29.86q/ha for conventional tillage. The minimum work presented only 22.67q/ha with a difference of about 6 q/ha. The yield is based on water available in late stage (Belaid, 1987).

Conclusion

The results of our experiments show that direct drilling or no-tillage gives good results compared to other crop management. The morphological parameters studied, show that the cultivation of wheat in direct drilling has presented the highest leaf area and stem height which has directly affect the yield and its components. The length of the ear was very close between the two techniques no tillage and conventional tillage. For root development is superficial in direct drilling. For the physiological parameters studied, direct drilling has exhibited low stomatal resistance and higher relative water content than the other techniques, what makes a good water supply plants.

The conventional crop management presented a highest weight of thousand grains. The yield wasn't different between prepared and no prepared soil.

If we look to the techno-economic aspect, we can say that direct drilling is widely economic than the other two techniques. With an economy of time spent in the field, which implies a gain of fuel, labor and machinery.

So, it remains to follow this technique for several years to confirm which is stable before the integration into the production system at the regional and national levels.

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Laboratory Stands for Wideband Analysis Radiocommunication Signals

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Abstract: A laboratory stand for wideband analysis radiocommunication signals is presented in the paper. The stand is designed for signals acquisition in wide spectrum and research a field of digital signal processing. Procedures used for simultaneous acquiring many frequency channels in selected wide band are described. The method of detection of direct sequence spread spectrum signals (DS SS) which power spectral density is lower than noise is also discussed. Executed research were performed with signals locally generated and with signals from real radio communication systems.

Key words: signal processing, wideband signals, data acquisition

Introduction

Currently produced electronic parts and circuits allow to increase the speed of signal processing. A frequency sampling of A/D converters is still growing up and it enables registering signals of wider bands or higher carrier frequencies.
A method of simultaneous acquisition of many narrowband frequency channels with one receiving set is presented in the paper. The following procedures of signal processing are described: managing of filtering, down conversion and decimation; frequency synchronization; symbol synchronization and phase synchronization. This work shows that it is possible to receive narrowband signals acquired in wideband by a receiving set. Such simultaneous registration has some advantages over the traditional separate acquisition of every frequency channel: it needs less space on a hard drive, one receiving set is needed instead of a few, information about other transmissions are not lost during the acquisition, it is much easier to examine time relations between transmissions.

Moreover such acquired signal might by used to detect the DS SS transmissions. These transmissions are usually used in military systems to hide the signal below the noise. It makes such transmissions impossible to detect by traditional methods such as using signal analyzer. The method of detection DS SS transmission with laboratory stand for wideband analysis radiocommunication signals employment is also presented.

Description of Laboratory Stand

A main aim of the laboratory stand for wideband analysis radiocommunication signals it to acquire signals in wide spectrum and then analyze them in post processing on the personal computer. It is the typical realization of software defined radio (Pereira, 2001; Faxin et al., 2006) where the main part in signal analysis and transmission receiving plays software.
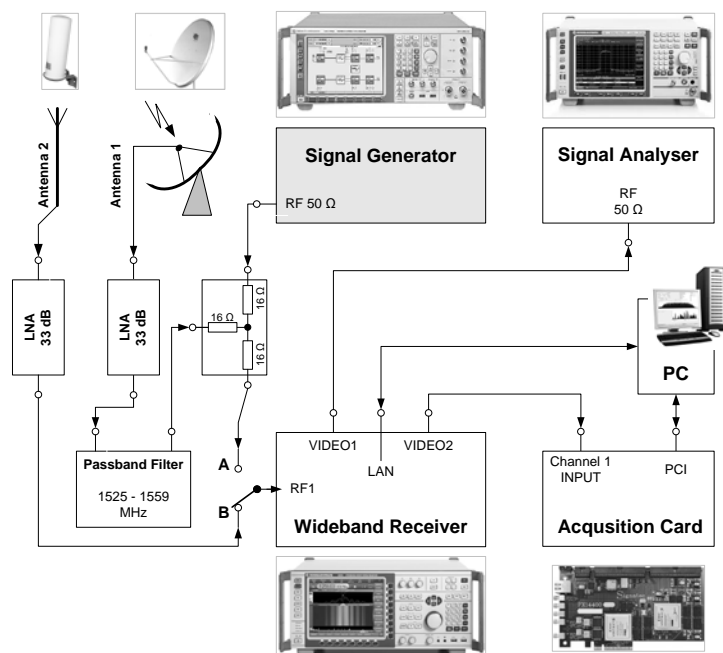
Fig. 1. The scheme of laboratory stand for wideband analysis radiocommunication signals

The laboratory stand shown in Fig. 1 consists of three parts:
- a kit of different antennas - an omnidirectional and directional antennas operating in the 0.3 - 18 GHz
- wideband receiver,
- computer with analog to digital converter (an acquisition card).

On the stand are also used following devices:
- a vector signal generator for simulation research,
- a signal combiner,
- a spectrum analyzer to control the work of receiver and acquisition card.

The omnidirectional antenna is used when acquiring signals from transmitters placed on the Earth surface, especially while the DS SS signals detection is proceeded. The satellite antenna allows to acquire signals from one of the communication satellite system. Presented stand allows to receive information transmitted in that satellite system from many frequency channels simultaneously.

The detection of DS SS signals method is vulnerable to the influence of narrowband signals. That makes essential to perform a research which helps to work out the methods of decreasing the narrowband signals influence on the reliability of detection of direct sequence spread spectrum transmissions. In this research the vector signal generator was needed as a source of the spread spectrum signal. Signals from antenna were treated as narrowband disturbances.

The vector signal generator might by used in tests and researches of procedures which enables the simultaneous information receiving from mentioned satellite system. The generator helps in providing the predictable circumstances.

The receiver allows to acquire signals in band from 100 Hz to 20 MHz. In discussed laboratory stand this receiver transforms signals from radio frequency to intermediate frequency on which the receiving or detection procedures are performed. The acquisition is usually made in 20 MHz band on intermediate frequency equal to 11 MHz. Signals from wideband receiver are delivered to the acquisition board where they are converted to digital form most often with 50 MHz sampling frequency. The role of computer is to supervise the work of wideband receiver and acquisition card. The computer also does all of the signal computing: filtering respective frequency channels, another frequency down conversion, performing receiving procedures, filtering the narrowband distortions and realizing the detection of DS SS transmission. Most of this procedures are described in the following two paragraphs.

Wideband Receiving of Satellite Communication Signals

The stand shown in Fig. 1 may be used to receive information from one of the satellite communication systems. It can be made simultaneously, because radio signals are acquired in wide spectrum. The stand allows to record almost all downlink frequency channels used in the considered system. The band of single frequency channel in this system is less then 10 kHz. The functional scheme of signal processing used to receive transmitted information is shown in Fig. 2.
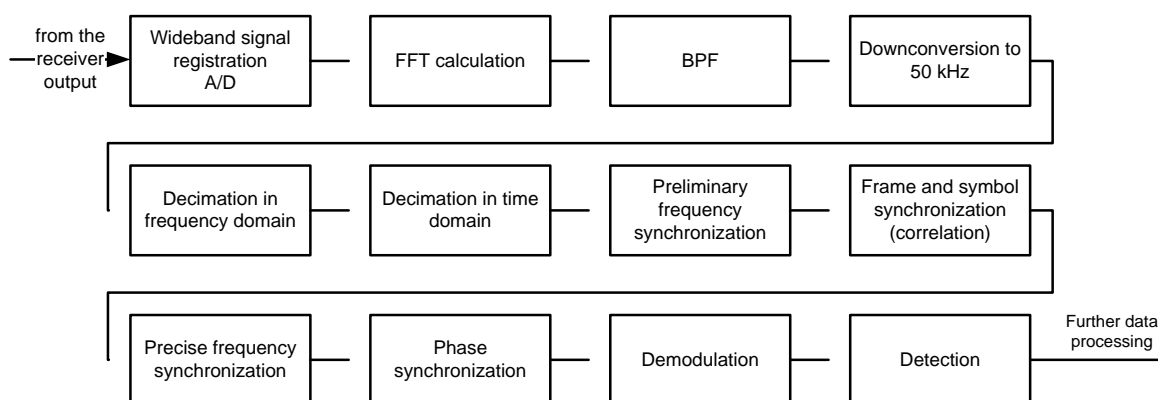
Fig. 2. Functional scheme of signal processing procedures used to receive signals

While signal registration is performed in the wideband (20 MHz) and channel band is less than 10 kHz, the first operation is a band pass filtering which suppresses the impact from other systems and channels. Moreover, to decrease frequency sampling the digital down conversion to frequency 50 kHz is required. For the frequency shifting two solutions can be implemented. In the first one, traditional frequency shifting, useful signal is combined with the signal from heterodyne to obtain the desired frequency. After this operation unwelcomed new frequency components are also generated and to suppress them another band pass filter is needed. It makes this method both time and resources consuming. The second solution uses a filter which values are 1 in the band pass and 0 beyond it which allows to carry out a frequency shifting from frequency f_1 to f_2 by changing the index of suitable spectrum components as shown in Fig. 3. The last solution has been used in the project.

After this operation the decimation is enabled. We reduce the number of samples 64 times, what changes the sampling frequency value to 781,25 kHz. This value significantly decreases the size of processed data and simultaneously keeps the gain achieved of cumulating when noise is integrated in detector. Such prepared signal is used in synchronization and demodulation operations. For demodulation, it is essential to know the exact carrier frequency of the signal, it means phase and symbol timing.

a)

b)

c)
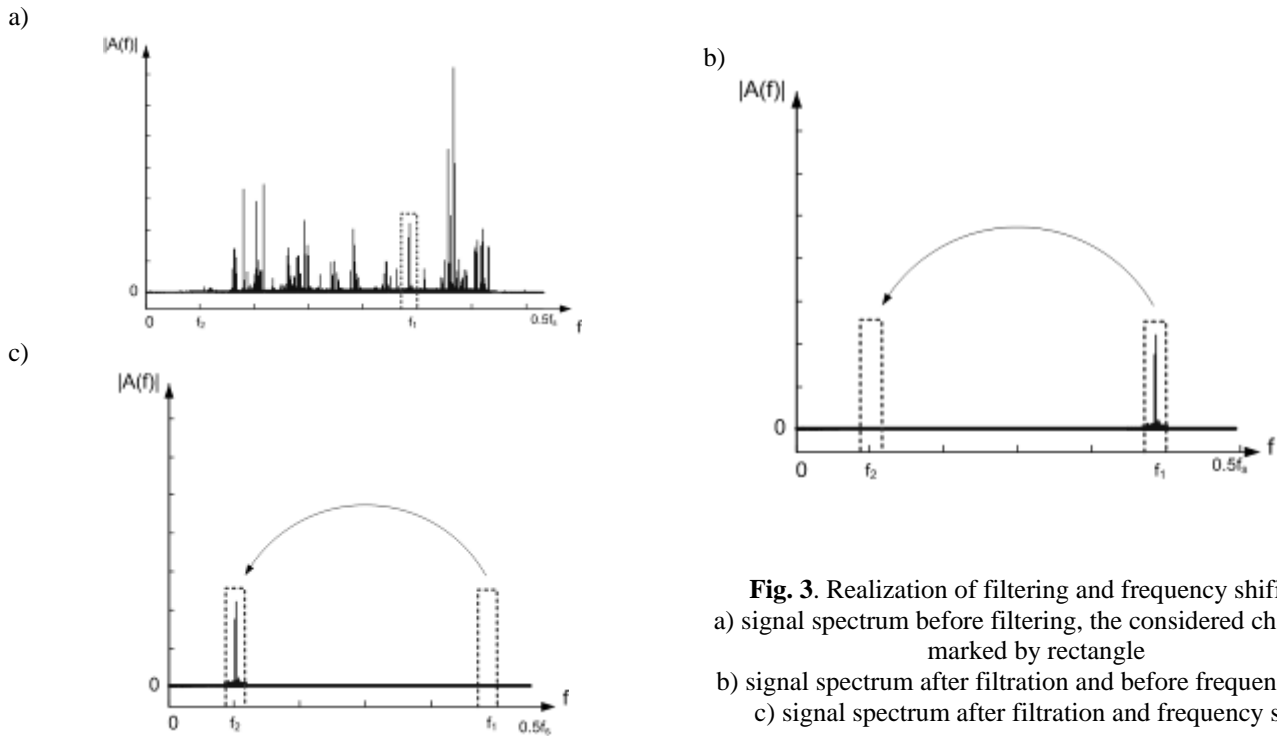
Fig. 3. Realization of filtering and frequency shifitng:
a) signal spectrum before filtering, the considered channel is marked by rectangle
b) signal spectrum after filtration and before frequency shift
c) signal spectrum after filtration and frequency shift

In the considered system in every frame there are bits provided for synchronization processes. These bits are especially used while finding the beginning of symbols and phase of the signal.

Because in discussed system the OQPSK modulation is used, the frequency synchronization is made by finding in the spectrum of signal raised to 4th power a component of carrier frequency $4f_c$. For example, when the OQPSK signal frequency is 50 kHz, then the component on frequency 200 kHz will be distinctive in spectrum of signal raised to the 4th power. As it is shown in Fig. 2, after decimation the preliminary frequency synchronization is performed. For the correlation part we need to know only approximately the signal frequency. It is managed by computing the spectrum of signal raised to 4th power from fewer of number samples then when signal frequency is computed precisely. When the frequency signal is known, the model of signal is prepared for correlation. The unique word modulates the carrier which frequency is equal to the found one. Then the signal model is correlated with acquired signal to find the symbol and frame synchronization. If the signal is found the precise frequency synchronization is performed. In the end the phase synchronization must be achieved. It is accomplished because the unique word is known. As we know what symbols to expect, we can compute the difference between the angle of predicted point in the constellation diagram and the point achieved by demodulating signal without phase synchronization. The difference between these angles is the phase correction which should be taken in account during actual demodulation. When all signals parameters are known the demodulation processes can be performed.

The DS SS Signals Detection

The method of the DS SS signals detection is based on rising the value of signal samples to the power of n, where n depends on the type of used digital angle modulation. In spectrum of raised signal in $n*f_n$ appears a sufficiently large value, where f_n is a frequency of discussed signal.
If the input signal is squared, then in accordance with trigonometric relationship:

$$\cos^2 \alpha = \frac{\cos 2\alpha + 1}{2}. \tag{1}$$

the appearance of a spectrum component at frequency two times higher than the signal carrier frequency can be observed (Was et al, 2008.; Katulski et al, 2008). The scheme of signal processing is presented in the Fig. 4.
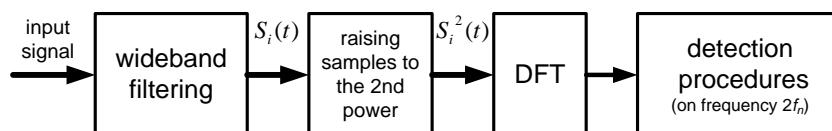
Fig. 4. The simplified scheme of signal processing used to detect of DS SS transmissions with BPSK modulation

An experiment was performed to detect the wideband transmission of the DS SS with BPSK modulation with negative SNR values, carried out in the vicinity of real and relatively strong signals which is narrowband interference for the detection algorithms. Results for procedures performed with an inactive and active block for detection and elimination of narrowband signals are presented below.

The aim of the experiment was to explore the possibilities of the DS SS signal with BPSK modulation detection in the presence of the real signals. The satellite signals received in the frequency range 1525 MHz to 1560 MHz were used as the background. The range of frequency band was chosen in such a way that there was relatively strong narrowband interference in the vicinity of the sought signal. The ratio of the maximum levels of the carrier power to the level of noise ranged from 10 to 20 dB (see Fig. 5a). The parameters of generated the DS SS signal with BPSK modulation were selected in such a way to get a negative ratio of wanted signal to the noise power $SNR = -10$ dB at the input of the acquisition card. The frequency range covered by the presence of the wideband direct-scattering spectrum indicated in Fig. 5a and Fig. 6a in a shaded box ($B_{DS} = 2.44$ MHz, $f_n = 21.4$ MHz on the IF). The results of the experiment in the form of spectrum power density characteristics of the analyzed signal bandwidth and signal PSD of squared signal samples (in terms of twice the frequency) is shown in Fig. 5b and 6b. In the presented spectral characteristics the FFT of size $N = 2^{14}$ was used.

Analyzing obtained results, it can be concluded that when the narrowband signals have not been subjected to elimination (see Fig. 5b), the detection condition has been met for the six components of the spectrum. As it can be seen, none of the components exceeding the detection threshold does not come from the DS SS signal hidden in noise. Moreover, in the middle of the band appeared some unwelcome "false" components indicating the possibility of hidden signals in noise. These components are the products of intermodulation, arising from the squaring of signal samples.
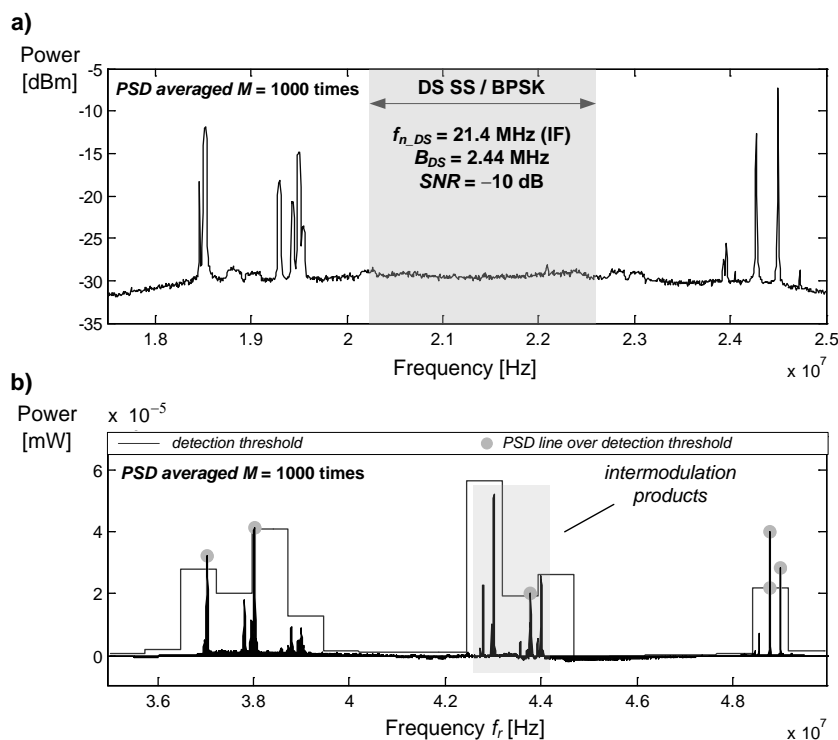
Fig. 5. Demonstration of PSD for signal samples on the input of the acquisition card (a) and results of the DS SS transmission in the absence of procedures for the elimination of narrowband signals

To sum up the carried out experiments, it can be concluded that the detection process has been disturbed by narrowband signals, and the obtained results give an erroneous impression of the existence, in the analyzed band, the wideband DS SS signals with negative SNR values. Therefore, detection procedures were repeated on the same set of samples, but this time with the active block for detection and elimination of narrowband signals. As a result of implementation of appropriate procedures six narrow-band signals were detected and eliminated. The PSD which figure in the band analysis is presented in Fig. 4a. Such a prepared signal was processed in accordance with the signal detection algorithm for the DS SS transmission with BPSK modulation using the spectral analysis of the squared samples put in the time domain. A result in a graphic form and the selected detection threshold is shown in Figure 6b. The experiment RF center frequency for input circuits of the receiver corresponded to the carrier frequency of generated spread spectrum signal, which in turn should lead to the emergence of P_h component (harmonic coming from searching for DS SS signal) on the frequency 42.8 MHz, exactly twice the IF carrier of 21.4 MHz.

a)

b)
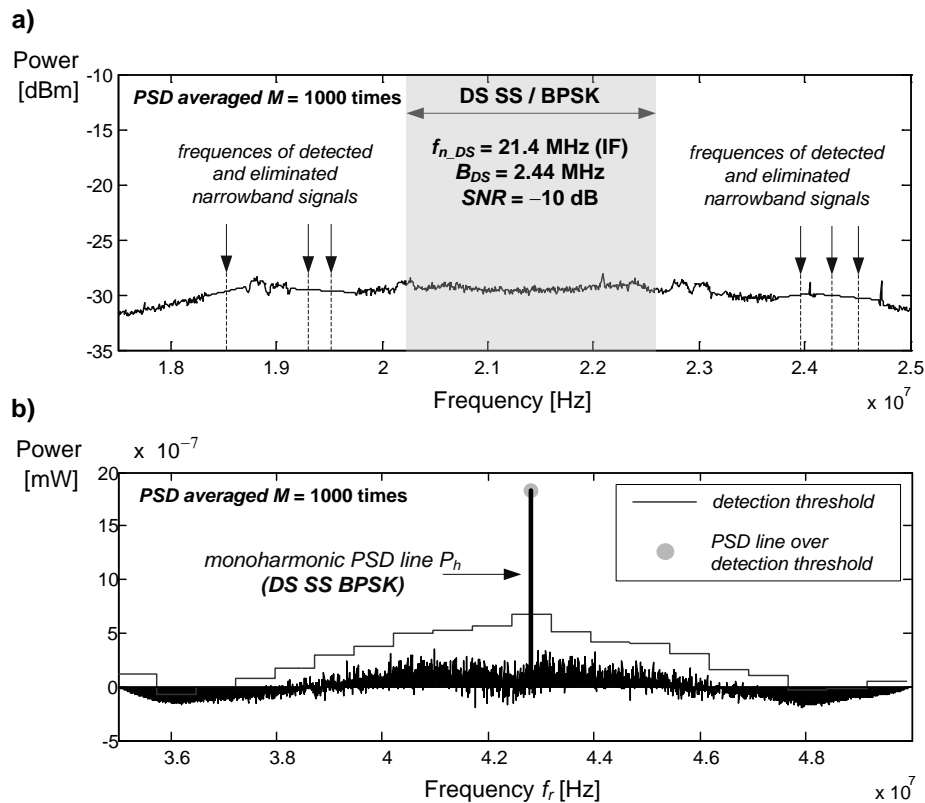
Fig. 6. PSD of the signal of fig. 5a after the elimination of narrowband signals (a) and the results of the procedures for detecting the DS SS transmission with BPSK modulation (b)

Proposed procedures of detection DS SS signals were used to detect the GPS signals (for more details see Studanski et al., 2011).

Conclusion

The development of electronic parts and computational components enables to use digital signal processing in wider variety of applications. Therefore, the thorough technical analysis of registered signal is possible.

It is manageable to receive narrowband signals from a real radio satellite system acquired in the wideband. Such approach enables to register signals from many frequency channels and store them on a hard drive.

The conducted experiments have confirmed the effectiveness of signal processing methods developed for the detection of the DS SS transmission with BPSK modulation and the power of signal lower then noise power. Using the method for testing the squared signal PSD, it is imperative to carry out the elimination of narrowband signals present in the analysis. Unwanted narrowband signals can disturb the proper operation of the detection algorithms by generating ambiguous and "fake" results.

Acknowledgement

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Municipal Solid Wastes Gasification/Polymer Electrolyte Membrane Fuel Cell Integrated CHP System

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Abstract: Secured, cheap and clean energy sources are very vital for economic growth and development. The current fossil fuel dominated energy scene is not sustainable. There is increasing interest in biomass as a sustainable energy source to arrest the fast depletion of the global fossil fuel reserves and the attendant environmental challenge posed by its end uses. Municipal Solid Wastes (MSW) is continuously generated with no threat of depletion. Over 70% of MSW is composed of combustible materials ideal for energy production. Gasification of the MSW via the refuse derived fuel (RDF) route will generate heat for power generation and synthesis gas rich in hydrogen as feed to fuel cell in a combined heat and power (CHP) systems. This study proposed a MSW treatment and processing strategy for energy and hydrogen production. It explores waste-to-energy approaches to eliminate the environmental footprints of the current MSW treatments and disposal methods in South Africa.

Keywords: municipal solid wastes; biomass; gasification; hydrogen; fuel cell.

Introduction

In South Africa, the steady economic growth and development has resulted in a steady rise in energy consumption and municipal solid waste (MSW) production necessitating more investment in the power industry on one hand and sustainable approach to management of the MSW on the other hand. The energy sector in South Africa is dominated by coal and nuclear, with approximately 93% of the electricity produced from coal-fired plants (Eskom, 2011). The over reliance on fossil fuels as primary energy source worldwide is not sustainable. It is essential not only to search for new energy carriers but also for new material sources. In this respect, virgin biomass and municipal solid wastes will become more important in the search for alternatives for fossil fuels alongside other alternatives such as solar, wind, tidal and nuclear energy. Supply of biomass unlike the other renewable sources of energy, is not intermittent or site-dependent, and can be used to produce not only energy, but also chemicals and materials (Deswarte *et al.*, 2008). Processes that recover materials and energy from the MSW and hence solved the problem of energy production and waste conversion same time, have been suggested and are currently at various stages of implementation worldwide.

South Africa for the first time runs out of surplus energy in 2007 resulting in power shortage and load shedding. With a reported reserve margin of around 8%, load shedding will be implemented at peak demand and supply falls due to some generating units taken offline for maintenance or repairs. There is need therefore urgent need to address this problem for sustained growth and development. To increase the generation capacity by constructing more coal-fired power plants has huge environmental consequences and hence not a way out. At the moment, South Africa is among the top 20 emitters of greenhouse gases (GHSs) in the world and is the largest emitter in Africa. So there is a need to use cleaner sources of fuel. An energy security strategy formulated by the Department of Minerals and Energy (DME) seeks to implement measures that will guarantee adequate supplies of energy in the short term; ensure accessible, affordable and reliable energy, especially for the poor and to diversify the primary energy sources to reduce the high dependency on coal. To achieve these objectives, it is imperative to put in place a mix of energy sources. Alternative sources of power from renewable and sustainable sources are currently being considered. These include biomass, geothermal, wind and solar powered plants. Of these sources, an integrated system of fuel cell coupled to a biomass gasification plant look very promising and is receiving more interest.

The Department of Science and Technology is presently promoting hydrogen and fuel cells as priority technologies under the national framework for hydrogen and fuel cell technology (DST, 2010). With the potential to produce hydrogen from biomass and the largest reserve of platinum (used in fuel cells), the country has a significant competitive advantage in developing hydrogen fuel cell-based applications. South Africa's rich platinum reserves (about 78% of the world's platinum along with 39% of the world's palladium production) could make it a key player in the development of fuel cell technology regarded as the future energy source. This will enable South Africa to extract more value from its platinum group metals (PGM) resources; diversify her energy industry, and reduce the environmental impacts of coal-fired plants. Most fuel cells use platinum-group-metals (PGM) as the electrode catalysts to convert hydrogen into electricity. The PGMs are also essential to achieve low-temperature reforming to improve the efficiency of CHP systems.

On a parallel front, the management and disposal of MSW has been a recurring problem in South Africa as elsewhere experiencing similar social and economic growth. In Cape Town, about 550-600 tons/day of MWS is produced in 2007. In sub-Saharan Africa, existing waste management practices are inadequate thus affecting human health, the environment, air

quality, and the landscape. MSW supply is very much sustainable with no threat of depletion. A recent report published by the USDOE and USDA reported that the US alone could sustainably supply more than one billion dry tons of biomass per annum by 2030 (USDOE, 2005). 70% of the MSW are combustible materials that could be thermo-chemically converted to energy, fuels and chemicals thereby solving the two problems simultaneously. MSW are combustible and non-combustible wastes that come from household, municipal, commercial, and industrial sites. For technical and economic reasons, the indirect conversion of the combustible materials in the MSW to energy and materials has been suggested. Refuse derived fuel (RDF) is produced from dried combustible portions of MSW. The gasification of the RDF to produce clean and energy-carrying hydrogen gas as fuel for high temperature polymer electrolyte membrane (HTPEM) fuel cell for cogeneration (heat and electricity) plants will be an ideal energy source. The use of MSW avoids competition with the food sector and unlike virgin biomass is not to be cultivated. The major impediment to biomass use is the development of economically viable methods (physical, chemical, thermochemical and biochemical) to separate, refine and transform it into energy, chemicals and materials (European Commission, 2005). The options for economic conversion and integration of RDF gasification and HTPEM fuel cell CHP systems for domestic and industrial application is the focus of this article.

Current Municipal Solid Wastes Management of Cape Town

MSW is a mixture of wastes from households, commercial activities, industrial wastes, farm wastes, and educational institutions. Generally, MSW compositions include paper, plastics, sawdust, wood wastes, leather, glass, rubber, e-wastes, ceramics or debris, metals, textiles, bones, ashes, putrescible, food wastes, yard wastes, inert (Parfitt and Bridgwater, 2008; Burnley *et al*., 2011). Table 1 shows composition of MSW from a number of regions.

Table 1: The Municipal Solid Waste Composition on Regional Basis

Regions	Combustible (Weight %)	Non-Combustible (weight %)	Others (Weight %)
Asia			
Eastern Asia	67.30	5.80	26.90
South Central Asia	69.20	7.30	23.50
South Eastern Asia	77.10	7.30	15.60
West Asia and Middle East	78.70	4.50	16.80
Africa			
Eastern Africa	76.90	7.30	15.80
Middle Africa	73.70	8.00	18.30
Northern Africa	66.60	8.00	25.40
Southern Africa*	77.20	20.30	2.50
Western Africa*	88.00	3.10	8.90
Europe			
Eastern Europe	71.70	13.60	14.70
Northern Europe	79.40	15.00	-
Southern Europe	64.50	-	-
Western Europe	62.70	-	-
Oceania			
Australia and New Zealand	90.00	-	-
Rest of Oceania	76.00	-	-
America			
Northern America	76.10	12.00	11.90
Central America	82.10	6.30	11.57
Southern America	80.80	6.20	13.00
Caribbean	83.20	10.70	6.10

Source: IPCC Guideline for National Greenhouse Gas Inventories (2006)

The variation in the waste composition has been linked to the economic level of countries, geographical location, energy resources, climate, living standards and cultural habits. The typical composition of Cape Town MSW is presented in Figure 1.
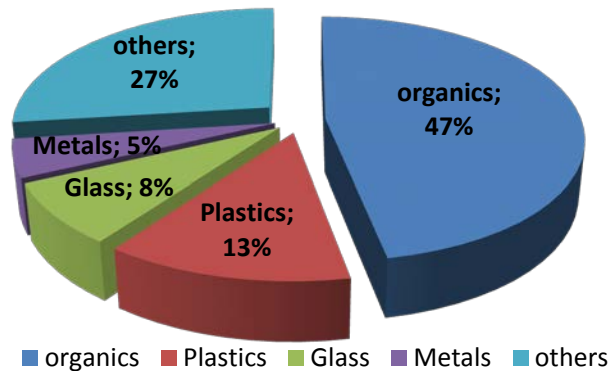
Figure 1: Typical composition of Cape Town MSW

In South Africa, current solid waste management systems include waste collection and sorting, followed by one or more of, recovery of secondary materials by recycling, biological treatment of organic waste for production of marketable compost, thermal treatment by incineration to recover energy in the form of heat and electricity and landfilling. In Cape Town alone, about 2.1 million tons of waste was landfilled in the city's three landfill sites in 2007. Despite the waste-to-wealth policies put in place, the figure is still about 1.6 million tons in 2010. The problem is further compounded by the fact that one of the landfill sites will be closed by 2013 and the last by 2022 at most.

Landfilling of MSW releases GHGs and volatile organic compounds along with leachable toxic heavy metals to the surrounding environment. Soil is contaminated by the heavy metals and radionuclides content and leachate. In a study on a dumpsite, trace metal concentrations in soil within a 50 meter radius of land fill sites had been contaminated by trace metals, lead, iron, copper, zinc, and phosphorus (Mangizvo, 2008; Chifamba, 2007). Leachates collected from various dumpsites revealed level of *coliforms,* cadmium, iron, lead, and nitrates above the water quality guideline (Ikem *et al.,* 2006). Okonkwo and Mothiba (2004) attributed the high concentration of lead in the Madanzhe and Mvudi Rivers in Thohoyandou, South Africa to the nearby waste dumping site.

Incineration to generate energy has become the most common method of dealing with combustible waste as it decreases the volume and mass of MSW. But, it has many drawbacks, particularly releasing hazardous emissions (NO_x, SO_x, HCl), harmful organic compounds (Gordon, 2002; Zhang, *et al*., 2011) and harmful process residues (Floyd and Anthony, 1996). Globally, about 4.6 million tonnes of solid waste is being incinerated per annum. This has led to the generation of a large amount of solid residues including fly ash and bottom ash and emission of hazardous gases to environment (Kwak *et al.,* 2006). Incineration of MSW generates fly and bottom ashes which release leachable toxic heavy metals, dioxin, furans and volatile organic compounds. Stringent environmental regulations are being imposed to control the environmental impact of MSW and incinerator residues (Zhang, *et al*., 2011).

Refuse Derived Fuel (RDF)

MSW is heterogeneous consisting of combustible, non-combustible, organic, inorganic and inert materials. It also exhibits a low bulk density and relatively high water content. Processes must therefore be designed to reduce the cost of collection, transportation and storage for any MSW conversion technique to be competitive (Gravitis, 2007; Wright and Brown, 2007). This is achieved by densification of the MSW via pelletization or briquetting to form RDF. Density increase of up to a factor of three is obtained with the RDF (Deswarte *et al.*, 2007). Briquettes has a density of about 800–1300 kg/m^3 compared to loose biomass with a bulk density of 10–20 kg/m^3 (Hedman *et al.,* 2005). The RDF is more homogeneous and has higher heat content per unit mass than raw MSW (Dalai *et al.,* 2009). Untreated MSW typically has a heating value of around 5815 kJ/kg while processed (and dried) municipal solid waste has a fuel value as high 9304 -16282 kJ/kg. The economics of the thermo-chemical conversion processes therefore would be dramatically improved through the reduced volume and water content. The gasification of the RDF with higher carbon and hydrogen contents is advantageous.

Pelletization of MSW involves the processes of segregating, crushing, mixing high and low heat value organic waste material and solidifying it to produce RDF. It is prepared by the pelletizing machine or compactor after it has been shredded to homogenous particles. Various qualities of RDF pellets can be produced, depending on the needs of the user. A high quality RDF would possess higher heating value, and lower moisture and ash contents.

Proposed Process Design

The process flow diagram for the proposed RDF gasification/PEM fuel cell co-generation plant is presented in Figure 2. The detail of each stage is discussed in detail in the following section.

Characterization and pre-treatment of MSW

To determine the moisture content and hence the suitable drying method, a sample of the MSW was put in a specially designed oven set at 100°C. The weight and hence the moisture loss is recorded every one hour for 24 hours. After the period, the oven temperature was increased to 120°C and the same procedure repeated. A further reduction in mass of the MSW was noted implying that at 100°C, only the free water was removed and to remove more water higher temperature is required. To confirm these results, the method of Laurent *et al.* (2005) was used for the same sample. Based on this, a drum dryer or hot air contactor at 120°C for the required time is proposed to remove the free water and as much as the trapped water. Characterization of the composition of MSW by proximate and ultimate analysis of dried MSW and fly ash from the bomb calorimeter is carried out. Chemical compositions of these samples were analyzed with x-ray fluorescence spectroscopy, atomic absorption spectroscopy (AAS).

RDF Production

Magnetic separation and Eddy current separations is proposed to separate the ferrous and non-ferrous metals while glass and plastics would be separated by optical scanning system, pneumatic and NIR sensor sorting system. The plastics content is suggested to be first removed during sorting and added backed to the MSW after drying. The presence of the plastics will increase the cost of shredding and pelletizing, but the plastics contents is expected to give higher heating value and hydrogen content (Wu and Williams, 2010a, 2010b; Ahmed and Gupta, 2009; Dalai, *et al.*, 2009).

The combustibles materials (plus plastics) after the separation are dried, shredded and pulverized to form a fluff, which is then pelletized to produce RDF. The pelletizing process can be achieved by different techniques, by adding a binder or by direct compacting without any binder. In this work, used vegetable oil is proposed as a binder. Previous works done shown that emission of obnoxious compounds during gasification is not changed. The net calorific heat value of pellets is about 24 MJ/ kg. The pellets should be secured in close containers to prevent adsorption of water. The characteristics of the final pellets will depend on the gasifier design. An optimum gasification process depends on the pellets particle size, and particle size distribution, pellet density (measured and controlled by the pore volume and pore volume distribution), and hence need to controlled as desired.

Gasification of RDF

Gasification is the thermochemical conversion of a carbon-containing material through the addition of heat in an oxygen-starved environment (Basu, 2010) using air or oxygen and their mixtures to produce gaseous products, rich in hydrogen and carbon monoxide (or synthesis gas). RDF gasification reduces corrosion and emissions by retaining alkali and heavy metals (except mercury and cadmium), sulphur and chlorine within the process residues (Chen *et al.*, 2011) and reduces thermal NO_x formation due to lower temperatures and reducing (He *et al.*, 2009).

The hydrogen-rich gas would be directly used in the production of electrical power in fuel cells (Chaudhari *et al.*, 2003). The product yield during the gasification of MSW depends on temperature, pressure, time, reaction conditions and reactor type. RDF gasification processes have been studied using several different types of reactors such as fixed bed, fluidized beds, rotary kilns and plasma furnace (Xiao *et al.*, 2006; Min *et al.*, 2005; Galvagno, *et al.*, 2006; Mountouris, *et al.*, 2006). Basu (2010) reported that a survey of gasifiers in Europe, the United States, and Canada show that downdraft gasifiers are the most common, 75 % are downdraft, 20 % are fluidized beds, 2.5 % are updraft, and 2.5 % are of various other designs. The fixed bed gasifier air-blown downdraft is simple type gasifier compared to other fixed bed types. It is one of the simplest and cheapest biomass conversion technologies (McIlveen-Wright, *et al.*, 2011). Updraft fixed bed gasifier is proposed because of tar formation and removal.
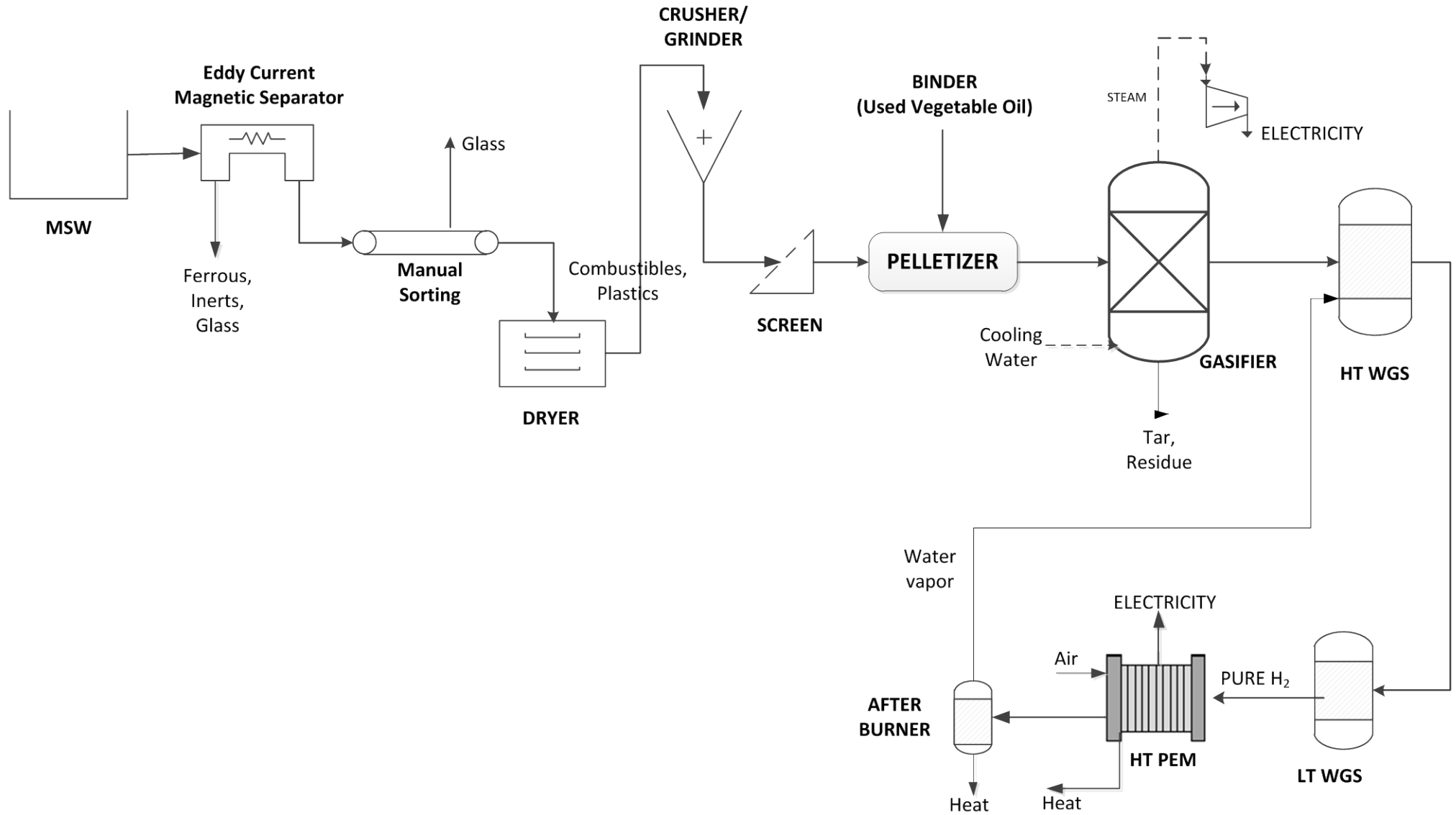
Figure 3: The Proposed Ideal Cogeneration System

Syngas Post Processing and Cleaning

The synthesis gas from the gasifier is sent to the Water Gas Shift (WGS) reactors to convert the CO into more hydrogen. This increases the total yield of hydrogen and also reduces the CO content of the gaseous products. During the WGS reaction, CO and H_2O react in the presence of a catalyst to form CO_2 and H_2. This is a reversible reaction and therefore steam is added in excess to shift the equilibrium towards the product side. The WGS reaction occurs in two temperature ranges: the high temperature reaction is carried out using Fe/Co supported on alumina at temperature between 350 and 500 ^{0}C. The low temperature WGS reaction is carried out over Cu-Zn oxide catalysts at 200-250 ^{0}C. The use of the high performance catalyst lowers the CO content to the less than 10 ppm level that can be safely fed to the high temperature PEM fuel cell. Otherwise an additional preferential oxidation (PROX) reactor may be necessary.

The High Temperature PEM Fuel System

The predominantly hydrogen product from the Lower Temperature Water Gas Shift (LTWGS) reactor is fed to anode side of the fuel cells stack. A compressed air/oxygen is fed to the cathode. The stack is maintained at 160 ^{0}C which is tolerable by the phosphoric acid doped Polybenzimidazole (PBI) membrane. A cooling loop of water/alcohol mixture is used to remove and recover the heat co-produced with power in the stack and so maintain the operating temperature. The stack exit containing unreacted hydrogen is fed to an afterburner to re-use the materials for heat production. The waste heat and H_2O generated are integrated back into the system. The heat loop or the heat from the afterburner is used to pre-heat the air supply to the stack operating temperature, to lower the start-up time. The air compressor isentropic efficiency is 85 %. The fuel cell stack characteristics and performance is as described by Rabiu *et al.* (2011) to be presented in the next paper. The stack simulation study was implemented in Engineering Equation Solver (EES).

Conclusion

The proposed design generates heat and electricity via the electrochemical conversion of hydrogen clean fuel for material (hydrogen) and energy (electrical and thermal) recovery. The system is made of three major sub-systems: the fuel processing sub-system, the fuel post-processing and cleaning and the High Temperature Polymer Electrolyte Membrane (HTPEM) fuel cell stack sub-system. All these are shown in Figure 2. The HTPEM fuel cell-based CHP system produces little emission and gave high total system efficiency. Further studies are being conducted on the use of process integration technique to optimally integrate the various sub-systems and hence improve its overall economics. This system provides solution to the twin problems of waste management and energy security and with very little environmental footprint.

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Myco and Phyto Remediation of Heavy Metals from Aqueous Solution

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Abstract: Biosorption technique was applied to remove the Ni(II), Cu(II), Cr(III) and Cr(VI) from single metal solution. Seven fungal species viz., *Aspergillus niger*, *A. terreus, A. flavus, Trichoderma harzianum, Alternaria alternata*, *Rhizopus arrhizus* & *Cunninghamella echinulata*, three agricultural materials viz., *Oryzae sativa* straw (rice straw), *Cicer arietinum* dried seed (gram husk) & *luffa cylindrical* dried fruit (luffa sponge), leaves of five trees i.e., Neem (*Azadaricta indic*a), Dareek (*Melia azedarach*), Bohar (*Ficus benglensis*), Peepal (*Ficus relgiosa*), sunflower (*Helianthus annus*) and charcoal were chosen as adsorbent material. Laboratory biosorption experiments were performed with different concentrations of each of four metals. Results showed highly significant sequestering capacity of all selected biosorbents for both Cr(III & VI) in comparison to Cu(II) and Ni(II) ions. Removal efficiency of candidate biosorbents reached up to 80%, 58% and 52% for Cr(III & VI), Cu(II) and Ni(II) ions, respectively.

Key words: Biosorption, Metals, Fungi, Agricultural waste, Tree leaves

Introduction

Industrial wastewater is considered as most notorious source of heavy metal pollution in the surrounding environment (Sun et al., 2010). In Pakistan industrial wastewater pollution from the electroplating processing has become most serious issue. Volume of the wastewater produced by such processing units is comparatively much smaller but highly toxic in nature because of the high concentration of copper (Cu), zinc (Zn), nickel (Ni), chromium (Cr), cadmium (Cd) , lead (Pb), various acids and cyanide compounds as compared to prescribed limits of National Environmental Quality Standards (Javaid et al., 2010).

Now the attention is being focused on reducing reliance upon expensive chemical methods, and finding alternatives directing attention towards biological technique like Biosorption. Biosorption is ability of certain biological material to sequester contaminates like heavy metals from adjoining environment in economic and eco-friendly way. It occurs through bindings of metal ions with chemical groups present on the biosorbent cell wall surface. Biosorption technique offers several advantages over conventional treatment methods including cost effectiveness, efficiency, minimization of chemical/biological sludge, requirement of additional nutrients, and regeneration of biosorbent with possibility of metal recovery. A diversity of adsorbents like microorganisms (fungi, bacterial, algae and yeast), plant by-products (rice straw and husk, wheat straw and husk, chick pea husk) and waste material (fallen leaves and peels) have been utilized to remove heavy metals from aqueous medium (Javaid et al., 2010). Biomaterials like fungi have been proved efficient and economic for removal of metal ions from aqueous solution due to high percentage of cell wall material, which shows excellent metal binding properties (Das et al., 2008). Among the fungi, *Aspergillus*, *Trichoderma* and *Penicillium* are the most important group that degrades variety of polysaccharides in agricultural waste, soil and feces of cattle and sheep (Sun et al., 2010). So far, Ali et al. (2007) results showed *Trichoderma viride* is successful as biosorbents for the removal of Zn, Pb and Cd from the aqueous media. Rajender et al. (2008) examined tremendous ability of *Aspergillus niger*, *A. sydoni* and *Penicillium janthinellum* to remove Cr(VI) ions @ 91.03, 87.95 and 86.61% from aqueous solution as well as from electroplating effluent. Pal et al. (2010) showed cell surface functional groups of the fungus might act as ligands for metal sequestration and varied their findings with *Aspergillus niger* during Cd and with *R. arrhizus* during Pb biosorption from the aqueous culture media. Findings of Hmambika et al. (2011) indicted more than 60-95% metal ions like Cu, Cd and Pb were removed due to application of *Aspergillus* sp. *Penicillium* and *Cephalosporium* sp**.** from aqueous solution.

Apart from fungi, removal of heavy metals by lignicellulosic and plant waste material has been extensively investigated in past decades. The plant and agricultural waste material are good source of cheap, easily and locally available adsorbent with reasonable metal loading capacity. *Cicer arietinum* dried seed (gram husk) showed 99.9% removal of Cr(VI) (Ahalya et al., 2005), *Ficus religiosa* leaves powder was found to be a very good adsorbent for Cr(VI) and Pb (Qaiser et al., 2007) and sunflower (*Helianthus annus*) exhibited 80% removal efficiency for Cr(VI) (Jain et al., 2009). Oboh et al. (2009) found 76.8, 67.5, 58.4 and 41.45 removal efficiency of neem leaves for Cu, Ni, Zn and Pb, respectively. Aslam et al. (2010) showed that *Ficus Religiosa* leaves are the suitable material for Ni(II) biosorption. The potential use of rice straw as an adsorbent for Ni and Cd was suggested El-Syed et al . (2010). Ohbo et al. (2011) stated that *Luffa cylindrica* seeds and sponge mixture is a good alternative biosorbent for Ni, Pb, Cu and Zn ions removal from aqueous solution.

Based on literature survey, present study was conducted to evaluated the Ni(II), Cu(II), Cr(III) and Cr(VI) removal potential of variety of fungal and natural adsorbent from single metal solution at various concentrations.

Methodology

Biosorbents

The pure cultures of fungal species viz., *Aspergillus niger* (FCBP 0074), *A. terreus* (FCBP 0058), *A. flavus* (FCBP 0064), *R. arrhizus* (FCBP 800), *A. alternata* (FCBP 0092), *T. harzianum* (FCBP 0139) and *C. echinulata* (FCBP 0104) were procured from First Fungal Culture Bank of Pakistan, Institute of Agricultural Sciences (IAGS), Punjab University. Mycelial biomass of the each fungal species was cultivated in 2% malt extract (ME) broth in 250 mL conical flasks. Inoculated flasks were incubated for 6-7 days under controlled temperature of 25 ± 1°C in stationary phase. Prepared biomass of each candidate fungus was separated from culture broth by filtration and subjected to successive washings with double distilled deionized water followed by drying in oven at 60°C for 24 hours. The dried biomass of each test fungus of 0.5-1 mm was used in biosorption experimentation.

O. sativa straw, *C. arietinum* husk and luffa sponge were obtained from local market. *A. indic*a, *M. azedarach*, *F. benglensis*, *F. relgiosa*, *H. annus* leaves were collected from local environment of University of Punjab Lahore, Pakistan. Each biosorbent material was dried in oven at 100°C for 24 hours and homogenized in a blender to break the cell aggregates into smaller fragments of 0.5-1 mm diameter (mesh size 150 μm). Waste charcoal was acquired from Natural Product laboratory of Herbal Heritage Centre, IAGS, Punjab University and utilized for biosorption experiment after drying at 100 ^{o}C for two hours. Each of the natural biosorbent material was kept in separate airtight bottles for later utilization in biosorption experiments. Table 1 shows list of biosorbens materials selected for current investigation.

Table 1. List of biosorbent materials utilized in present wor**k**

No	Biosorbents	Metal			
	Fungi	**Ni(II)**	**Cu(II)**	**Cr(III)**	**Cr(VI)**
1	*Aspergillus niger*	+	+	+	+
2	*Aspergillus terreus*	+	+	-	-
3	*Aspergillus flavus*	+	+	-	-
4	*Alternaria alternata*	+	+	-	-
5	*Rhizopus arrhizus*	+	+	+	+
6	*Trichodrma harzianum*	+	+	+	+
7	*Cuninnghamalla echinulata*	+	+	-	-
	Agricultural waste				
8	*Oryzae sativa* straw	+	+	+	+
9	Dried seed of *Cicer arietinum*	+	+	+	+
10	Dried fruit of *Luffa cylundrica*	+	+	+	+
	Tree Leaves				
11	*Azadaricta indic*a	+	+	+	+
12	*Melia azedarach*	+	+	+	+
13	*Ficus benglensis*	-	-	+	+
14	*Ficus relgiosa*	-	-	+	+
15	*Helianthus annus*	-	-	+	+
16	Charchol	+	+	+	+

+ indicates material utilized in biosorption experiments for aforementioned metal; indicates material not utilized in biosorption experiment for above mentioned metal

Metals

The stock solutions of Ni(II), Cu(III), Cr(III) and Cr(VI) ions were prepared from respective salts, included Ni $(NO_3)_2$ $6H_2O$, $Cu(NO_3)_2$. $3H_2O$, $Cr(NO_3)_2$. $9H_2O$ and $K_2Cr_2O_7$ by dissolving the exact quantity of salt in double distilled deionized water. Stock solution measuring 1000 mg L^{-1} of each metal ion was further diluted for composing various concentration regimes. On the basis of literature available, four concentrations 50, 100, 300 and 500 mg L^{-1} were prepared from standard solution of Cu(II) and Ni(II) five levels of 5, 15, 25, 35 & 45 mg L^{-1} were made from stock solution of Cr(III) & Cr(VI)

Experiment

Biosorption experiments were performed by suspending 0.1g of fungal and 0.5g of natural biosorbent material in 100 mL of metal solution in 250 mL flask stirred at 150 rpm at pH 4.5 (0.5M NaOH and 0.5M HCl was used to adjust pH in each flask) for 3 hours. The change in working volume due to addition of NaOH and HCl was negligible. These chemicals were added to reaction mixture before the addition of biomass to avoid change in pH value. Different sets of experiments were carried out to appraise the maximum metal accumulating capacity of the biosorbents at different initial concentration of metal ions ranging between 50, 100,

300 & 500 mg L^{-1} for Cu(II) and & Ni(II), and 5, 15, 25, 35 & 45 500 mg L^{-1} in case of Cr(III &VI). After desired contact time, the mixture was filtered through Whatman filter paper No.1 and the residual metal ion concentrations were determined using Atomic absorption spectrophotometer (AAS).

Biosorption data evaluation

The efficiency of the biosorbent or its removal capability (E) was calculated using following equation:

$$q = \left(\frac{C_i - C_f}{m} \right) V \; ; E = \left(\frac{C_i - C_f}{C_i} \right) * 100$$

Where, C_i = initial concentration of the metallic ion (mg L^{-1}); C_f = final concentration of metallic ion (mg L^{-1}); m = dried mass of the biosorbent in the reaction mixture (g) and V = volume of reaction mixture (mL).

Results and Discussion

Comparative analysis of data acquired, in general, exhibited significantly higher sequestering capacity of all selected biosorbents for both Cr(III & VI) in comparison to Cu(II) and Ni(II) ions. Removal efficiency of candidate biosorbents reached up to 80%, 58% and 52% for Cr(III & VI), Cu(II) and Ni(II) ions, respectively (Table 2, 3, 4 & 5). This may also be related to differential electrode potential of various metal ions, resulting in different biosorption affinities (White et al., 1979). Similar concept of stronger chemical and physical affinity for metal ion at greater electronegative bonds and ionic radii has been suggested in other studies (Tsezos &Volesky, 1981, Weast, 1988).

Data acquired on influence of initial concentration of metal ions revealed strong impact of this factor on uptake potential by the biosorbents, the effect being more conspicuous at higher concentrations. Accordingly, adsorption efficiency reduce up to 5-20% for Cu(II) and Ni(II) at 300-500 mg L^{-1} and 2-35% in case of Cr(III &VI) at 35-45 mg L^{-1} by the biosorbents. Over and above, this trend in metal uptake reduction was dominant in case of Cr(III & VI), as 10 amongst the twelve elected biosorbents exhibited this decline in efficiency. Whereas, in case of the Cu(II) and Ni(II) the reduction rate was recorded in half of the biosorbents (6). These results are similar to the observations made by Malkoc et al. (2006), Dubey and Krishna (2007) and Zvinowanda et al. (2010) with different biomaterials. However, the sorption characteristic represented that surface saturation was dependent on the initial metal ion concentrations. At low concentrations adsorption sites took up the available metal more quickly. However, at higher concentrations, more metal ions are left un-adsorbed in solution due to the saturation of binding sites (Lokeshwari & Joshi, 2009).

For each metal different adsorbent were noticed that hold maximum metal adsorption efficiency. For **Cu(II) ions**, *C. arietinum* husk showed significantly greater biosorption efficiency 44-50% within concentration range of 50-500 mg L^{-1}, respectively in comparison to rest of the 12 biosorbents. However, removal rate declined only up 20% in case of *R. arrhizus*, *A. niger*, *A. indic*a, *M. azedarach*. Among rest of adsorbents, *O. sativa* straw, *L. cylindrica* dried fruit, *A. terreus*, *A. flavus, T. harzianum* and *A. alternata* showed up to half time reduction and *C. echinulata* and charcoal exhibited 75% decline in biosorption efficiency as compared to maximum recorded in *C. arietinum* husk (Table 2). *L. cylindrica* dried fruit showed the highest removal efficiency of 44-50% for **Ni(II)** ions followed by *T. harzianum, R. arrhizus*, *O. sativa* straw and leaves of *A. indic*a, *M. azedarach* within concentration range of 50-500 mg L^{-1}. Amongst remaining 6 biosorbents, efficiency was further reduced up to 50-60% in *C. arietinum* husk, charcoal, *A. niger*, *A. terreus*, *A. flavus, A. alternata* and *C. echinulata* in comparison to the highly efficient (44-50%) biosorbent (Table 3). In case of **Cr(III),** four biosorbents viz. *O. sativa* straw, leaves of *F. bengalensis*, *F. religiosa* and *H. annus* hold the greatest biosorption efficiency (80%) at applied concentrations in comparison to rest of adsorbents (Table 4). On the other hand, *F. religiosa* was proved to be most efficient biosorbents (80%) for adsorption of **Cr(VI)** (Table 5).

Disparity in biosorption capacity of different adsorbents may be ascribed to the intrinsic ability of organism, its chemical composition of cell wall leading various types of interaction of metals with adsorbents (Gadd, 1993). This indicates adsorbent variability in metal ions binding affinities for the same or different functional groups (amino, carboxylate, phosphate, sulphahydral, phosphate and thiol) on cell walls. Since in solution all the metal ions are in competition for the available binding sites, a metal that has a higher affinity for particular functional group would bind in greater concentration (Bayramoglu et al., 2003).

Generally we observed that agro-waste and plant leaves exhibited greater adsorption efficiency than fungi. Among the fungi, *T. harzianum* and *R. arrhizus* were found to be good adsorbents of metal ions. Difference among the different fungal species could be owing to marked variations in the wall composition between different fungal taxonomic groups (Siegel et al., 1990; Fourest and Roux, 1992). Generally, major constituents of fungal cell wall are carbohydrates, chitin, chitosan, polyuronide and polyphosphates and proteins that probably participated in metal binding. It has been stated that difference in the high chitin and chitosan content of the cell walls attributed differential metal uptake efficiencies in the fungal biomass (Tsezos &Volesky, 1981).

In case of agro-waste, *O. sativa* straw, *C. arietinum* husk & *L. cylindrica* are ligno-cellulose based. Most of the plant tissues are composed of structural carbohydrates as cellulose, hemicellulose, pectin, lignin, proteins, subreins, mineral salt and waxes (Rowell et al., 2002; Mazali and Alves, 2005). Carbohydrates of lingo-cellulosic mainly contributed in metal binding. Variation in adsorption efficiency of agro-waste materials could be due to the variation in number of fissures and holes. Presence of some fissures and holes indicated the existence of the macroporous structure. Previous findings reported that major contribution of the metal ions uptake is due to micro- and mesoporous structures (Oboh et al., 2009).

In present study leaves were found to be good biosorbents for Cr(III) than rest of metals. This could be due to difference in the metal-attracting groups of the cell walls of these leaves. Leaves of different trees are contained a variety of organic and inorganic compounds. Cellulose, hemicellulose, pectins and lignin present in the cell wall are the most important sorption sites (Volesky, 2003). Leaves have chlorophyll, carotene, anthocyanin and tannin which contribute to metal biosorption. The important feature of these compounds is that they contain hydroxyl, carboxylic, carbonyl, amino and nitro groups which are important sites for metal sorption (Qaiser et al., 2007).

Table 2: Comparative representation of biosorption efficiency of various biosorbents at selected concentrations. Biosorption conditions: biosorbents concentration, 0.1 g 100 mL^{-1}; pH, 4.5 (the solution pH was not controlled during the experiment); 150 rpm and 25°C for 3 hours.

	#	Biosorbents	Efficiency (%)					#	Biosorbents	Efficiency (%)			
			50 mg/L	100 mg/L	300 mg/L	500 mg/L				50 mg/L	100 mg/L	300 mg/L	500 mg/L
Cu(II)	1	*A. niger*	36	34	35	34	Ni(II)	1	A. niger	20	20	16.67	14
	2	A. terreus	21	20	20	19.8		2	A. terreus	20	21	17	16
	3	A. flavus	22	22	23	20		3	A. flavus	16	16	15	15
	4	T. harzianum	24	24	24	24		4	*T. harzianum*	46	45	43.33	43
	5	A. alternata	20	20	19	18		5	A. alternata	20	19	15	15
	6	*R. arrhizus*	34	35	36	36		6	*R. arrhizus*	36	40	46.67	46
	7	C. echinulata	20	18	16	12		7	C. echinulata	20	20	18.67	18
	8	O. sativa straw	30	30	30	25		8	*O. sativa straw*	36	38	41	43
	9	*C. arietinum husk*	44	58	54	50		9	C. arietinum husk	18	19	30	24
	10	L. cylundrica dried fruit	20	25	20	18		10	*L. cylundrica dried fruit*	44	50	51.67	48
	11	A. indica leaves	30	29	31	31		11	*A. indica leaves*	32	30	46	45
	12	M. azedarach leaves	30	30	33	33		12	*M. azedarach leaves*	36	35	48	46.6
	13	Charcoal	6	7	8	10		13	Charcoal	28	27	26	26

Note: Highlighted rows indicate biosorbent with the maximum biosorption efficiency

Table 3 A&B: Comparative representation of biosorption efficiency of various biosorbents at selected concentrations. Biosorption conditions: biosorbents concentration, 0.1 g 100 mL^{-1}; pH, 4.5 (the solution pH was not controlled during the experiment); 150 rpm and 25°C for 3 hours.

	#	Biosorbents	Efficiency (%)						#	Biosorbents	Efficiency (%)				
			5 mg L	15 mg/L	25 mg/L	35 mg/L	45 mg/L				5 mg/L	15 mg/L	25 mg/L	35 mg/L	45 mg/L
	1	*A. niger*	50	50	51.2	51.43	48.89		1	*A. niger*	47.2	47.33	46	45.71	44.44
	2	*R. arrhizus*	70	70	68	66.86	66.67		2	*R. arrhizus*	34	33.33	32	31.43	32.22
	3	*T. harzianum*	76	73.33	60	54.29	40		3	*T. harzianum*	70	68	65.2	65.14	65.11
	4	*O. sativa* straw	80	78.67	76	74.29	72.22		4	*O. sativa* straw	57.6	56.67	56	55.71	55.55
	5	*C. arietinum* husk	80	73.33	64	57.14	48.89		5	*C. arietinum* husk	72	70	68	67.71	66.67
Cr(III)	6	*L. cylundrica* dried fruit	80	80	80	57.14	51.11	Cr(VI)	6	*L. cylundrica* dried fruit	30	26.67	24	20	17.78
	7	*A. indica* leaves	60	60	48	48.57	44.44		7	*A. indica* leaves	66	56.67	48	45.71	40
	8	*M. azedarach* leaves	66	66.67	58	46.86	44.44		8	*M. azedarach* leaves	40	33.33	30	28.57	28.89
	9	*F. benglensis* leaves	80	80	80	80	80		9	*F. benglensis* leaves	52	42.67	39.6	35.14	33.33
	10	*F. relgiosa* leaves	80	80	80	80	80		10	*F. relgiosa* leaves	80	80	80	80	80
	11	*H. annus* leaves	80	80	80	77.15	75.56		11	*H. annus* leaves	60	46.67	46	45.14	44.44
	12	Charcoal	50	46.68	46	46	44.44		12	Charcoal	52	66.67	72	72	73.33

Note: Highlighted rows indicate biosorbent with the maximum biosorption efficiency

Conclusion

Perusal of results acquired on metal removal capability of the biosorbnets revealed that among thirteen selected candidates for Cu(II) and Ni(II) half of them proved to be 30-50% efficient with concentration range of 50-500 mg L^{-1}. For removal of Cu(II) from aqueous solution, *C. arietinum* husk, *A. niger* and *R. arrhizus* could be utilized. For Ni(II), six namely *T. harzianum*, *R. arrhizus*, *O. sativa* straw, *L. cylindrical* dried fruit, leaves of *A. indica* and *M. azadarch* were found as efficient adsorbents. Five biosorbents viz. *R. arrhizus*, *O. sativa* straw, leaves of *F. bengalensis*, *F. religiosa* and *H. annus* hold the greater biosorption efficiency 80% for Cr(III). Four biosorbents, *T. harzianum, C. arietinum* husk*, F. religiosa* leaves and charcoal were recorded to be best option (75%± 5) as Cr(VI) sequestering agents at applied concentrations (5-50 mg L^{-1}).

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Numerical Properties of Stochastic Linear Quadratic Model with Applications in Finance

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Abstract: The aim of this paper is to consider the characteristics of the numerical equilibrium solution of the stochastic linear quadratic models (SLQ) along with possible applications in financial modelling. The purpose of this approach is to find feedback control function that maximizes the portfolio value keeping the condition that stock prices are modeled by stochastic differential equation.

Two iterations – the Newton iteration and the Lyapunov iteration for solving the generalized algebraic Riccati equation, associated with the stochastic linear-quadratic problem in an infinite time horizon are discussed. We compare these iterations with the approach based on the solution to a semidefinite programming problem. Finally, in order to demonstrate the efficiency of the proposed algorithms, computational examples are provided and numerical effectiveness of the considered algorithms is commented.

Key Words: Stochastic linear-quadratic control; Generalized algebraic Riccati equation; Positive definite solution; Linear matrix inequality; Portfolio optimization

Stochastic Linear Quadratic Model

Let us consider the following SLQ model (Yao, Zhang & Zhou, 2006):

$$\min \quad E\int_{t_0}^{\infty}(y(t)^T Q y(t) + u(t)^T R u(t))dt$$

(1) $$dy(t) = [Ay(t) + Bu(t)]dt + \sum_{j=1}^{n}[C_j y(t) + D_j u(t)]dW_j(t) ,$$

$$y(0) = y_0 .$$

In the above control problem Q, R, A, B, C_j and D_j for j=1, ..., n are constant matrices with appropriate dimensions, $y(.)$ denotes the state variable, and $u(.)$ the control. The model is defined on a filtered probability space (Ω, F, F_t, P) involving an n-dimensional standard Brownian motion W(t).

The solution of the SLQ problem is related to a stochastic algebraic Riccati equation which is a result of the indefiniteness of the linear quadratic model.

Recently a computational approach to stochastic algebraic Riccati equation is developed based on a semidefinite programming problem over linear matrix inequalities (LMI). Many authors have considered a semidefinite programming problem as an unifying approach to stochastic linear quadratic problem in the absence of the positive definiteness (semidefiniteness) of the cost matrices R and Q .

The introduced model (1) can be directly related to portfolio oprimization problem (Yao, Zhang & Zhou, 2006), where the control of a portfolio affects not only the average return of the portfolio but also its volatility.

Consider m listed stocks that are constituent of a market index. Assume that the price of each stock $S_i(t)$, $i = 1,2,...,m$ follows the multi-dimensional GBM:

$$dS_i(t) = b_i S_i(t)dt + \sum_{j=1}^{m}\sigma_{ij}S_i(t)dW_j(t), \qquad S_i(0) = S_{i0},$$

where $W(t) = (W_1(t) , . . ., W_m(t))^T$ is an m-dimensional standard Brownian motion (with $t \in [0,\infty)$ and $W(0) = 0$), defined on a filtered probability space (Ω, F, F_t, P) .

Further assume that there is a risk less asset, the price of which is $S_0(t)$:

$$dS_0(t) = rS_0(t)dt, \quad S_0(0) = S_{00} .$$

Given a portfolio of n (n≤m) stocks out of the m constituent stocks, our objective is to control the investment of a given wealth initially values at x_0, among the n stocks and the bond, via dynamic asset allocation, in such a way that the performance of the investment follows as closely as possible a pre-specified, deterministic, continuously compounded growth

trajectory, $x_0 e^{\mu t}$ (where $\mu > 0$ is a given parameter representing the growth factor) over a long time horizon. Here, the number of stocks in the portfolio n is a typically much smaller that m, the number of stocks in the market index. Thus we are essentially dealing with a portfolio selection problem in an incomplete market. Assume that the first n of the m stocks have been selected for the portfolio.

Let $\pi_i(t)$, $i = 1,2,...,n$ denote the wealth invested in stock i at time t. That is $\pi(.) = (\pi_1(t), ..., \pi_n(t))^{\mathrm{T}}$ is the composition of the stock portfolio at time t, and it is called a (continuous - time) portfolio. In control parlance, $\pi(.)$ is the control. We say the portfolio or control is admissible if $\pi(.)$ belongs to $L_F^2(R^n)$, the space of all R^n-valued, F_t-adapted measurable processes satisfying $E \int_0^\infty \| \pi(t) \|^2 \, dt < +\infty$.

It is well known that in a self-financed manner, the wealth process $x(.)$, under an admissible control $\pi(.)$, satisfies

$$(2) \qquad dx(t) = [rx(t) + \sum_{i=1}^n (b_i - r)\pi_i(t)]dt + \sum_{j=1}^m \sum_{i=1}^n \sigma_{ij}\pi_i(t)dW_j(t) , \quad x(0) = x_0 .$$

In the control terminology $x(.)$ is the state process under the control $\pi(.)$. Note that $\pi_0(t) = x(t) - \sum_{i=1}^n \pi_i(t)$ is the amount invested in the bond, which is uniquely determined by $\pi(.)$ via the above equation. We define

$$b = (b_1 - r,...,b_n - r)^T , \qquad \sigma = (\sigma_{ij})_{mxm} , \qquad \Gamma = \sigma\sigma^T .$$

Moreover, let σ_n denote the n x m matrix which is identical to the matrix consisting of the first n rows of σ, and let $\Gamma_n = \sigma_n \sigma_n^T$.

The dynamics in (2) can be rewritten as follows:

$$dx(t) = [rx(t) + b^T \pi(t)]dt + \pi^T \sigma_n dW(t) , \qquad x(0) = x_0 .$$

Our objective is

$$\min \quad E \int_{t_0}^\infty e^{-2\rho t}[x(t) - x_0 e^{\mu t}]^2 dt ,$$

where $2\rho > 0$ is a discount factor. At this point we simply remark that ρ is introduced to guarantee the stabilizability of the control system, its actual value will have minimal impact on the result.

Applying a transformation of variables

$$y(t) = e^{-\rho t}[x(t) - x_0 e^{\mu t}], \qquad \tilde{\pi}(t) = e^{-\rho t}\pi(t)$$

to turn the above control problem into the following equivalent form:

$$\min \quad E \int_{t_0}^\infty | y(t) |^2 \, dt$$

subject to:

$$dy(t) = [(r - \rho)y(t) + b^T \tilde{\pi}(t) + (r - \mu)x_0 e^{(\mu-\rho)t}]dt + \tilde{\pi}(t)^T \sigma_n dW(t)$$

$$y(0) = 0 .$$

The above is a control problem to minimize a quadratic cost functional, with the system dynamics being linear with a nonhomogeneous term with respect to the state and control variables. Moreover, the system dynamics are stochastic. Hence, this is a SLQ problem. In order to relate the above control problem in (1) we can follow Yao et al. (Yao, Zhang & Zhou, 2006). Yao et al. (Yao, Zhang & Zhou, 2001) have investigated the SLQ model (1) in case k=1. Further on, they have extended (Yao, Zhang & Zhou, 2006) such type models and they have proposed a new approach to tracking either a given fixed growth rate or a stochastic market index. Both problems have been formulated as SLQ models.

Consider the introduced canonical formulation (1) of the above indefinite SLQ problem. To solve the SLQ problem (1) it is necessary to solve the following Riccati equation (Yao, Zhang & Zhou, 2006):

$$\mathrm{R(X)} := A^T X + XA + Q + \sum_{j=1}^n C_j^T X C_j$$

$$(3) \qquad - (XB + \sum_{j=1}^n C_j^T XD_j)[R + \sum_{j=1}^n D_j^T XD_j]^{-1}(XB + \sum_{j=1}^n C_j^T XD_j)^T = 0 .$$

with the additional condition $R + \sum_{j=1}^{n} D_j^T X D_j \succ 0$ (positive definite) for the unknown matrix X. The new equation has the inverse matrix depending on the unknown X and the additional strictly positive definiteness condition for the inverse one.

If $\tilde{X}$ is the maximal positive definite solution of the above equation with $R + \sum_{j=1}^{n} D_j^T \tilde{X} D_j \succ 0$, then

$$\tilde{u}(t) = -(R + \sum_{j=1}^{n} D_j^T \tilde{X} D_j)^{-1} (\tilde{X}B + \sum_{j=1}^{n} C_j^T \tilde{X} D_j)^T \tilde{x}(t)$$

is an optimal state feedback control for (1). The optimal control $\tilde{u}(t)$ depending on the matrix $\tilde{X}$ which is the maximal solution to (3). There are few iterative algorithms for solving a generalized Riccati equation (3) under the assumption that R is a positive definite matrix. Very interesting the case where R is an indefinite symmetric matrix. We adapt the Newton-type algorithm for solving (3) and an algorithm that is called the Lyapunov iteration for (3) can be considered. Numerical simulations are used to demonstrate the performance of considered solvers.

Thus, following the classical linear quadratic theory we know that the following optimization problem is associated with the equation $R(X) = 0$, for example see Yao et al. (Rami & Zhou, 2000; Yao, Zhang & Zhou, 2006):

$$\max < I_p, X >$$

(4)
$$\begin{pmatrix} R + \sum_{j=1}^{n} D_j^T X D_j & (XB + \sum_{j=1}^{n} C_j^T X D_j)^T \\ XB + \sum_{j=1}^{n} C_j^T X D_j & Q + A^T X + XA + \sum_{j=1}^{n} C_j^T X C_j \end{pmatrix} \succeq = 0$$

$$R + \sum_{j=1}^{n} D_j^T X D_j \succ 0$$

$$X \succ 0,$$

where <X, Y> denotes the matrix inner-product. The above convex optimization problem is called a semidefinite programming problem. We use the existing MATLAB functions for solving the semidefinite programming problem. The solvability of $R(X) = 0$ and the corresponding semidefinite programming problem and connections between the maximal positive definite solution to $R(X) = 0$ and the positive definite solution to (4) are fully investigated in (Rami, Zhou & Moore, 2000; Rami & Zhou, 2000). The obtained results are related to $R(X)=0$ where n=1. In this special case the equation $R(X) = 0$ is solvable if and only if the LMI (4) (n=1) with $X \succ 0$ are feasible. We cite the following theorem (Theorem 10, Rami & Zhou, 2000) where it is claimed that if equation (3) (n=1) has a maximal positive definite solution then it is the unique optimal solution to the related semidefinite programming problem. We can extend this conclusion to our consideration. The above conclusion stay valid in more general case, i.e. if rational matrix equation (3) with n>1 has a maximal positive definite solution then it is the unique optimal solution to the related semidefinite programming problem (4). In practical, it is interesting to find the solvability margin r^* of (3). The solvability margin is defined as the largest the nonnegative scalar $r \geq 0$ such that (3) has a solution for any symmetric matrix R with $R > -r^* I$. It is easy to extend Theorem 11 derived from Rami & Zhou (Rami & Zhou, 2000) for the equation (3) in general case (n>1).

Theorem 1. The solvability margin r^* can be obtained by solving the following semidefinite programming problem:

$$\min(-r)$$

$$\begin{pmatrix} A^T X + XA + \sum_{j=1}^{n} C_j^T X C_j + Q & XB + \sum_{j=1}^{n} C_j^T X D_j \\ (XB + \sum_{j=1}^{n} C_j^T X D_j)^T & \sum_{j=1}^{n} D_j^T X D_j - rI \end{pmatrix} \succeq = 0$$

$$\sum_{j=1}^{n} D_j^T X D_j - rI \succ 0$$

$$r > 0.$$

The margin r^* (Rami & Zhou, 2000) has the properties:

If the smallest eigenvalue of $R(\lambda_{min}(R))$ is such that $\lambda_{min}(R) > -r^*$, then (3) has a solution.

If the largest eigenvalue of $R(\lambda_{max}(R))$ is such that $\lambda_{max}(R) \leq -r^*$, then (3) has no solution.

We have seen that the feasibility of LMIs is necessary and sufficient for the solvability of (3).

Numerical Solution of the Generalized Riccati Equation

Yao et al. (Yao, Zhang & Zhou, 2006) have considered the application the LMI techniques for solving the SLQ model (1). This techniques is presented via LMI problem (4). Here we propose two recursive equations for solving equation (3). These iterations can be considered as an effective alternative to (4). First, the Newton method for solving equation (3) is considered. The Newton method to the rational matrix equation R(X)=0 can be applied under the conditions that R(X) is stabilizable and that the inequality $R(X) \geq 0$ is solvable in $domR = \left\{ X = X^T, R + \sum_{j=1}^{n} D_j^T X D_j > 0 \right\}$. Under these conditions, Damm and Hinrichsen (Damm & Hinrichsen, 2001) have proved the convergence of Newton's method if the method starts at any stabilizing initial point X_0. The standard Newton-iteration for equation R(X) = 0 has the following form

$$X_{i+1} = X_i - (R'_{X_i})^{-1}(R(X_i)) , \quad i=0,1,2, \ldots$$

where R'_{X_i} is known as the Frechet derivative of R(X) at X_i. The Newton algorithm becomes

(5)
$$(A + F_{X_i})^T X_{i+1} + X_{i+1}(A + F_{X_i}) + Q + F_{X_i}^T R F_{X_i}$$

$$+ \sum_{j=1}^{n} (C_j + D_j F_{X_i})^T X_{i+1}(C_j + D_j F_{X_i}) = 0 ,$$

where $F_X = -(R + \sum_{j=1}^{n} D_j^T X D_j)^{-1}(XB + \sum_{j=1}^{n} C_j^T X D_j)^T$. The following theorem is derived by Damm & Hinrichsen:

Theorem 2 (Theorem 6.1, Damm & Hinrichsen, 2001). Assume that there exist a solution $\tilde{X} \in domR$ to R(X) $\geq$ 0 and a stabilizing matrix X_0 (i.e. R'_{X_0} has eigenvalues in the open left plane). Then the iteration scheme (5) defines a sequence $\{X_i\}$ in *domR* with the following properties:

(i) for i = 1, 2, . . . : $X_i \geq X_{i+1} \geq \tilde{X}$ and R(X_i) ≤ 0;

(ii) for I = 0, 1, 2, . . . : R'_{X_i} is stable;

(iii) $\{X_i\}$ converges to a limit matrix $X_\infty \in domR$ that satisfies R(X_∞)=0;

(iv) X_∞ is the greatest solution of R(X) $\geq$ 0 and all eigenvalues of R'_{X_∞} lie in the closed left plane.

In the last equation we replace X_{i+1} with X_i in the expression $\sum_{j=1}^{n} (C_j + D_j F_{X_i})^T X_{i+1}(C_j + D_j F_{X_i})$ and we derive the new formula for the Lyapunov iteration to solve R(X)=0, which is

(6)
$$(A + F_{X_i})^T X_{i+1} + X_{i+1}(A + F_{X_i}) + Q + F_{X_i}^T R F_{X_i}$$

$$+ \sum_{j=1}^{n} (C_j + D_j F_{X_i})^T X_i(C_j + D_j F_{X_i}) = 0 .$$

The convergence properties of iteration (6) in case n=1 is derived in the following theorem:

Theorem 3 (Theorem 2.10, Ivanov, 2007). Assume there exist Hermitian matrices $\hat{X}$ and X_0 such that R($\hat{X}$) $\geq$ 0 and $X_0 > \hat{X}$, R(X_0)<0 and $A + F_{X_0}$ is stable. Then for the matrix sequence $\{X_i\}$ defined by (6) are satisfied:

(i) $X_i \geq X_{i+1}$, $X_i \geq \hat{X}$, R(X_i) < 0, i = 0, 1, 2, . . .;

(ii) $A + F_{X_i}$ is stable for i = 0, 1, 2, . . .;

(iii) $\lim_{i \to \infty} X_i = \tilde{X}$ is a solution of R(X) **=** 0 with $\tilde{X} > \hat{X}$. Moreover, if $X_0 > X$ for all solutions X of R(X) **=** 0, then $\tilde{X}$ is the maximal solution;

(iv) the eigenvalues of $A + F_{\tilde{X}}$ lie in the closed left half plane. In addition, if R($\hat{X}$) > 0, then all eigenvalues of $A + F_{\tilde{X}}$ lie in the open left half plane.

In our model of portfolio optimization the matrix *R* can be a negative definite or even a zero matrix. In such cases the expression $R + \sum_{j=1}^{n} D_j^T X D_j$ depends on the unknown matrix X and can be singular, so $(R + \sum_{j=1}^{n} D_j^T X D_j)^{-1}$ is not defined and therefore the Newton iterations (5) and Lyapunov iterations (6) are not applicable. The only working method in such cases is the optimization problem (4), but reaching of the optimal solution is not guaranteed when *R* is negative definite (Rami & Zhou, 2000). Moreover in our previous works (Ivanov & Lomev, 2009), (Ivanov, Lomev & Netov, 2010) we

demonstrated that methods (5) and (6) are faster when R is a positive definite matrix. Therefore if we can find a transformation of $R(X)$ where instead of R we have new symmetric matrix $\widetilde{R}$ that is a positive definite matrix, then we might expect improvement of the numerical properties of the solution. There are many examples of such transform, for instance proposed in (Lin, Bao & Wei 1994). Let's introduce new variable $X=Z+Y$ in (3):

$$R + \sum_{j=1}^{n} D_j^T X D_j = R + \sum_{j=1}^{n} D_j^T (Z+Y) D_j = R + \sum_{j=1}^{n} D_j^T Z D_j + \sum_{j=1}^{n} D_j^T Y D_j = \widetilde{R} + \sum_{j=1}^{n} D_j^T Y D_j$$

The Z matrix can be selected in a way to assure that $\widetilde{R}$ is a positive definite matrix. After transformation we obtain new form of (4), where the unknown variable is $(Y=Y^T)$:

$$
\max < I_p, Y >
$$

(7)
$$
\begin{pmatrix} \widetilde{R} + \sum_{j=1}^{n} D_j^T Y D_j & (L^T + YB + \sum_{j=1}^{n} C_j^T Y D_j)^T \\ L^T + YB + \sum_{j=1}^{n} C_j^T Y D_j & \widetilde{Q} + A^T Y + YA + \sum_{j=1}^{n} C_j^T Y C_j \end{pmatrix} >= 0
$$

$$
\widetilde{R} + \sum_{j=1}^{n} D_j^T Y D_j > 0
$$

where $\widetilde{Q} = A^T Z + ZA + Q + \sum_{j=1}^{n} C_j^T Z C_j$ and $L = B^T Z + \sum_{j=1}^{n} D_j^T Z C_j$.

Numerical Simulations

Our experiments are executed in MATLAB on 2,16GHz PENTIUM(R) Dual CPU computer. We denote tol - a small positive real number denoting the accuracy of computation, $E_s = \| R(X_s) \|_2$, It - number of iterations for which the inequality $E_{It} \leq tol$. The last inequality is used as a practical stopping criterion.

The coefficients of (3) will be generated as a pseudo-random numbers. All experiments will be carried out with negative definite matrix R and for different values of the dimension parameter p we shall generate series of 100 simulations. For each of the series the maximum number of iterations (mIt) and the average number of iterations (avIt) for finding of the solution are calculated. The details of the test simulation are :

$R=$ diag $[-0.001, -0.5]$, $q=2$; $A=$randn(p,p)/100-0.5 I_p, $B=$2randn(p,2), $C_1=$randn(p,p)/10; $D_1=$2 randn(p,2);
The selected transformation is: $Z= 0.4 I_2$. The results are presented in the following table:

Table 1: Maximum and average number of iterations for simulated 100 cases

p	LMI(4):		NI (5):		LI (6):		LMI(7):	
	m It	av It	m It	av It	m It	Av It	m It	av It
10	55	39.3	6	4.1	20	14.6	31	26.7
12	54	41.7	6	4.2	21	14.6	31	25.7
15	68	57.3	6	4.2	22	15.8	27	27.2
The total time for solving of 100 cases (in seconds)								
15	111.42		4.93		1.79		40.46	
20	320.46		118.06		20.4		118.46	

Conclusion

The obtained results confirm that the introduction of new variable leads to substantial improvement of LMI method. Again the Lyapunov approach (6) is the fastest method.

Acknowledgements

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Probiotic Potential of Lactic Acid Bacteria Isolated from Human Gut

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Abstract: The aim of this study was to characterize human gut lactic acid bacteria group strains on the basis of their phenotypic profiles. In addition, their *in vitro* potential probiotic properties were evaluated with a view to identifying potential interesting application. Fifteen strains of lactic acid bacteria were isolated and identified. Among the strains, both biochemical and physiological characteristics differed noticeably and also showed a remarkable heterogeneity. The strains were grouped into the species *Lactobacillus gasseri, Lb.casei* ssp *casei, Lb. delbrueckii* ssp *lactis, Lb. fermentum* and *Lb. delbrueckii* ssp *bulgaricus*. These strains have an inhibitory activity against enterobacteria including *Escherichia coli* and *Salmonella* sp. A major part of these strains survived at pH 2.5 and in 0.3% bile salts. Additionally they produced no haemolysis, were resistant to kanamycin and adhered to epithelial cells.
The results showed that the strains *Lb. gasseri* HG8 and *Lb. fermentum* HG3 have the best potential probiotic properties.

Key words: Human gut, Lactic acid bacteria, Probiotic.

Introduction

Intestinal microflora is a complex ecosystem formed by a number of bacterial populations, which are crucially important for the host. Most of the bacteria (>400 species) colonizing the intestine are strict anaerobes (*Bacteroides* sp., bifidobacteria, eubacteria, propionibacteria, clostridia) while aerobes (enterobacteria, especially *E. coli*, enterococci) and facultative anaerobes form a minor part (2–5 %) (Fanaro et *al.*, 2003).
The large intestine in the human body is where the highest numbers of microbes are housed. It is believed that the general well-being of humans depends on the number and type of microbes associated with the gastrointestinal (GI) tract, especially those colonizing the large intestine (Mitsuoka, 1992).
Among colon biota, lactobacilli have drawn considerable attention among researchers in last four to five decades. Since their lactobacilli have attracted the attention of researchers because of their probiotic and therapeutic advantages (Mayur et *al.,* 2002). The contemporary definition of a probiotic is "a microorganism which, when administered in adequate amounts, confers a health benefit on the host" (FAO/WHO 2002).

To exert a beneficial effect, it is generally considered essential that probiotic cells remain viable during transit of the gastrointestinal tract (GIT) in sufficiently high numbers to either establish residence (i.e. to colonise) or to benefit the host (Sheehan et *al.,* 2007).
However, the ability of lactobacilli to survive in the GIT varies considerably between different species and strains. For probiotic cells to accumulate in the GIT, they must adhere to mucus or tissue cells and then survive exposure to the relatively harsh conditions imposed by gastric acids, bile and digestive enzymes and by the highly diverse and competitive commensal microbiota of the GIT (Saulnier et *al.,* 2008).
Adhesion to the intestinal mucosa is considered an essential trait of probiotic bacteria and is thought to be a possible mechanism where by probiotics provide protection against pathogens through competition for binding sites and by localised production of antimicrobial substances (Coconnier et al., 1993).

The objective of the current study was to isolate identify and characterize a number of lactic acid bacteria (LAB) isolated from adults faeces. The strains were further characterized by tolerance to low pH and bile, and adhesion to intestinal mucous of poultry. The competitiveness of selected strains with Gram negative strains was also evaluated.

Material and Methods

Samples:
 Fresh faecal samples were obtained from five healthy adults' person (region of Chekfa, Taher and Texana, Algeria). Samples were transported to the laboratory at 4°C.

Isolation and identification of lactobacilli strains:
From each sample aliquots, five 10-fold dilutions were prepared and these were inoculated on plates of MRS agar (Pasteur institute, Algeria), acidified with glacial acetic acid to pH5.7 and incubated anaerobically for 48h at 37°C.
The identification of isolates was performed according to the criteria of Bergey's Manual of Determinative Bacteriology and using the methods and criteria of Sharpe (1979).

The ability of the isolated strains to produce acid from different carbohydrates was determined by API 50 CHL test kits (Bio Merieux, S.A., France). The API test strips were prepared as recommended by the kit supplier and scored after incubation for 24 and 48 hours at 37°C. The results were loaded on the API system software, which used the phenotypic data to predict a species identity (%) for each isolate.

Sensitivity of isolates to several parameters:

***Bile salt tolerance*:** The overnight cultures of LAB cells were inoculated into MRS broth with or without 0.3% bile salt (Pasteur institute; Alger's, Algeria).
Initial bacterial cell in the culture broth was measured by reading the optical density (OD) at 620nm and numeration using the Thomas Cell. After 4 h incubation at 37 °C, the same parameters were determined. The percentage of bile tolerance was calculated by comparison of the OD values of the bacteria cultures in MRS broth with bile salt to those in MRS broth without bile salt (Lin et *al.,* 2007).

***Acid tolerance*:** To determine the acid sensitivity or resistance of lactobacilli isolates, MRS broth was prepared in accordance with the manufacturer's instructions. pH were adjusted to pH2, pH3 and pH4 with glacial acetic acid, the media were autoclaved. The overnight cultures of LAB cells were inoculated into MRS broth and incubated for 3h at 37°C.
Viable bacterial counts were determined by plating serial dilutions (in PBS, pH 7.2) on MRS agar followed by incubation at 37 °C for 48 h (Lin et *al.,* 2007).

***Antibacterial activity*:** The inhibitory activity was screened by the agar spot agar (Schillinger and Lucke, 1989) in MRS agar at 37°C. The indicator strains used were of human gut origin (*Escherichia coli, Klebsiella* sp, *Enterobacter* sp, *Salmonella* sp and *Citrobacter* sp). A well diffusion assay with the inhibitory strain was performed.
The neutral supernatant culture fluid was tested. The plates were incubated overnight at 37°C. The diameters of the inhibition zones were measured.

Adherence of LAB to the epithelial cell: The method described by Annika et *al.* (1983) was used for the preparation of epithelial cells. Segment of poultry ileum was washed with sterilized phosphate-buffer saline (PBS, pH 7.2). It was held at 4°C for 30 min and then washed three times with PBS. The epithelial cell concentration was adjusted to approximately 5.10^4 cells/ml.
Briefly, cell pellet from overnight culture of LAB was resuspended to approximately 1.10^8 cells/ml in PBS (pH 7.2). One ml of such bacteria suspension was mixed with 1 ml of the cell suspension of epithelial cells. The mixture was incubated at 37°C for 30 min. The adhesion was observed using phase contrast microscopy (magnification fold, 200) after stained with 0.5% crystal violet for 5 min.

Results and Discussion

Isolation and identification of LAB:
Forty isolates, primarily lactobacilli were recovered from faecal samples of healthy adults' person (figure1). Only fifteen isolates were identified. From this collection, five of the identified *Lb.*strains was *Lb. gasseri*, which accounted for 33.33 % of the total isolated strains. The species *Lb.delbrueckii* ssp *bulgaricus*, *Lb.casei* ssp *casei*, *Lb.delbrueckii* ssp *lactis* and *Lb.fermentum* represent respectively 26.66%, 20%, 13.33% and 6.66% of the total isolated strains.
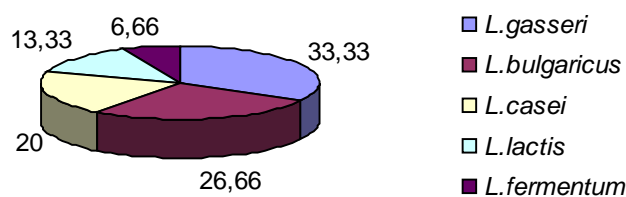
Figure1. Repartition of the identified isolates of lactic acid bacteria

Bile salt Tolerance:
The bile in intestine is an important factor which affects the viability of LAB cells. Although the composition of human bile juice is not exactly the same as that of the 0.3% oxgall solution, most studies used oxgall as one substitute for human bile because of their similarity (Lin et *al.,* 2006)

The best results were obtained, only with 6 out of 15 strains tested. From the results (table1), *Lb. fermentum* HG3 exhibited the highest bile acid tolerance (98.83%) followed by *Lb.gasseri* HG 8 (85.59%). The lowest bile acid tolerances were observed by *Lb. delbrueckii* subsp. *lactis* (21.25%). The results of this study were in accordance with those found by some authors. In similar study, Garriga et *al.* (1998) found that the selected LAB strains were resistant to 4% of bile salts. Gilliland et *al.* (1984)

observed a great variability among *Lb.acidophilus* strains isolated from calf intestinal contents in their ability to grow in vitro in the presence of bile salts

Table1. Effects of bile salt on the growth of some lactobacilli strains

Strains	OD $_{620\,nm}$		Percentage of tolerance
	Without bile salt (BS)	With 0.3 % BS	
Lb.fermentum HG3	0.942	0.931	98.83
Lb.bulgaricus HG2	0.793	0.505	63.68
Lb.casei ssp *casei* HG3	0.797	0.495	62.11
Lb. delbrueckii ssp *lactis* HG4	0.480	0.102	21.25
Lb.gasseri HG8	0.951	0.814	85.59

Tolerance to Low pH:
The effect of acidity on the viability of the isolates was assessed by adjusting the growth medium to different pH values. At pH 2, the strains' viability was affected, where this pH value was considered as the lethal for all cultures (data not shown).
The results showed (table 2) that the five isolates were able to grow on the MRS broth with different pH. The viable bacterial counts for these LAB strains changed after incubation in the pH 2. After 3 h incubation in the pH 2 or pH 3, the viable LAB counts decreased about   1–2 log value for a few strains.
In comparison to the acid tolerance of the *Lactobacillus* species which we isolated from the gastrointestinal tracts of human, strains of *Lb. fermentum*, *Lb.gasseri* and *Lb.delbrueckii* ssp *bulgaricus* seem to have better acid tolerance. These results were in accordance with previous study. The results of study conducted by Idoui *et al.* (2007) showed that *Lb.plantarum* BJ0021 was resistant to pH3 and this strain shows a good resistance to rabbit gastric juice.

Table2. Survival of some lactobacilli strains at different pH values

Strains	Number of cell / ml			Percentage of reduction (%)
	pH2	pH3	pH4	
Lb.fermentum HG3	5.48×10^5	2.00×10^6	1.92×10^7	97.14
Lb.bulgaricus HG2	7.40×10^5	2.80×10^6	2.32×10^7	97. 18
Lb.casei ssp *casei* HG3	6.76×10^5	6.40×10^6	2.72×10^7	96.51
Lb. delbrueckii ssp *lactis* HG4	3.32×10^5	3.20×10^6	2.40×10^7	92.81
Lb.gasseri HG8	3.60×10^5	5.80×10^6	2.28×10^7	98.42

Antibacterial activity evaluation of the isolated strains:
One of the major probiotic properties for probiotic LAB is its inhibitory effect on the growth of pathogenic bacteria. In our study, the bacteria used as indicator is a Gram negative bacteria, such as *E. coli*, *Salmonella* spp., *Klebsiella* spp., *Enterobacter* spp and *Citrobacter* spp from human origine.
Table shows that LAB exhibited an inhibitory activity to the indicator bacteria, although inhibitory extents are variable and we observed that *Klebsiella* spp strain seem to be more tolerant to LAB inhibition when compared to the other bacteria, such as *E. coli*. In the other hand, the antagonistic effect of the isolate was more pronounced on *E. coli* (table 3).

In study conducted by Garriga *et al.* (1998), 77 lactobacilli strains showing inhibition against one or more enteric indicator strains (*E.coli*, *Salmonella.enteritidis*). In addition, Xanthopoulos *et al.* (2000) indicated that *Lb.paracasei* subsp.*paracasei* and *Lb.acidophilus* strains isolated from infant feces had weak antibacterial activity on *E.coli* and *Yersinia enterocolitica*

Table3. Growth inhibition zones of enterobacteria caused by some lactobacilli strains.

Inhibition zone (mm)	*Lb.fermentum* HG3	*Lb.bulgaricus* HG2	*Lb.casei* ssp *casei* HG3	*Lb.delbrueckii* ssp *lactis* HG4	*Lb.gasseri* HG8
E.coli	3	3	3	2	3
Enterobacter spp	3	3	2	2	2
Salmonella spp	3	3	2	0	2
Klebsiella spp	2	3	1	1	2
Cirobacter spp	3	2	3	1	1
diameter of inhibition zone: 3 >10mm; 10 mm >2 > 5 mm; 1 < 5 mm; 0 < 0 mm					

In our study, supernatant broths were neutralized to pH6.5; the inhibition activity to enterobacteria isolates became lower. The result obtained with neutral supernatant, showed that the inhibition was not related to lactic acid but might be due to other antimicrobial substances.

The results indicate that neutral supernatant inhibited the tested indicator strains (table4). Excepted the strain *Lb.casei, In vitro* inhibitory capability of neutral supernatant of the other strains against indicator bacteria seems to be a good probiotic property. Daeschel, (1989) has reported that the antimicrobial effect exerted by LAB is due to the production of lactic acid and reduction of pH, acetic acid, diacetyl, hydrogen peroxide, fatty acids, aldehydes and other compounds.

Table4. Growth inhibition zones of enterobacteria caused by neutral supernatants of some lactobacilli strains

Inhibition zone (mm)	*Lb.fermentum* HG3	*Lb.bulgaricus* HG2	*Lb.casei*ssp *casei* HG3	*Lb.delbrueckii* ssp *lactis* HG4	*Lb.gasseri* HG8
E.coli	2	2	1	1	2
Enterobacter spp	2	2	1	0	2
Salmonella spp	2	2	1	0	2
Klebsiella spp	2	1	1	0	1
Cirobacter spp	1	1	0	0	1
diameter of inhibition zone: 3 >10mm; 10 mm >2 > 5 mm; 1 < 5 mm; 0 < 0 mm					

Assay of the adherence capability for LAB isolates:

The ability to adhere to host intestinal mucosa is considered as an important selection criterion for LAB strains intended for probiotic use. It should be reminded that for LAB strain, only more than 15 LAB cells adhered on one epithelial cell, it could be considered as ''positive'' adherent strain.

In our case, we found that solely *Lb. fermentum* HG3 and *Lb.gasseri* HG8, showed the adherence specificity to the chicken intestinal epithelium (fig.2). We don't know if they are able to adhere to the human intestinal epithelium.
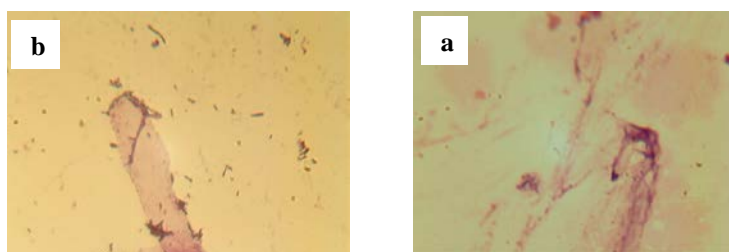

Fig. 2. Adherence of isolated *Lactobacillus gasseri* on the epithelium cells: (a) negative adhesion (control) (b) positive adhesion of *Lb. gasseri* HG8

Conclusion

From the results of the study reported here, potential lactobacilli strains isolated from human gut able to be used as probiotics may be found. Strains *Lb.fermentum* HG3 and *Lb.gasseri* HG8 were able to adhere to the intestinal epithelium from poultry. In addition, they were resistant to acid and were also bile tolerant. As the antagonistic effects of strains against enterobacteria, the isolates HG3 and HG8 might be the most preferential strain of choice.

Therefore, this study provides the information that human digestive tract offer a potential source for the isolation of probiotic LAB strains suitable for use as feed supplements**.**

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Semantic Adaptation Approach for Adaptive Web-Based Systems

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Abstract: The principles of the WWW used today rely solely on links and on content presented through simple HTML tags. The drawback of the above mentioned modus operandi is that it is purely syntactic with no clear emphasis on meaning about data. The Semantic Web approach tries to bridge that gap by providing additional information, mainly conceptual to the data at hand. In this paper we are focusing on extension of the adaptation methods with semantic adaptation dedicated to Adaptive Web-Based Systems. The approach is consisted of five steps based on querying RDF resources through SPARQL every time the user is visiting a particular resource. It is worth mentioning that the retrieved resources represent similar resources relevant to the currently visited resource which guides the user towards the desired information while browsing.

Key words: Semantic adaptation, Web based system.

Introduction

The expansion of the web in the latest years consecutively with the increase of new applications and social web phenomena has made it a place where information is not simply posted, searched, browsed and read, but also has made it a place where it can be adapted in various ways for a single purpose of action, which is meeting user's needs. The second part of the above mentioned clause is being conducted through the use of *Adaptive Web-Based Systems*. Adaptive Web-Based Systems represent systems that tend to arrange its internal link structure, content or both based on user access patterns.

In (Raufi & Georgieva, 2008), a layered framework is introduced that concentrates on the issue of complexity in adaptive web-based systems. The proposed framework guarantees:

- **Flexibility:** that offers quicker discovery of new knowledge and the reuse of the existing.
- **Expressiveness:** this allows extensive usage of semantic web technologies in the sense of good manipulation and reasoning with the knowledge at hand.
- **Interoperability:** offers sharing and accessing of data from other resources for performing adaptation (closed or open corpus adaptation).
- **Modularity:** that allows a certain degree of independence between layers.

The proposed layered framework is consisted of five layers as illustrated in (Raufi & Georgieva, 2008):

- *Data Layer* where all the data and the site's internal link structure resides. Also this is the layer where the atomic information is located with the precedence and next links as well as their particular information weights.
- *Concept Layer* represents the knowledge representation layer of the system, consisted of concepts and concept relationship. This layer represents the semantic layer of the proposed framework
- *User Layer* where user preferences like access patterns and user behaviour are collected and used for performing the adaptation process.
- *Adaptation Layer* which performs the adaptation based on knowledge gained from concept layer and user layer.
- Finally the *Presentation Layer* is what the user sees at the end as a final product of adaptation. In this stage, a rearrangement of atomic pieces of information or whole pages is done so the adaptation goal posed in adaptation layer can be met.

In (Raufi & Georgieva, 2010) we have introduced the work done in each layer of the above proposed framework. In this paper we are focusing on semantic adaptation aspects for the framework and approaches proposed in (Raufi, Georgieva, Luma, Ismaili & Zenuni, 2010) and (Raufi, Georgieva, Luma, Ismaili & Zenuni, 2010). The rest of the paper is structured as follows: In section 2, a semantic web technology available for adaptation is introduced. Section 3 outlines an approach towards adaptation which utilizes the Semantic Web, whilst section 4 illustrates an example of semantic adaptation with an included case study and finally section 5 concludes this paper with some future direction towards semantic adaptation approaches.

Semantic Web Technologies and Adaptation

The advent of *World Wide Web (WWW)* has substantially altered the understanding on how people communicate with each other. This change transformed the world and smoothly pushes the web toward knowledge based society. The above mentioned transform also changes the way how people understand computers. While, at the beginning, the computers were used for performing solely numerical calculations, today their main goal is given to data processing even though the latter is not intended to be human understandable. Data mining is a typical example for this. However, most of the web content today

is used for human consumption, disregarding the aspect of what the data conceptually represents in its essence. This disadvantage makes the content usable only for browsing, online ordering, filling forms or searching.

The reason of using Semantic Web techniques for Adaptive Web-Based System can be outlined as follows:

1) Semantic web can be used to describe every document in adaptive web-based system's repository (documents and any other smaller units) according to a certain vocabulary.
2) After their description, these documents can become machine processable and conceptually describable.
3) Numbers of these described documents are scaling optimally with no particular increase in processing power. Such examples have been detected in OpenLink Virtuoso, BigOWLIM, Garlik 4store and many more (W3C Media Wiki - Large Triple Store., 2010)
4) These described documents can be queried through a particular endpoint and presented to the user.

Knowledge representation through semantic web uses many underlying methods and technologies starting from those used for describing resources on the web (like RDF and RDF Schema), representing knowledge and knowledge flow (like OWL) up to use of rules (like Rule markup languages). All the above mentioned technologies are meant to make the web more machine-processable, which is also a requirement for building adaptive web-based systems.

One promising way of making content for Adaptive Web-Based Systems more machine-processable as well as human readable is the use of method for describing resources on the web with utilization of RDF (Resource Description Framework) (Becket & McBride, 2004) which is more like a data model rather than a language and is based on *object-attribute-value* (also referred to as *resource-property-value*) triples called *statements*.

- **Resource:** Represents every object or thing that is describable. Every resource has its own URI (Unified Resource Identifier) that uses the underlying web's standard URL naming to gain access to the resource itself. Even though RDF does not require a strict accessible resource, however the Linked Open Data Initiative (Heath, 2010) that deals with linking web resources highly recommends such an action. Our approach in Semantic Adaptation follows the Linked Open Data recommendation.
- **Property:** Represents also a special kind of resources that describe relations among resources (objects). For example, *writtenBy*, *age*, *visited* etc. are typical properties. The same as objects, properties are also represented by URI's
- **Value:** Is the actual value of the object itself, such as page name given in the above statement. It is worth mentioning that property value can also be another resource or a simple literal.

In (Raufi, 2011) we propose an architectural model for addressing the complexity of Adaptive Web-Based systems by dividing it into two logical modes: the *offline* and *online* mode.

The *offline mode* orchestrates computer exhaustive tasks such as data mining within web site's repository (clustering and association rule mining), navigation pattern mining and session reconstruction within web server's log files. The reason for performing such tasks offline is the intensive calculation nature of the above mentioned functions considering that dealing with online web application with many requests and clicks during user visits would render the system inefficient. Therefore the offline mode utilizes the above mentioned techniques on the background, issued by the webmaster which performs the overhead tasks, analyzes them and the extracted knowledge is incorporated in the overall adaptation process. The incorporation involves putting additional information on the adaptive presentation panel besides the information retrieved by adaptation algorithm. Based on the above mentioned claim, the offline mode does not obstruct the overall functioning and performance of the system because it is being conducted on the background as a separated task from that of the adaptive web application.

Online mode on the other hand considers the adaptation "on-the-fly" presented through the adaptation algorithm elaborated extensively in (Raufi, Georgieva, Luma, Ismaili & Zenuni, 2010). The online mode traces the user visits through the links it clicks and presents adaptive content based on the visited information units (documents or atomic units). The characteristic of the online mode is that it offers two types of adaptive content. The first one is adaptive content delivery through the adaptation algorithm which was based on web site's link structure and document similarity measures and the second one is adaptive content delivery by querying the knowledge repository as presented in figure 1 which in fact is the concept layer of our framework. Querying is conducted on the generated RDF triples from Relational database, represented through RDF Repository. For this purpose SPARQL (Prud'hommeaux & Seaborne, 2008) query language was utilized for querying the knowledge base. The results of SPARQL queries can be presented as result sets, RDF graphs or as RDF triples presented for human consumption through web pages (Adida & Birbeck, 2008), (Prud'hommeaux & Seaborne, 2008).
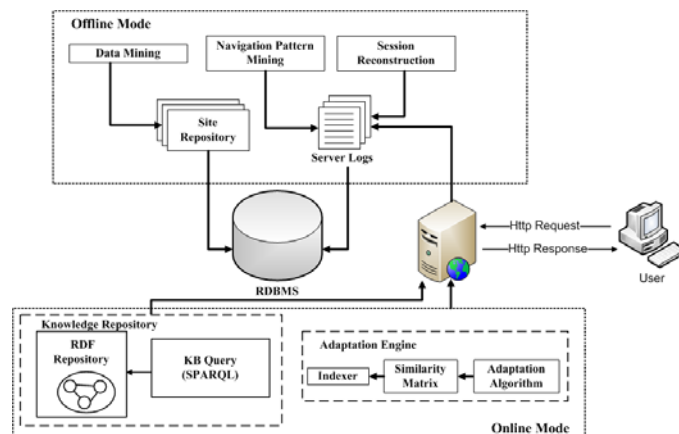
Figure 1 Architectural Model for Adaptive Web-Based Systems

Main goal of this paper is to explore the possibilities of utilizing the *Knowledge repository* as given in figure 1, consisted of *RDF Repository* and *Knowledgebase Query (KB)*, for performing RDF-Resource adaptation for users. The mechanism for querying the RDF triples mentioned in the above architecture will be elaborated in section 3.

Semantic Adaptation Approach for Adaptive Web-Based Systems

Many systems regarding adaptation for semantic web have emerged the recent years like (Mikroyannidis & Theodoulidis, 2007) and (Partarakis, Doulgeraki, Leonidis, Antona & Stephanidis, 2009). However, the approach mentioned on the systems above focus mostly on case of web usage and text mining methodologies for semi-automatic construction and evolution of Web ontologies characteristic mostly for the former and on user interface adaptation which is characteristic mainly for the latter approach.

Developing particular applications for adaptive content presentation on Semantic Web requires a set of particular skills that need to be mastered. The first skill that needs to be considered is the aspect of data representation as recommended from Open Linked Data (Heath, 2010) initiative, which is consisted of four basic rules which are (Berners-Lee, 2006):

1. Use URIs as names for things

2. Use HTTP URIs so that people can look up those names.

3. When someone looks up a URI, provide useful information, using the standards (RDF, SPARQL)

4. Include links to other URI's so that they can discover more things.

The second important skill, which is logically derived from rule 3 and 4 given above, is extracting useful information from the visited links and recommending to the users as sources for discovering new resources represented through URI's. This can be achieved in two methods:

- The first method is by simply following the typed links that Semantic Web offers, i.e. each of these links have a clearly defined semantics which allows us to precisely know which links to present to users. For example, `rdfs:seeAlso` and `owl:sameAs` clearly defined semantics and by simply using *Depth-First* or *Breadth-First* search strategies to determine which links should be offered.

- The second method, which will be followed in our approach, is by using a query language SPARQL (Prud'hommeaux & Seaborne, 2008) for querying closed or open corpus repositories in relation to link (resource) that user have already visited.

A typical SPARQL query that can retrieve everything about a particular concept can be written as:

```
SELECT ?propertyValue ?propertyName
WHERE {
      <Resource>
      ?propertyName ?propertyValue.
}
```

Where `<resource>` represent a particular dereferencable URI. Having all these aspects in mind, the proposed semantic adaptation algorithm is consisted of steps given as:

Step 1: user visits (clicks) a particular resource while browsing.

Step 2: execute a SPARQL query for every resource the user is visiting.

Step 3: present similar resources to the one that user have currently visited.

Step 4: present the resources to the user in user friendly way

Step 5: repeat steps 2-4 every time the user is visiting a resource

The whole semantic adaptation process goes by visiting and providing resources by querying RDF internal or external repositories. It is worth mentioning that resources can be described by generally accepted vocabularies like SKOS (Miles & Bechhofer, 2008), FOAF (Miller & Brickley, 2010) or more general adaptive web-based system ontology (Raufi, Ismaili & Zenuni, 2009). The above mentioned five step algorithm is going to be illustrated with a simple case study outlined in the following section.

Semantic Adaptation: A Case Study

Let us suppose that a particular RDF resource is being requested over the semantic web application and we are requesting some information about person from DBPedia <http://dbpedia.org/resource/Tim_Berners-Lee>. Executing SPARQL query that will achieve the above mentioned steps between 2 and 4 can be done by utilizing properties from OWL language. One of the properties is the owl:sameAs property. The overall query will look like:

```
SELECT ?aliasURI WHERE {
    {
        <http://dbpedia.org/resource/ Tim_Berners-Lee>
        <http://www.w3.org/2002/07/owl#sameAs> ?aliasURI.
    }
union
    {
        ?aliasURI <http://www.w3.org/2002/07/owl#sameAs>
        <http://dbpedia.org/resource/Tim_Berners-Lee>.
    }
}
```

After the execution of the query, the retrieved resources will be outlined as follows:

```
<http://www4.wiwiss.fu-berlin.de/flickrwrappr/photos/Tim_Berners-Lee>
<http://mpii.de/yago/resource/Tim_Berners-Lee>
<http://www4.wiwiss.fu-berlin.de/dblp/resource/person/100007>
<http://rdf.freebase.com/ns/m/07d5b>
```

It is worth mentioning that every time the user is visiting a particular resource, similar resources will be presented to the user as part of the above mentioned algorithm. The sole aspect that needs to be considered is the large number of retrieved resources which often can be enormous; therefore a proper filtering of such resources may be required.

Conclusion and Future Work

In this paper we have introduced a semantic approach towards adapting the content in the conceptual aspect by utilizing semantic web. We have introduced an approach towards adaptation through querying the RDF resources from internal or external repositories. The proposed semantic adaptation approach delivers similar and relevant resources every time the user clicks an RDF resource. With this algorithm, constant and up to date information is being presented to the user.
The future work on presenting adaptive on semantic level would involve:

- Limiting and filtering the number of resource according to their relevance and
- Presenting the content of resources in a more user friendly manner. Fortunately, there is a promising W3C standard technology called RDFa which is designed to present such resources in a manner which is more "human-consumable" (Adida & Birbeck, 2008).

The above presented future guidelines would ensure minimum robustness to the system considering that resources presented will be limited and filtered based on some criteria as well as it will provide readability of resources by presenting them in user friendly trait.

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The Effect of Hypergravity on the Germination and Growth of *Eruca Sativa Mill*

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Abstract: Many environmental factors such as soil, temperature and gravity influence plant development. The aim of this research was to evaluate the effects of hypergravity on *Eruca sativa* Mill. (Rocket plant). A centrifuge was used to perform hypergravity experiments. Rocket plant seeds were placed on germination paper followed by the addition of water, and subsequently subjected to intermittent hypergravity (8h hypergravity followed by 16h rest), repeated over four days. Total germination and size of seedling were evaluated before and after being cultivated in soil in a natural environment. Results showed that root growth was greater in the centrifuge group than the control group. The growth of shoots after transference to soil was also found to be higher than the control group. Additionally, the centrifuge group of rocket seeds germinated 1% more and had a material mass of almost 20% more than the control group.

Key words: Hypergravity, Eruca Sativa Mill.

Introduction

One of the main problems faced by food, pharmaceutical and perfume companies working with vegetal materials is the maintenance of access to good quality and quantity of supply in order to keep continuous production of their products. The quality of vegetal material produced depends on cultivation conditions as well as the specific germination time of each species. The environment interferes with the physiological mechanisms of plants (Arimura et al.*,* 2005) and consequently on the substances they produce. Among these environmental factors are soil, temperature, altitude, luminosity and gravity (Leite, 2009; Martins-Ramos et al., 2010). Gravity is one of the most important cues and plants respond to it by growing shoots upwards (negative gravitropism) and roots downwards in the direction of gravitational pull (positive gravitropism). Gravitropism is a coordinated response composed of four sequential processes: gravity perception, signal formation, intracellular and intercellular transduction and transmission of the signal, and asymmetric cell elongation between the upper and lower sides of the responding organism (Morita et al. 2007). Researchers have been investigating the application of different technologies to plant growth aimed at producing greater volumes of vegetal material in shorter time periods, whilst maintaining a good quality of plant. Rocket plant (*Eruca sativa* Mill. or *Eruca vesicaria* L.) is widely distributed all over the world, is usually consumed fresh (leafs or sprouts) and is known for its typical spicy taste. It contains a number of health promoting agents including carotenoids, vitamin C, fibers, flavonoids, and glucosinolates. Rocket plant has been used in traditional pharmacopoeia for various purposes: antiphlogistic, astringent, depurative, diuretic, digestive, emollient, tonic, stimulant, laxative, and rubefacient (Barillari et al., 2005). All of these aspects, in addition to its short germination time, stimulated the investigation of the effect of hypergravity on *Eruca sativa* Mill. Therefore, the aim of this research is to evaluate the effects of hypergravity on the germination and growth of *Eruca sativa* Mill.

Material and Methods

Hypergravity conditions
A small centrifuge was built at the Microgravity Centre/PUCRS in order to perform hypergravity experiments. It consists of two main structures and an electromechanical motor system. The base structure is made from carbon steel (120mm height, 350mm length, 230mm width) and holds the electromechanical motor system within. Connected over this via a rotary shaft, is a round plastic formation with a diameter of 660mm (Figure 1) and this holds the plant containers. This structure can carry 12 sample holders of 65mm in diameter for each test (Figure 2). Each sample holder allows the plant container to lean during centrifuge tests to ensure that the acceleration is applied to the desired axis.
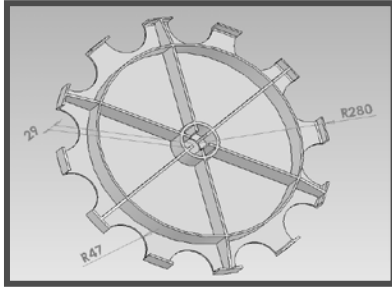
Figure 1. Schematic view of the round structure used to support plant containers (n=12)
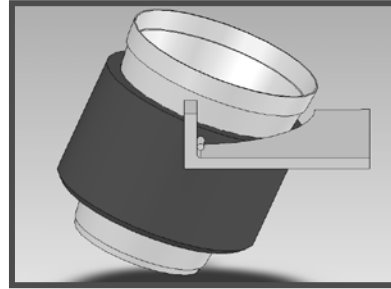

Figure 2. Schematic view of the plant container.

The electromechanical system consists of one electric motor that is connected to a reduction pulleys and gears system capable of delivering a continuous rotation up to 200rpm on the samples support structure. Rotation of the system is controlled by a DC power supply that is directly connected to the DC motor. The desired rotation in revolution per minutes (rpm) is established by changing the voltage of the power supply and measuring the rotation frequency with a contactless optical tachometer. A Digital Timer is used to control the schedule for turning the system on and off, by programming it for a period of 4 cycles of 16 hours off and 8 hours on.

For this study the centrifuge was set to run for a determined rotation frequency that would result in an acceleration equivalent to +7Gz. To calculate the rotation frequency for the desired acceleration the following procedure was used.

Using the schematic of acceleration in the centrifuge (Figure 3) and all the known parameters:

  Length of the arm (Length): 0.33m
  Desired Resultant Acceleration (a_r): +7Gz
  Earth's Gravity Acceleration (aG_z): +1Gz

Then the parameters to be determined:

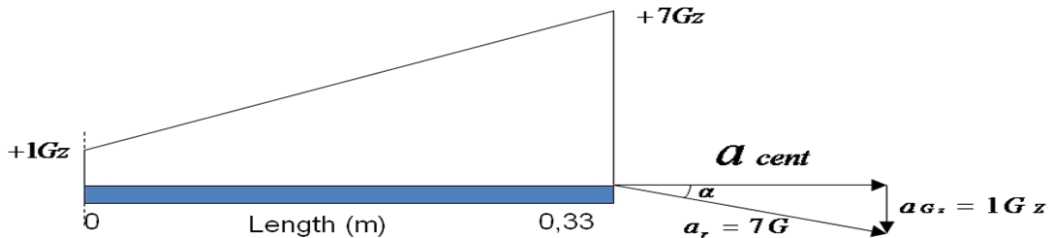 Centripetal Acceleration (a_{cent})
  Resultant Sample Angle (α)

Figure 3. Schematic of acceleration of the sample in the centrifuge.

The α angle can be determined using a rectangle triangle formed by the a_r as hypotenuse and the aG_z as the opposite side and the Equation 1.

$$\sin \alpha = \frac{aG_z}{a_r} \text{ Equation 1}$$

Applying the values $a_r = 7$ and $aG_z = 1$ on the Equation 1:

$$\sin \alpha = \frac{1}{7} = 0.143$$

It is then possible to have the α angle using the Equation 2:

$$\alpha = \text{arc sin } (\sin \alpha) \text{ Equation 2}$$

Resulting in:

$$\alpha = 8.21°$$

The α angle is then used to determine the value of a_{cent} by applying the cosine relation, Equation 3:

$$\cos \alpha = \frac{a_{cent}}{a_r} \text{ Equation 3}$$

Applying the values $a_r = 7$ and $\alpha = 8.21°$ on the Equation 3:

$$\cos 8.21° = \frac{a_{cent}}{7}$$

$$a_{cent} = 0.989 \times 7$$

$$a_{cent} = 6.923G$$

To determine the rotational frequency of the centrifuge needed to produce calculated a_{cent} the value was converted to meters per square second (m/s²) multiplying it by the Earth´s Gravity 9.81m/s²:

$$a_{cent} = 6.923 \times 9.81$$

$$a_{cent} = 67.914 \text{ m/s}^2$$

The a_{cent} can be described in the Equation 4, where ω is the rotational speed in radians per second (rad/s):

$$a_{cent} = \omega^2 \times Length \qquad \text{Equation 4}$$

It is then possible to determine ω, using:

$$\omega = \sqrt{\frac{a_{cent}}{Length}}$$

$$\omega = \sqrt{\frac{67.914}{0.33}}$$

$$\omega = 14.346 \text{ rad/s}$$

Then convert this value to frequency f in revolutions per minute (rpm):

$$f = \omega \times \frac{60}{2\pi}$$

$$f = 14.346 \times \frac{60}{2\pi}$$

$$f = 137 \text{ rpm}$$

Hypergravity experiment

Eruca sativa Mill (Rocket plant) seeds from Isla Pak (Batch:18708/10), were submitted to hypergravity experiments. The centrifuge described above was used to simulate hypergravity. Three rolls of germination paper, previously humidified with water and seeded with fifteen seeds each (forty five seeds in total), were placed in each of six of the twelve recipient containers. The hydration of the seeds was maintained by the addition of 80mL of distilled water to each container, and subsequently, each was covered by a plastic film containing holes to allow air exchange, yet reducing the loss of water by evaporation. The experiment was performed in an intermittent form, 8h in a centrifuge rotating at a +7Gz velocity speed, followed by 16h of rest, repeated over a four day period. The same procedure and number of samples were used to prepare a control group. At the end of the allotted time the number of germinated seeds were evaluated for both groups, and all seeds then removed from the germination paper and measured individually for the total size of seedling (shoot + root). The results of the experimental and control groups were compared by applying Student's *t*-test on the average, using an SPSS statistics program.

Natural environmental cultivation

After being submitted to hypergravity simulation in an intermittent form over four days, the seedlings from both groups were transferred to plant pots containing soil and kept outside on a terrace for continued cultivation in a natural environment. Water was added to each to keep the soil humidity at 80%.

Results and Discussion

Many studies about the effect of hypergravity on plants have been done (Kasahara et al., 1995; Soga et al., 1999; Hoson and Soga, 2003). According to Kasahara *et al*., (1995) gravitational forces greater than +1G have been useful to study the influence of gravity on the growth of plants. The stems of the seedlings from the centrifuge group were verified by this present study as being less flexible than those of the control group. These findings are in agreement with experiments conducted by Hoson et al. (2002), who demonstrated that the hypergravity produced by centrifugation increased the stiffness of the cellular wall due to the gravitational force. Research performed by Tamaoki et al. (2009) has shown that the content of matrix and cellulosic polysaccharides in unit length increases in shoots when under hypergravity conditions. Some authors have also mentioned that hypergravity increased the amount of cell walls per unit length of shoot in radish, cucumber, cress, azuki bean, and maize seedlings (Wakabayashi et al., 2005). These observations could explain the weight difference observed between the two groups in this experiment, whereby the total weight of *Eruca sativa Mill* seedlings submitted to hypergravity simulation was 25.72g, as compared to 20.89g for the control group, an increased vegetable mass of almost 20%.

Upon analysis of the shoots and roots of the *Eruca sativa Mill* seedlings, it was seen that growth was greater in the centrifuge group than the control group ($p < 0.001$) (Figure 4 and 5). When subsequently being transferred to the pot containing soil, the aerial part of the plant grew more in the experimental group than the control group, probably due to the greater root development during the hypergravity simulation. These results are very important, considering that the active substances of

Eruca sativa Mill. are presents in its the aerial part. (Leite, 2009).Additionally, it is important to mention the germination of the Rocket plant seeds in the centrifuge group was 1% more than for the control group.
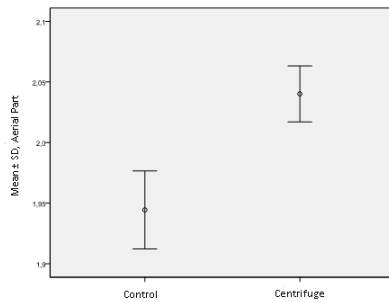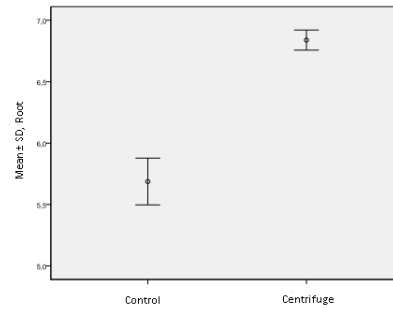

Figure 4. Growth of Aerial Part

Figure 5. Growth of Root

Conclusion

The results suggest that hypergravity simulation increases the germination and growth of *Eruca sativa* Mill. The roots of those seeds subjected to hypergravity simulation developed more than those in Earth's gravity, but in addition, after continued cultivation in a natural soil environment, an increase in growth rate for the experimental group plant shoots as compared to the control group would suggest that the effect of the hypergravity simulation on the rocket plants is ongoing and will consequently produce a greater volume of vegetal material for use by industry. Further qualitative analysis must be conducted to evaluate if any modifications to the secondary metabolites occur for plants subjected to hypergravity simulation. More studies are also necessary in order to increase understanding of the influence of hypergravity on plants.

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The effect of monks in the Hungarian Urban Design and Landscape Forming

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Abstract: Hungary has a specific history. The monks were settled after the settlement of the Magyars in Hungary. The appearance of the new monks and the continuous proselytization were able to make the country become an elemental part of the Catholic Europe. Therefore the monks had a great role in the urban design and landscape forming. The orders can be divided into three groups based on the relations between the location, activity and landscape forming. In the first category there are those orders which were present in Hungary, but are not substantial in the landscape forming. In the second group there are those orders which settled in large free areas, had significant donations, their main activity was farming, so their impact on the landscape was outstanding. In the third group there are monks who settled in towns, built monasteries, so they had an important role in the formulation of the city structure. I am describing these orders in my essay.

Key words: Monk, Landscape, Hungarian urban design

Introduction

The environment has been formed by the humans. The landscape changes continuously because of the socio-economic conditions. The landscape changes because of the extent and nature of the influence. In the Hungarian history, the landscape history and landscape forming was important due to the maturation of the settlements in the time of Saint Stephen. The defensive-, central- and economic affairs had significant role in the settlements' establishments. The administrative-, commercial- and information functions have increased the central role of the settlements. This central role was advanced by the education-, health- and cultural institutions. The emergence of the monks had a further impetus on the cities. We can know the burden of the landscape forming, via the landscape forming activity of the humans, the humans' ideas in the land-usage. We can see the conscious activities in the landscape forming via the examples of landscape forming, landscape history and landscape ecology. *(Csemez, 1996)* So my choice was the orders. I will describe the effects of the monks on the urban design and landscape forming.

Orders in Hungary

Christianity conquered Europe very quickly. Its spreading was influenced by many factors. The early Cistercian persecutions hurdled the advancement of the belief all across Europe. The turning point was in 380 AD. on 28th February, when Emperor Theodosius decreed that everyone had to follow Jesus 's teaching in the Roman Empire. Then, the religion's spreading was unstoppable. *(http://hu.wikipedia.org/wiki/Kereszt%C3%A9nys%C3%A9g)* The orders were formed. The Hungarians encountered the Christianity at the first time during their migration. The first order was the Benedictine in Hungary in 960. The first reimbursements were the period of Taksony (913?-972), but the first successes were during Géza (972-997). According to the great legend of Saint Stephen (1077) the monks were provided: *"Everywhere they established the holy foundations of the churches, they raised the cloister of the canons, the monastic communities began flourishing. (SRH. II. 383. Leg. ford. 26-27.)* The first monastery was founded in Saint Márton hill in 996, during Géza, in Pannonhalma. The foundation of monastery grew then. After Saint Benedict's sons, the Cistercians came to our country. They were called by Géza II. (1141-1162). Their first monastery was in Cikádor (1142) (today: Bátaszék). They were followed by the Premonstratensians, who followed Saint Augustine's canon. Then different orders came to our country: the Carthusians, the Dominicans, the Franciscans, the equestrian orders. As a result of our specific historical events the monks' history was different and specific in Europe. The initial recovery was interrupted by the Mongol invasion (1240-1242) in the middle ages. The next low point was the Turkish occupation (16th-17th century), when the monks disappeared. Because of secularization of the Regulation of Joseph II (1782) the most monasteries were closed. They returned to Hungary in the early 1800s, and they worked again, but after 150 years, they were forced to leave again in the time of communism. After the regime they returned and they started to advocate the idea of monasticism again. *(Török, 1990)*

Landscape Forming and Urban Design

The landscape forming of the monks depended on several factors. The orders can be divided into three groups based on the relations between the location, activity and landscape forming. In the first category there are those orders which were present in Hungary, but are not substantial in the landscape forming. In this group there are the knightly orders whose members were not monks, but secular knights who lived under monastic regulations. These are the Templars, the Hospitallers and the smaller nurse orders. They had a significant role in the Crusades and the surveillance of borders, they were always moving. *(Török, 1990)* In the second group there are those orders which settled in large free areas, had significant donations, their main activity

was farming, so their impact on the landscape was outstanding. They settled down in solitary, uninhabited places, they lived for God, but they had to cultivate the land to live on. The landscape changed thanks to their farming. In the third group there are monks who settled in towns, built monasteries, so they had important role in the formulation of the city's structure. In this group we can find the begging orders, the teaching orders and the healing orders. *(Gecse, 1995)*

The landscape forming activity of the orders is characterized by these two citation.

"Who gives us back the days when we worked all day together? When we cut trees, we made extraction of stone, and other time we planted saplings or watered?"(Nazinia Saint Gergely wrote a letter to Saint Basileios):" First of all /we have to choose/ farming, because it provides the food for our existence..." (I. Aszk 38.)

At first I will write about the farming orders because of the citation and after that, about the urban design of the monks.

The farming orders

"But the servants of the Church were not only the providers of spiritual goods. They were educators, leaders of the people at farming, too... They destroyed forests, dried out marshes, dug channels... Villages were generated. "- wrote Menyhért Érdujhelyi. *(Érdujhelyi, 1903, 3.)* In Hungary, the three main farming orders are the Benedictines, the Cistercians and the Premonstratensians. Not only was their farming successful, but also the landscape was changed. The Pauline and the Basilian should also be mentioned.

The members of the Cistercian order established flourishing agriculture everywhere, contributing to the reviving of the tillage and the fruit- and grape cultivation, raising the standards. *(Gecse, 1995)* The agriculture of the order was successful, because they organised the duties better, they pre-planned the utilization of soil, compared to the feudal farming. They worked themselves, and their life and their future depended on the success of their work. They made farming subunits, grangias. In those places, where the climatic and soil conditions allowed, vineyards were established. The gardens were created both on flatlands and the hilly country; on the hillsides they made terraces which eased the cultivation. *(Lékai, 1991)*

The centre of the Hungarian male Cistercian life is Zirc. King Béla III founded the abbey in 1182. *(Hervay, Legeza and Szacsvay, 1997)* From the beginning the agriculture was significant and dominant; the continuous change of the original landscape was the result of that. The landscape forming has been visible since the years of 1700.

A 1776 depiction demonstrates the monastery's building and the regular parcels on its neighbourhood. We can see that in this place there are only the monastery and the soil that became cultivated, because the forests were fall by the monks. The lands were surrounded by the remaining forest. The first military survey originates from 1784 *(Figure 1)*. The settlement was due to the presence of the order, because the viable places had power to modulate the settlement which suffered from the shocks but did not disappear, but were re-populated, and they were blooming again duly owing to the presence of the order. *(Tóth, 1998)* The appearance of a settlement means a considerable change in the landscape, as the settlement appears as a new landscape element. The fishing ponds were created by the monks by swelling the brooks up. It is visible that between the two depictions what kind of considerable changes ensued in the landscape, thanks to the work of monks. The next detailed depiction originates from 1805 *(Figure 2),* on which the increase of the settlement and the usage of the areas are clearly discernible, the number of the fishing ponds decreased, and the ornamental garden and the arboretum, which are in the monastery's direct environment, had already appeared here. The abbey's donations were in Bakony, Fejér county and Mezőföld. On each area they adapted to the local conditions, so they cultivated and shaped the landscape.
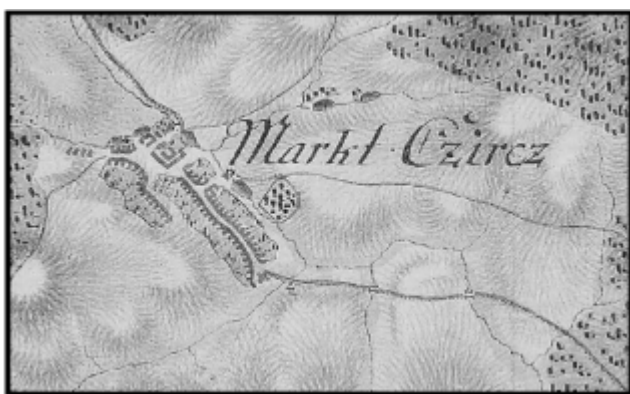

Figure 1: The first military survey of Zirc (1784)
(The first military survey, 1784, IX 17)

Figure 2: Zirc from 1805
(Veszprém County Archives)

The watchword of abbeys *is „Cruce et aratro"* at the Benedictines, that is with "a cross and with a plow". The Benedictine monasteries established flourishing agriculture during a short time all over Europe. Townships and villages were born at the foot of monasteries. *(Puskely, 2006)*

The centre of the national Benedictine order is Pannonhalma, which is the earliest founded monastery. It was founded by Grand Prince Géza in 996, but that work was finished by St. Stephen. *(Romhányi, 2000)* The farming was on the St. Martin's Hill and the surrounding area from the 11th century, at bottom of the slope and in the valleys there was arable cultivation, three-crop rotation was applied while on the slopes there were vineyards. *(Puskely, 2006)* For the order to be able to do farming, it also was necessary to destroy the forests. On a 1680 depiction *(Figure 3)* the monastery's building is well visible. The depiction was made after the expulsion of the Turkish, and accurately reflects the fact that during the occupation the area was completely deserted, the nature took control of the area. The settlers broke up virgin lands again, but the growing population prompted them to make many great cultivated areas. Especially the forests' clearing was severe at the end of the 18th century. The new lands were taken away from forests, pasture, fields and completely useless areas. The names show this, as well: Old Pines, Forest bottom, Flat, Little Field. The vines were replanted, and also to new areas. The wine-growing was the main occupation in this area. The pace of development was fast. The cultivation methods and pace were adjusted to the needs and capabilities. *(Tóth, 1998)* The following representation is the first military survey, it was made in 1784. It can show how much development and transformation had been in this area. The settlement continued to grow, in the hill the viniculture was carried on, and while in the surrounding areas there were fields, and on the not arable, steep slopes there were woods. The river, at the foot of the mountain, was inflated in several places. The second military survey was made in this area between 1846-47 *(Figure 4)*. The areas of the viniculture were grown, this shows that this area was suitable for this agriculture. The 1880 survey shows that the area of the vines was reduced, but it still defines the landscape. The damming disappeared, a swampy, moorland area took shape on its place.

Figure 3: The abbey in 1680
(Iconismus astorum urbum et regionum Hungariae ex Museo Hungarico, Depiction 30.)
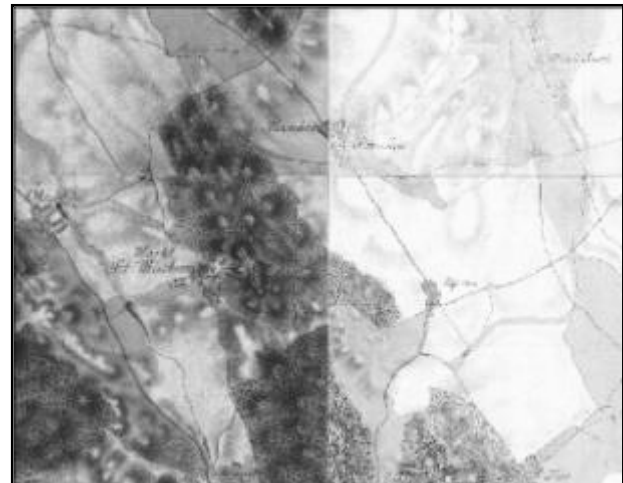

Figure 4: Pannonhalma in the second military survey
(The second military survey 1846-47, XXVII 50)

The Premonstratens settled down on bleak and lonely places. Trees were destroyed, lands were dug to be suitable for farming. As their writing said, they made flourishing agriculture with hard work, each monastery was transformed into paradise. *(Takács, 1905)* Their work was the creation of gardens, draining of swamps, usage of the water of springs and streams, the granges were formed farther of the monasteries, and then they expanded into villages, agricultural towns. *(Puskely, 2006)*

Urban design

Europe was characterized by the economic development and urbanization in the 13th century. There was a growing gap between the rich and the poor. The poverty ideal was emphasized at the orders in the 13th century, when the begging orders were formed, the Franciscans and Dominicans. They lived working and begging, so they settled down in cities. For their settlement, establishing a house was enough where they could live. In the beginning they lived simply, but after that they had donation of the nobels and kings, they lived better, began large-scale buildings. *(Török, 1990)* Religious, educational and medical centers were made in the city, around them other secular buildings appeared in the future. So a separate urban fabric was established which influenced the way of the urban constructions.

In the middle ages the attendance number of begging orders was one of the features of the urbanization. The more monasteries appeared in the city, the city got bigger. The Franciscans were represented in all big cities and in the important market towns. The Dominicans settled down in the most important cities, while the Agota hermits settled down only in the cathedral towns. The Paulines, like the Franciscan, had many buildings. The location of the monks was specific in the city, the same as for the farming orders. They built their monasteries in the city where traffic was much, people gathered in large numbers temporarily and they could build in the city centrewith royal permission. If the city did not have space, they built at the edge of the town, near the defenses. The location depended on the city on which activities they made. Whose function was the education and the pastoral, they built in the centre or near the centre, while those function was the medication, they built only at the edge of town, but along the traffic roads, bridges, city gates. This was due to the fear of the disease and of the religion. The location

depended on the role of the building as well. The bishop buildings were in the prominent, confirmed place in the city, often connected to the city wall, because of security reasons. These were the most prominent building in the city. The schools were in the neighbourhood of the bishop's palace or the cathedral. The churches and monasteries of the different orders were scattered within the city wall. *(De Cevins, 2003)*

I would lift a city from medieval Hungary's area. Bratislava. Due to its location, Bratislava was in the focus during the history. It was a royal and religious centre, royal city and place of the Hungarian parliament. *(http://hu.wikipedia.org/wiki/Pozsony_t%C3%B6rt%C3%A9nelme)* When we see the medieval description *(Figure 5)*, the first number is the royal church, number seven is the Franciscan church and monastery, and the number nine is the town hall around the market place. Outside the city wall there are three churches. These medieval town structure has been preserved to this day with the buildings, too. If we look at the various-age maps *(Figure 6-10)*, they show that the structure of the city have not change anything around the religious building.
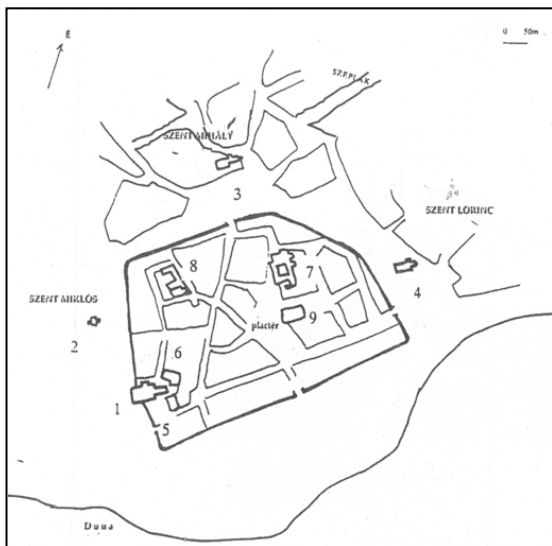

Figure 5: Bratislava in the medieval ages
(De Cevins, M. M. ,2003)
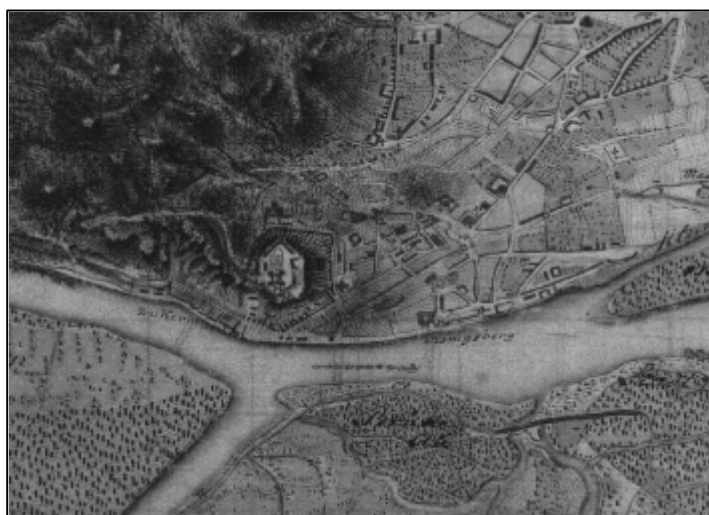

Figure 6: Bratislava in the first military survey
(The first military survey, 1782-85, VI 8)

Figure 7: Bratislava int he second military survey
(The second military survey, 1840-47, XXIV 45)

Figure 8: Bratislava today
(Google Earth)

Figure 9: The Franciscan church and monastery today
(Own photo)

Figure 10: The market place today
(Own photo)

Conclusion

As you can see the orders' activity and its settlement is closely connected to each other, and through this change their impact on the landscape varied the urban design. At first via the demonstrated domestic and foreign example it can be seen, that farming and landscape forming are connected to each other, but its significance and extension change continuously. Initially the aim was, the interest of the assurance of the self-sufficiency, the more land was feature of under cultivation, this activity in the case of the farming orders was well-organized and planned, for all works it had the aim and its way. The initial changes were the biggest changes in the landscape, because, where earlier forest or barren was, the monastery was built, and they made tillages. In the course of the centuries the landscape changed, because of the habits, the values and the order it-self working was transformed, so the farming, which was the main source of living, was sidelined into 20th century, the neighbourhood was populated duly for the processes of urbanization, and other revenue sources were provided for the living of the order. . I have examined several cities in the urban design of the monks. I can conclude that the religious buildings have had structure-forming impact. The developed medieval urban structure was preserved around the religious building throughout the centuries. More and more religious and secular buildings were built around the square. The building is preserved for posterity, or disappeared, but the urban structure survived until the present day.

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The Shell Characteristics of Land Snail *Eobania* Vermiculata (Müller, 1774) From Croatia

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Abstract: The land snail genus *Eobania* P. Hesse, 1913 in Croatia consists of four taxons. The mean shell largest diameters (D) of the 13 samples ranged from 19,99 mm to 31,78 mm and the mean shell height (H) from 17,31 mm to 25,66 mm. The shell morphology confirms that all islands populations are smaller with examples of nanism on outside islands Palagruža and Sušac. Molecular analysis (16S rDNA and COI sequence data) showed no significant differences between the South – Adriatic population from the mainland and islands, thus providing no molecular–genetic evidences for classification of a single *E. vermiculata* species into separate subspecies. The observed differences could, probably, be attributed to ecological influences.The mean size of the largest population was approximately 1,5x larger than the mean size of the smallest population. The low variance between the size variation within populations and variation in shell shape were not expected.

Key words: Shell of land snaill, Eobania Vermiculata, Croatian Study

Introduction

Eobania vermiculata (Müller, 1774) or chocolate banded snail is a wide distributed land snail. The nearest countries to Croatia in which *Eobania vermiculata* is registered are Italy, Bulgaria (Dedov, 1998), Greece (Welter-Schultes & Willians, 1999) and Turkey (Örstan et al., 2005). By a review of the available literature we determined that *E. vermiculata* has been recorded in Croatia only in general terms in Dalmatia (Jaeckel et al., 1957), on The Island Dugi otok (Štamol 2004; Štamol & Kletečki, 2005) and as subspecies *Eobania vermiculata pelagosana* (Stossich, 1877) from the Islands of Palagruža and Sušac (Berberović 1963, 1967). Molecular phylogeny and biogeography for the species *E. vermiculata* from Croatia are unknown.
The previous studies on a terrestrial gastropods *Helix aspersa* and *Eobania vermiculata* (Sacchi, 1957; Berberović 1963, 1964, 1967) in Croatia were based only on morphometric characteristics of the shell. The results showed that all shells from the adriatic islands are smaller than the average values for land specimens. Those „nanism" is especially expressed in populations of the Island of Palagruža and Sušac (open sea islands close to the italian seaside) so Berberović (1964) described new subspecies *Helix aspersa pelagosana* and Stossich (1877) *Eobania vermiculata pelagosana*.The basic survey on *Eobania vermiculata* shell morphometry made Berberović (1963) on land and island populations from the Middle Dalmatia (Croatia). He distinguished three separated groups: 1. group Palagruža and Sušac; 2. group „Biševo" and 3. group „Lastovo". The shell characteristics of group Palagruža and Sušac showed the nanism caused by geological origin of those islands, vegetation and abundance. The group Biševo is more similar to those from the Island of Gali (Gulf of Salerno). He also divided all examined populations in morphological groups in relation to populations from Palagruža and Sušac to „continental type" (H/D ratio lower than Palagruža and Sušac; middle adriatic islands except island of Vis and lastovo archipelag). Lastovo archipelag and the Island of Vis are „lastovo type" (H/D ratio same or bigger than Palagruža and Sušac) and „biševo type" consists of populations from Island of Biševo, Korčula and Hvar (H/D ratio much lower than Palagruža and Sušac). The contact zone between types are Island of Vis with neighbouring islands. The land populations divided on populations north from the river Cetina, between the river Cetina and the river Neretva and south from the river Neretva. In this paper we examined the same shell parameters as Berberović (1964) and represent the morphometric characteristics of 15 different populations of *E. vermiculata*. The aim scope was to determine if any changes in shell size took place in a period from Berberović (1964) till today. Molecular analysis (16S rDNA and COI (Puizina et al., unpublished sequences GenBank Accession Numbers JF277380– JF277396 and JF802030 - JF802030) showed that there is no molecular–genetic evidences for classification of a single *E. vermiculata* species into separate subspecies.

Material and Methods

The sampling design we used for morphological and molecular analysis followed the pattern of Berberović (1963) (samples for Middle Adriatic) as well as from North and South Adriatic, thirteen sites in total (Figure 1).

Figure 1. Sampling sites along The Adriatic coast.

For shell measurement we collected 20 specimens per site and a total of 300 specimens with a reflected lip because this indicates cessation of growth and maturity of the snail. The measurements were made on the field.

The shell features we measured were shell high (H), shell width (D) and aperture high (h). After that we compared the results as relative shell high (H/D) (ratio between high and width in percents) and ratio between aperture high (h) and shell high (H) in percents. The intrapopulation variation was calculated with the coefficient of variation (CV) of all the morphometric characters of the examined populations. Geographical variation and qualitative data of the shell were subjected separately to principal component analysis (PCA). The UPGMA analysis was used to calculate similarities between the 13 populations based on morphometric data. All statistic calculations were made by Statistica 8.0 and XlstatPro softwares.

Results

The mean shell largest diameters (D) of the 13 samples ranged from 19,99 mm (sample from island of Sušac) to 31,78 mm (Šibenik, seaside) and the mean shell height (H) from 17,31 mm (Sušac) to 25,66 mm (Island of Šolta). The mean size of the largest population was approximately 1,5 x larger than the mean size of the smallest population. Coefficient of variation (CV%) values of *H*, *D* and *h* ranged from 11,02% to 11,72% and shows the low variance for the size variation within populations. The H/D ratio ranged from 0,78 (sample from Island of Palagruža) to 0,86 (sample from Island of Sušac). The low variance between the size variation within populations and variation in shell shape were not expected. The PCA analysis based on morphometric data of the shell characteristics of *Eobania vermiculata* confirmed that the populations from Islands of Palagruža and Sušac are clearly separated from the other populations (Figure 2).
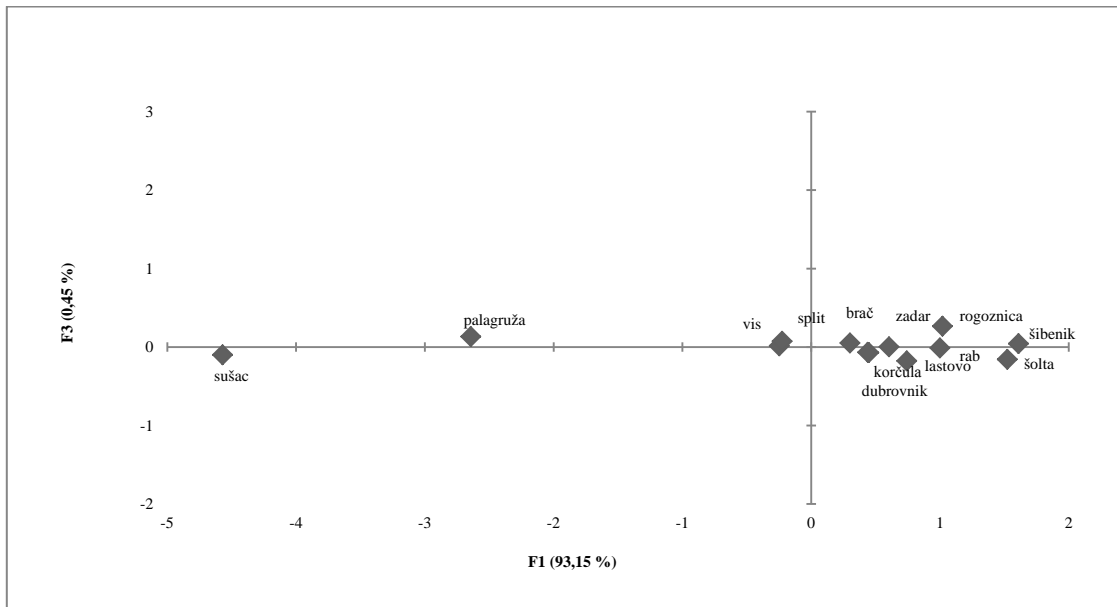
Figure 2. The diagram of PCA analysis.

The variables which mainly contributed to the first discriminant function (squared canonical correlation 0,98%) were shell hight (H) and for the second discriminant function (squared canonical correlation 0,94%) shell width (D). The populations from the island of Palagruža and Sušac constituted homogenous group (76,71%), populations from the island of Šolta and Šibenik (coast) constituted more or less homogenous group at the level of 13,57% and those from other sites were heterogenous (0-3%).The first factor (H, 93,15) and the second one (h, 0,45%) separated populations in seven groups according to their geographic proximity. The first group is characterized by two populations: Palagruža i Sušac; second group by population from the Island of Vis; third by Split (seaside); forth by the Island of Šolta and Šibenik (seaside); fifth by the Island of Rab and Rogoznica (seaside); sixth by the Island of Korčula; seventh is divided in three subgroups: Zadar (seaside), Island of Lastovo and Island of Brač and Dubrovnik (seaside) (Figure 2). UPGMA cluster analysis based on Euclidian distance (Figure 3) was consistent with PCA results.
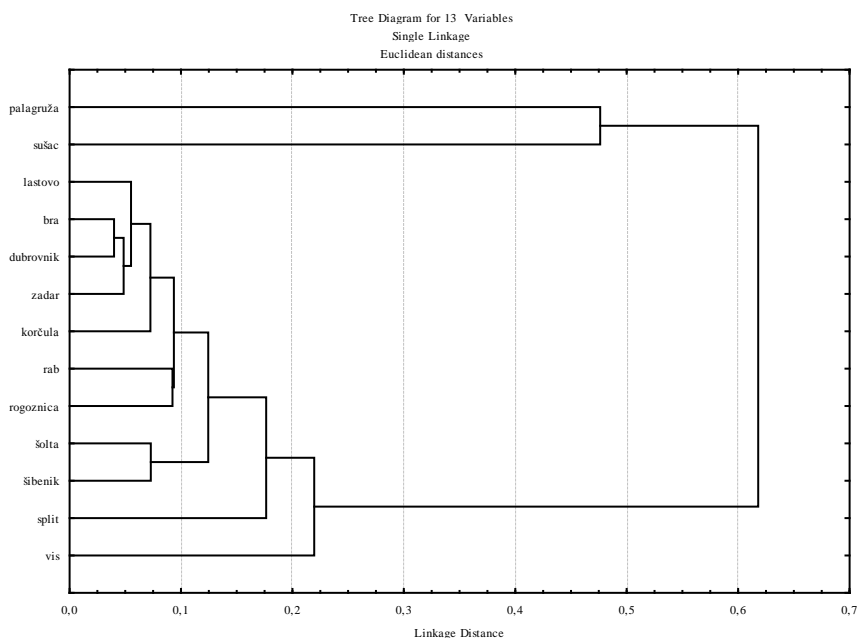

Figure 3. UPGMA cluster analysis.

Discussion

This study of morphometric characteristics of the shells revealed that populations exposed to antropogenic activity showed multivariate intrapopulation variation. The populations were grouped according to their geographical origin and cluster analysis support that thesis. Populations on open sea islands Palagruža (68 miles S from Split) and Sušac (25 km W from the Island of Lastovo) keep their „nanism" as Berberović (1964) stated in his research. The main reason for "nanism" on those islands is geographic isolation (took place approximately 10 000 years ago) and extreme ecological conditions. Namely, according to Köppen the Island Palagruža is included in the Csa type of climate - Mediterranean climate with hot summers (only 309,7 mm of rain; high relative humidity of air of 74%-77% with low precipitation of 304 mm) (Trošić et al., 2003). Such climate characteristics are directly reflected on plant communities in which xerophyts are dominant floral component (Pavletić, 1978) and they are not suitable for snail ingestion because of essential oils and silicates in plant tissue. Compared to the starting morphological variation, our shells showed the greater similarity to the sizes of the islands Tremiti (Sacchi, 1957). Lazaridou et al. (1994) stated that the largest shell diameter and the aperture area are negatively related to the mean minimum annual monthly temperatures and Cook and O'Donald (1971) confirms that smaller snails survived better in unshaded and warmer conditions. Ecological conditions in the outer islands (limited amount of food, temperature and humidity) could be the reason of increased body size because those islands are known for extremely unfavourable environmental conditions. The mean annual air temperature is 16,7˚C. Total of 85,3 days per year minimum air temperature is 20˚C or higher. Annual precipitation is 289,5 mm (Trošić et al., 2003). So, this climate type known as mediterranean arid clymate type with long dry period (more than three months per year) with extremely high temperature cause longer hybernation in poikilotherms such as terrestrial snails than in mainland. Also, the resource availability is reduced. The *Eobania* snails are polyfagous herbivores and the amount of suitable plants (herbs and grasses) is limited (Trinajstić, 1973). The Island of Palagruža and Sušac are uninhabited offshore islands app. 68 miles away from the mainland and continuity of such contributions appears perfectly stable nanism. Taking into consideration the formation of these islands it is quite certain that the species *E. vermiculata* is native species here. The populations of inner islands showed grater morphological polymorphism in a way that some individuals reach the standard shell size, almost the same as continental populations. The geographic isolation of those islands is not so long as in outer ones, and the anthropogenic influence is obvious. The environmental characteristics are quite different from those on islands Palagruža i Sušac because the most of the land is agricultural; more water and higher humidity as well as unlimited quantity of food are the main reason why those individuals are bigger than on the islands of Palagruža and Sušac. The populations from the islands Lastovo and Korčula according Berberović (1963) were grouped together with continental populations south to the river Neretva. Our survey confirms such shell sizes as Berberović (1963) but in that group are also the populations from the island of Brač. The continental populations from that group are populations from Zadar and Dubrovnik. The continental populations north from the river Cetina are similar with populations from the island of Rab and Šolta which is in accordance with Bereberović (1963). The continental populations from the area between the rivers Cetina and Neretva are in the same group with populations from Split and island of Vis. The populations from the Island of Vis is according Berberović (1963) defined as the mixed zone of different types of shell sizes. Our survey confirm this statepoint. The reduction of shell size towards continent-inner islands-outer islands our survey did not confirmed. We found enlargment of shell sizes except on outer islands probably caused by anthropogenic influence and changes in environmental conditions. Molecular analysis of two mitochondrial genes (Puizina et al. GenBank unpublished sequences) didn't support subspecies status of *E. vermiculata pelagosana* on molecular level so those samples could be define as ecotypes or forms.

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TOJSAT

Virtualmatriks: A Conceptual Mathematization Process in Virtual Learning Environment

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Abstract: In the Virtual Learning Environment, students interact with the teacher and the other students. By interacting, students can enhance the understanding of mathematical concepts and its application in the real life. This study aims to develop a model of virtual learning environment based on Realistic Mathematics Education. The research questions are how to develop and implement this model and its effect on the learning outcomes. The results of development in this study are the model and device of VirtualMATRiKS. Students simulate the conceptual mathematization process by create the movie about problem solving. Then students share and discuss it through virtual-learning device. After validated by experts, the model and device were implemented in Semarang Senior High School. And the result is the model and devices qualify the effectiveness and practicality. This model gives a positive impact on student learning outcomes, and students can reach the Upper Limit of Zone of Proximal Development. This model can be applied and developed further in learning mathematics by considering into environment, conditions and students interest.

Key words: RME ,Virtual-Learning Environment, Educational Movie, Conceptual Mathematization

Introduction

Teaching and learning mathematics are complex tasks. According to Freudenthal (1991), mathematics as human activity and mathematics must be connected to reality. Therefore, students should be able to understand the concepts of mathematics and and its application in the real world. But in fact, there are some problems in learning mathematics, such as some students are difficult to understand the concepts and problem solving, some students have low motivation in learning mathematics, and some students do not understand the application of mathematics in real life. By considering the expectations and problems, it is necessary to develop a model of learning environment that makes the learning activities become easier and more enjoyable so the students can reach the optimal learning outcomes. When referring to the Vygotskian perspective, learning outcomes and students' understanding can be increased as a result of interaction in learning. The interaction between teacher-student and student-student in learning, illustrates that social interaction in the form of discussion is able to provide students with opportunities to optimize the learning process. This interaction allows teachers and students to share and modify their ways of thinking. There is also a possibility for some students to showcase their own arguments as well as for other students the opportunity to try to capture the thought patterns of other students.

Activity is believed to be able to increase knowledge and understanding of the object was learned from the previous stage to a higher stage. Students can interact around the difficult task and share their effective problem-solving strategies, if there is an arrangement of classes and a form of learning environment. There are two forms of learning environment, namely physical learning environments and virtual learning environments. Virtual learning environment (VLE) developed by making the design of information spaces as learning environments. In the VLE, students interact with teacher and the other students, wherever and whenever. Teachers and students are familiar with the use of the system. Hardware and software that supports this system has been available. However, to achieve the purpose of learning mathematics, the development of the learning environment must be based on the characteristics and principles of mathematics and learning mathematics.

Theoretical Background

Vygotskian Perspective

According to Vygotsky (1978), there are two important concepts in the sociocultural theory, the Zone of Proximal Development (ZPD) and scaffolding. ZPD is the distance between the actual developmental level as determined by independent problem-solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers (Vygotsky, 1978). It is a dynamic developmental state. At the lower limit of the zone are the tasks that children can accomplish independently, while at the upper limit is the space where more complex tasks can be realized by children through interactions with more knowledgeable others. Learning can evoke a variety of mental processes that can only be operated stored when a person interacts with an adult or collaborate with their peers. With these interactions, students can complete a complex task that can only be solved if students are given assistance by adults or

collaborate with peers, the level is referred to as the upper limit of the ZPD. The process of giving assistance in this process is called scaffolding.

Scaffolding means providing large amounts of aid to students during the early stages of learning and then reducing the assistance and provide opportunities for children is to take over greater responsibility as soon as he can do it (Slavin, 1994). Vygotsky (in John and Thornton, 1993) explains that learning occurs in two stages: first stage occurs when collaborating with others, and the next phase done on an individual basis in which occurs the internalization process. During the process of interaction occurs (teacher-student and student-student), the following capabilities should be developed: mutual respect, to test the truth of the statement of others, negotiate, and adopt the other opinion.

Virtual Learning Environment

A Virtual Learning Environment is a collection of integrated tools enabling the management of online learning, providing a delivery mechanism, student tracking, assessment and access to resources (Dillenbour & al, 1999). In a virtual learning environment, students and teacher can interact anywhere, anytime and easy to find and share informations. Interaction can take many forms, including synchronous or asynchronous communication, one-to-one or one-to-many or many-to-many, text-based or audio and video, or even indirect communication such as sharing objects. Researchers have introduced the notion of "place" (Dourish & Chalmers in Dillenbour & al, 1999) to emphasize that space has a social impact. Places are settings in which people interact. (Munro, Höök & Benyon in Dillenbour & al, 1999). The representation of the learning environment ranges from text-based interfaces to the most complex 3D graphical output. 3D graphical representation is often used, because it can increase motivation, and triggering a positive attitude towards the environment. Dillenbour & al (1999) observed that virtual space imparts on users behaviour even when space is only described by text. In virtual environments, learning activities ranging from multiple-choice questionnaire for simulation and problem solving. The idea of learning activities in a virtual learning environment refers to something richer than the individual, closer to the idea of the project.

The difference between other constructivist environments and what virtual environments potentially offer can be described as making students not only active, but also actors, i.e. members and contributors of the social and information space. (Dillenbour & al, 1999). A virtual learning environment integrates a variety of tools supporting multiple functions: information, communication, collaboration, learning and management (Peraya & al. in Dillenbour & al, 1999). Virtual learning environments do not only integrate a variety of software tools but also integrate all the physical tools that can be found in a classroom. According Carabaneanu (2006), a learning environment is considered adaptive if it is capable of: monitoring the activities of its users; interpreting these on the basis of domain-specific models; inferring user requirements and preferences out of the interpreted activities, appropriately representing these in associated models; and, finally, acting upon the available knowledge on its users and the subject matter at hand, to dynamically facilitate the learning process.

Realistic Mathematics Education

Mathematics as human activity and mathematics must be connected to reality. These statements are the root of the Realistic Mathematics Education (RME). RME refers to the mathematics education approach which has been developed and applied in the Netherlands since 1971. Mathematics should be undertaken as an activity in the students experience mathematics as a meaningful subject and can better understand it (Freudenthal, 1991). Freudenthal emphasizes real activity in mathematical activities. Activities under consideration should consist largely of organizing or mathematization of subject matter and is taken from reality. Learners must learn mathematics with mathematization of subject matter from the real context and activity of mathematics, not learning from the traditional presentation of mathematics to the students as a ready-use system that is generalized. Real situations can include contextual problems or authentic Mathematically Contexts for students where they're having problems which are presented in relevant and real. The process of developing mathematical concepts and ideas that started from the real world called conceptual mathematization (de Lange, 1993). Schematic model of learning is described as follows.
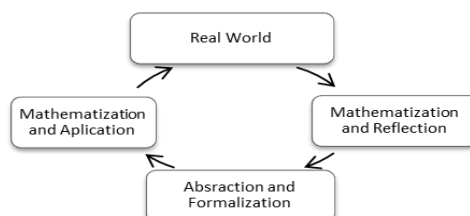
Picture 1. Conceptual Mathematization (de Lange, 1993)

Through a process of progressive matematization, learners are given the opportunity to rediscover the insight, knowledge and mathematical procedures. Thus learners do the stages which in RME called horizontal and vertical mathematization. Gravemeijer (in Sembiring & al., 2008), suggests that there are three main principles of RME, namely: (a) Guided reinvention / progressive mathematizing, (b) the didactical phenomenology and (c) self-developed models. For the operationalization of the three main principles of RME, according Panhuizen (in Gravemeijer, 1994: 114-115), RME has five characteristics, namely: a) The use of contextual problems, b) The use of various models, c) Student contributions, d) interactivity, and e) intertwining (integrated). Strategy, which could be applied in the implementation of RME by Loucks-Horsley (1998): (1) a short learning process, (2) curriculum development, and (3) the use of technology. The results of research in the Netherlands showed that the RME has shown satisfactory results. RME has the potential to improve students' understanding of mathematics (Streefland, 1991).

Activity Theory

All human actions are called activities. An activity involves an object. The object is to be transferred to the output of the activity. A subject performs an activity using a tool. The tool can be a physical or an abstract tool. The interactions between subject, object and community can all be mediated. Rules mediate the activity between the community and a subject. The activity may be collaborative, i.e. several subjects jointly do the activity using tools and dividing the work between each subject (Multisilta, 2008). In general, tools, rules and division of work mediate the relationship between the subject, community and object. Tools, rules and division of work are artefacts that are used to achieve the outcome. Experiences and attitudes that influence one another (Uden, 2007). Activity can furthermore be divided into actions and an action on operations. In general, activities are based on high-level goals (for example, documenting a work process with images and video clips). The Shared Activities and Experiences framework originates from a need to describe sharing and experiences in social media in theoretical terms (Multisilta, 2008).
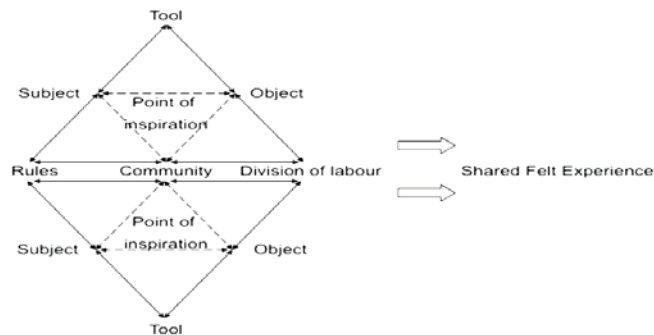

Figure 2. The Shared Experience and Activities Framework (Multisilta, J., 2008)

Figure 3: The Shared Experience and Activities (SEA) framework

Conceptual Framework and Research Question

Mathematics as human activity and mathematics must be connected to reality. Therefore, students shoud be able to understand mathematics concepts and its application in the real world. Students' understanding can be optimized through social interaction in the learning environment. There are two forms of learning environment, namely physical learning environments and virtual learning environments. In a Virtual Learning Environment (VLE), students can interact with the other wherever and whenever. In this learning environment, students do activities to learn and gain new knowledge and experience with solving problems, sharing information, and discuss. Thus, students are expected to reach the upper limit of the zone of proximal development (ZPD). Activities should be adapted to the characteristics of mathematics. Mathematical activity of solving contextual problem starts from the real world problem, mathematizing and reflecting the problem, abstraction and formalization, mathematizing in application and then bring back to the real world at the end process. In Realistic Mathematics Education (RME) approach, this process is called Conceptual Mathematization

This research questions are (1) how to develop and implement the model of VLE based on RME in Semarang Senior High Schools? and (2) Is the implementation of the model has a positive effect on student learning outcomes?

Research Method and Procedures

This research is a development research that continued from previous research, MATRiKSMovie: building the nation character through movie-based RME (See also Cahyono, 2011). The purposes of this research is to develop the model of VLE based on RME in Semarang Senior High School. According to Cahyono (2006), model is defined as a conceptual framework used as guidance to do certain activity. Pouwer (1974: 243) explain about model as assumption like metaphor formulized explicitly containing unsures which depends each other. As a metaphor, model has never been seen as part of data represented. Model explains phenomena in a form which is not usual. Every model is needed to explain something more or different from data. This requirement is fulfilled by presenting data in forms of summary (type, diagram), configuration (structure), correlation (pattern), idealization and the combination of the four. Thus, model is metaphor which is solid and useful for the comparison of relation between the choosen data and the relation among the choosen unsures of a logical construction.

In this study, validity, practicality and effectiveness criteria are defined as follows: validity refers to the extent that the design of the intervention should include "state of the art knowledge" (content validity) and the various components of the intervention are consistently linked to each other (construct validity), practicality refers to the extent that users (teachers and pupils) and other experts consider the intervention as appealing and usable in normal conditions, effectiveness refers to the extent that the experiences and outcomes from the intervention are consistent with the intended aims.

Following the work of Nieveen (1997) and Ottevanger (2001), the development and research activities in this research were conducted in three stages. The first stage is called the front-end analysis, the current situation of mathematics learning in Semarang Senior High School were analyzed. The second stage of the study is called the prototyping stage. This stage consisted to develop and validate the prototype, namely virtual-learning device, the lesson kit and formative evaluation. The

third stage of the research is called the assessment stage. In this stage the final version of the model and device are implemented in Senior High School, and then the learning process and result are reflected and evaluated with the instrument.

Results and Discussion

The first stage is called preliminary stage or front-end analysis, that the current situation of mathematics learning in Semarang senior high schools was analyzed. Result of the analysis in this stage are used as the basic for the development of model with valid, practical, and effective criteria. There are some problems in learning mathematics, such as some students are difficult to understand the concepts and problem solving, some students have low motivation in learning mathematics, and some students do not understand the application of mathematics in real life. Students and teachers need a medium to interact with easier, more enjoyable, and adjust to the development of information and communication technology. The results of the analysis indicate that some of the high school students still require visualization of abstract concepts and application of concepts in the real world. One material that is considered difficult by students is a matter of trigonometry. Student difficulties understanding the concepts and solving problems related to trigonometry, including equations and trigonometric functions and applications of trigonometry in real life. Students at this age also tend to be less motivated in carrying out learning activities in mathematics and more interested in the entertainment and and social networking because of the influence of age, social, environmental, facilities, and technology. Technological development encourages innovation in teaching and learning of mathematics by adjusting to conditions. By considering the expectations and problems, it is necessary to develop a model of learning environment that makes the learning activities become easier and more enjoyable so the students can reach the optimal learning outcomes. Learning outcomes and students' understanding can be increased as a result of interaction in learning.

In the second phase (prototyping stage), the result of analysis in first stage used to develop the prototype. Based on the preliminary analysis, the prototype being developed is a model and device of virtual learning mathematics based on RME, called VirtualMATRiKS. The prototype that need to develop, i.e virtual-learning device, lesson plan, teachers guide, students workbook, and the evaluation sheet. Preliminary description of the learning process is the students simulate of the conceptual mathematization process by creating the movie about problem solving. Then students experiencing by share and discuss the movie with other through virtual-learning device. It is based on the fact that mathematical activity of solving contextual problem starts from the real world problem, mathematizing and reflecting the problem, abstraction and formalization, mathematizing in application and then bring back to the real world at the end process. The activities of students in these activities is to demonstrate the process of solving problems related to the rediscovery of the mathematical concepts and applications of mathematical concepts in real life. Process in the production of educational films starting from a given theme as a problem (in the form of the rediscovery of the concept of mathematics, or mathematical applications), then the students discuss in a production team to develop problem-solving scenarios to be presented in the drama of human activity in problem solving, setting up properties which is needed in problem solving and presentation, to present the steps solving the problem by acting in front of the camera (as actrist or as a presenter), the product is presented in real video and/ or graphic animation according to student creativity and made simple with simple tools, so implementation of these activities in accordance with the allocation of time that has been planned in the lesson plan. The results of this learning process are portofolios and movie. Each team share the learning experience by uploading the movie in the Virtual Learning Environment device, then students discuss together about material with the guidance of teachers in the virtual learning environment. This activity can be done anywhere and anytime, with rules specified by the teacher.

Draft of prototype validated by experts (education, mathematics, media, evaluation) to obtain a valid prototype and ready to be implemented in learning process on the third stage. After validated, the prototype is corrected based on the suggestions given by experts, so getting a second prototype that is better than ever. Then the second prototype was simulated in the learning process. Simulation is used to obtain data on the implementation of models and tools in learning. The data come from teachers, students, and the observer. Simulation concludes with discussion and reflection to obtain feedback and know the lack of model and device as the basis for subsequent improvement. After repair and produce the final version of the prototype, and ready for use, then executed the third stage. The result of prototyping are the model of virtual learning environment and device of VLE. Learning environment that developed through this research is a hybrid learning environment (face-to-face learning and learning through elearning devices). Learning processes and devices were developed based on the philosophy, principles, and characteristics of RME and using IT-tools in the form of e-learning device that focus on providing support for teacher(s) and students in the learning process. E-learning device was developed with the software and computer networks. Syntax of the model are (1) Teachers provide instruction, convey learning goals, students in the class divides into groups, distribute the student activity sheet, (2) The teacher gives problems to be solved by the students, so students are able to construct the concept of matter being studied and/ or apply the concepts in real life, (3) Students discussing with his team to share tasks and create problem-solving scenarios in accordance with the creativity of each. (with teacher guidance). (4) Accordance with their respective duties, students creating a simple short film production process of solving the problem (the construction of concepts and/ or application of concepts). (5) Each team sharing the learning experience by uploading a movie in the VLE device (6) Students discuss their work together with the guidance of teachers in the virtual learning environment. This activity can be done anywhere and anytime, with rules specified by the teacher, (7) Each student gives a conclusion. (8) Teachers give clear, straighten the concept (if there is a less precise), and give final task of learning (projects, pop quizzes and/ or homework) using VLE device. Virtual learning device was developed and implemented by using software, hardware, and computer network, that supports text files, images, interactive media, mathematical formulas and video. The device also provides both synchronization and asynchronization communication feature.
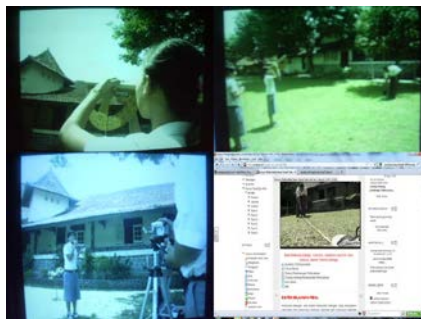
Figure 3. Practice problem solving in the real world, simple movie production,
share and discuss in VLE device

The third stage of the research is called the assessment stage. In this stage the final version of the VirtualMATRiKS model and device are implemented in Senior High School, and then the learning process and result are reflected and evaluated with the instrument.VirtualMATRiKS was implemented in a Semarang Senior High School class 10 in 2008 in the subject matter of Trigonometry.

The research result suggest that the average of reliability of learning equipment (virtual-learning device, lesson plan, teachers guide, students workbook, and the evaluation sheet) is 95,30%, that is a high reliability category, the capability of teacher in organizing the learning could be categorized as very good, with average score 3,52. The average of teacher's activities in the learning process is 3,54 or it reaches 88,48 % (category of very good). The average of students' activities in the learning process is 3,54 or it reaches 88,57 % (category of very good). Seeing the average of students' involvement of each meeting, it shows that there is an increase of students' involvement from 3.45 to 3.54 at the last meeting. The average of students' skill of process in the learning is 3.57 or it reaches 89.26% (category of very good).

According the calculation, $\chi^2_{calculation}$ = 1,296 which is significant at $0,069 > 0,05$, thus, Ho is accepted which means the data has normal distribution. Therefore, the statistic used is statistic of parametric. The result shows that the mathematics learning result data coming from upper, middle and lower groups in the experiment class and control class are normally distributed and are homogenous. By using *Univariate One Way Anova* to test the difference of averages between the upper, middle and lower groups. Based on the calculation, at the row group, the significant value is $0,020 < 5\%$, it means that the learning outcomes between experiment class and control class is different. At the column group, the significant value is $0,000 < 5\%$, it means that there is no difference of the learning outcomes among the three groups (upper, middle, lower). Then, there is no interaction because the value of significant is $0,091 > 5\%$.

By using *Regression Analysis*, $F_{calculation}$ = 25,643 with significant rate is 0,000. It shows that there is strong effect of skill of process toward the learning outcomes or Ho is rejected which means there is influence between skill of process and learning outcomes. From the calculation, the correlation between skill of process and learning outcomes is 63,5 % and the skill of process gives contribution toward learning outcomes 40,3%. Therefore, the skill of process strongly correlates with the learning outcomes. The regression equation between skill of process and learning outcomes is $\hat{Y} = 32,371 + 2,657\,X$, where Y = learning outcomes, and X = skill of process. From the calculation, $F_{calculation}$ = 27,616 with significant rate is. It shows that there is strong effect of students' activity toward the learning outcomes or Ho is rejected which means there is influence between students' activity and learning outcomes. The correlation between students' activity and learning outcomes is 64,9 % and the students' activity gives contribution toward learning outcomes 42,1%. Therefore, the students' activity strongly correlates with the learning outcomes. The regression equation between students' activity and learning outcomes is $\hat{Y} = 13,968 + 1,987\,X$, where Y = learning outcomes, dan X = students' activity.

From *Compare Mean One Sample t Test* , we find that $t_{calculation}$ = 2,963. By using right side test, for α = 5% and df = n – 1 = 39–1 = 38 we gain $t_{(1-\alpha)(n-1)}$ = 2,021. Because $t_{calculation} > t_{table}$, then Ho is rejected. Therefore, it can be concluded that the average of learning outcomes $\geq$ 65,0, thus, the students have mastered the material because they reach material comprehension. Therefore, learning process using this model can reach the purposes of learning (reach the material comprehension) with the average of learning result is 80,57.

The results of implementation show that the learning of mathematics through VirtualMATRIKS showed the good results. Activities and process skills of students in this learning is making a positive impact on student learning outcomes. The learning outcomes in this study referred to three aspects: cognitive, affective, and psychomotor. The cognitive aspect included pupils' achievement and reasoning, the affective aspect involved pupils' motivation, activity, and creativity, while the psychomotor included skills in problem-solving process. Scaffolding for students to reach the ZPD occurs when students interact with each other in processing of problem solving.

In the activities, students are trained to be creative and caring in problems solving, both social and environmental problems. Students work together in solving the problem. Students are able to communicate their ideas and dare to be responsible. This learning can build motivation, appreciation, contribution, interest, beliefs, creativity, confidence and

perseverance and a sense of responsibility and communication skills. RME approach can build self-reliance, democracy, tolerance, humanism and honesty. Mathematical learning occurs during the film production process and during the discussion and interact with teacher or the others using VLE device. Activities and process skills of students in mathematics learning through VirtualMATRiKS in the high school has provided a positive effect on the results student learning (cognitive, affective, and psychomotor). Students learning outcomes in this learning environment are better than students learning outcomes in the conventional leaqrning environment. There is a difference between understanding and student learning outcomes between before and after the learning process in that environment. After interacting via the VLE devices, understanding and student learning outcomes are higher than ever. Students can reach the upper limit of the ZPD.

Conclusion and Suggestion

Based on the results from the three stages of this study, it has been concluded that: The result of this research is a VLE model based on RME, namely VirtualMATRiKS. In this learning environment, the students simulate of the conceptual mathematization process by creating the movie about problem solving. Then students experiencing by share and discuss the movie with other through virtual-learning device.Model and device are effectively implemented in mathematics learning in Senior High School, and this model gives a positive impact on student learning outcomes (cognitive, affective, and psychomotor). Students can reach the Upper Limit of Zone of Proximal Development.

Based on the conclusions of this study, it can be suggested that this model can be applied and developed further in learning mathematics by considering into environment, conditions and students interest.

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