UNIVERSITY OF EAST SARAJEVO

FACULTY OF TECHNOLOGY ŽVORNIK

PROCEEDINGS

ZBORNIK RADOVA

III INTERNATIONAL CONGRESS

ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESSING INDUSTRY

III MEĐUNARODNI KONGRES

INŽENJERSTVO, EKOLOGIJA I MATERIJALI U PROCESNOJ INDUSTRIJI

JAHORINA, 04.03. - 06.03.2013.

BOSNIA AND HERZEGOVINA

FACULTY OF TECHNOLOGY ŽVORNIK
TEHNOLOŠKI FAKULTET ŽVORNIK

UNIVERSITY OF EAST SARAJEVO
FACULTY OF TECHNOLOGY ZVORNIK

UNIVERZITET U ISTOČNOM SARAJEVU
TEHNOLOŠKI FAKULTET ZVORNIK

PROCEEDINGS

ZBORNIK RADOVA

3rd INTERNATIONAL CONGRESS

"ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESSING INDUSTRY"

III MEĐUNARODNI KONGRES

„INŽENJERSTVO, EKOLOGIJA I MATERIJALI U PROCESNOJ INDUSTRIJI"

UNDER AUSPICIES OF:

- ***THE MINISTRY OF SCIENCE AND TECHNOLOGY OF REPUBLIC OF SRPSKA***
- ***THE ACADEMY OF SCIENCE AND ART OF REPUBLIC OF SRPSKA***

POD POKROVITELJSTVOM:

- ***MINISTARSTVA NAUKE I TEHNOLOGIJE REPUBLIKE SRPSKE***
- ***AKADEMIJE NAUKA I UMJETNOSTI REPUBLIKE SRPSKE***

JAHORINA, 04.03.– 06.03. 2013.

BOSNIA AND HERZEGOVINA

UDC: 502. 131. 1
Professional paper: **(I-72)**

CREATION OF LIFELONG LEARNING NETWORK FOR DEVELOPMENT OF SUSTAINABLE TECHNOLOGIES

СТВАРАЊЕ МРЕЖЕ О ЦЕЛОЖИВОТНОМ УЧЕЊУ ЗА РАЗВОЈ ОДРЖИВИХ ТЕХНОЛОГИЈА

Jadranka Blazevska Gilev [1], Kiril Lisichkov[1], Emilija Fidancevska[1], Vineta Srebrenkoska[2]

[1]Faculty of Technology and Metallurgy, Sts.Cyril & Methodius University, MK-1000 Skopje, Republic of Macedonia, e-mail: jadranka@tmf.ukim.edu.mk
[2] Faculty of Technology, Goce Delčev University,"Krste Misirkov" b.b. P.O. Box 201, 2000 Štip, Republic of Macedonia,

[1]Технолошко-металуршки факултет, Св.Кирил и Методиј, МК-1000 Скопје, Република Македонија, е-маил: jadranka@tmf.ukim.edu.mk
[2] Технолошки факултет, Универзитет Гоце Делчев "Крсте Мисирков" бб П.О. Бокс 201, 2000 Штип, Република Македонија,

Abstract

Learning for sustainable development occurs in a range of learning environments that can be formal, non-formal and informal in nature and is a process that continues lifelong. Lifelong learning is defined as „All learning activity undertaken throughout life, with the aim of improving knowledge, skills and competence, within a personal, civil, social and/or employment-related perspective". There have been several recent initiatives designed aimed at encouraging dialogue between universities, working in the field of lifelong learning and education for sustainable development, and companies. For such purpose it is necessary to produce a strategic document setting a clear concept of lifelong learning and vision of sustainable development. For sustainable development to retain any use for lifelong learning, it must take seriously the problem of ecological sustainability. Ecological sustainability recognizes that human society and economy is both part of, and interacting with an ecological context on which society is dependent for resources and maintenance of life. Ecological sustainability of plastic materials, it was our goal, namely to reduce waste generation and resource consumption in production processes. The integration of environment and development concerns and greater attention to them leads to improved living standards for all, fulfilling basic needs, better protected and managed ecosystems and a safer, more prosperous future global partnership for development of sustainable technologies.
Key words: *development of sustainable technologies, lifelong learning, ecological sustainability of plastic materials*

Izvod

Учење за одрживи развој које се јавља у рангу учења околине може бити формално, неформално и да је процес који се наставља доживотно. Доживотно учење се дефинише као "све активности учења предузетих током живота, са циљем унапређења знања, вештине и компетенције, у оквиру личне, грађанске, социјалне и/или работне перспективе". Било је неколико недавних дизајнираних иницијатива са циљем подстицања дијалога између универзитета, који раде у области доживотног учења и образовања за одрживи развој, и компанија. За ту сврху је неопходно потребно да се направи стратешки документ са јасним концептом доживотног учења и визије одрживог

развоја. За одрживи развој да може бити доживотно учење, мора озбиљно прихватити проблем еколошке одрживости. Еколошка одрживост препознаје да су људско друштво и привреда два дела, и да је њихова интеракција са еколошког контекста тако да је друштво зависно од постојања ресурса и њихове одрживости. Наш циљ је био, еколошка одрживост пластичних материјала односно смањење стварање отпада и потрошње ресурса у производним процесима. Интеграција животне средине и развој концерна и већу пажњу на њих доводи до побољшања животног стандарда за све, испуњавање основних потреба, боље заштићених и менаџираних екосистема и сигурније, више просперитетне будућности глобалног партнерства за развој одрживих технологија.
Кључне речи: *развој одрживих технологија, доживотно учење, еколошка одрживост пластичних материјала*

1. Introduction

The concept of sustainable development has spatial and temporal dimensions, as it must satisfy three goals equally around the world for current and future generations. It can be seen as progressive and balanced achievement of sustainable economic development, enhance social equity and environmental quality. Sustainable development consists of three individual components (society, environment and economy) and the objectives of sustainable development can be achieved if all three components can be satisfied simultaneously. For this to happen, a number of global and local issues need to be resolved. There are important links between poverty and environmental quality and much of the environmental degradation we see in the developing world arises as a result of people seeking basic essentials of life: food, water, etc. On the other hand, environmental problems are a significant cause of poverty and generally hit the poor, for example, a quarter of all diseases found in developing countries. One of the major causes of environmental degradation, however, is unsustainable development by the rich. U.S.A., Japan, Germany, Canada, France, Italy and UK, make up less than 12% of the world population but consume between 55 and 65% of world resources. It will need eight and a half planets to sustain current global consumption in 2050, if the rest of the world continues consuming energy resources such as making today in Great Britain (Azapagic A., 2003).

The concept of lifelong learning tends to be oriented around the economic versus humanistic interpretation. The economic implications of a low skills base and changing demographics to discuss lifelong learning better provides adults with the skills that employers need to compete in the global market. Through employment and competitiveness through increased productivity achieves social inclusion. Social purpose education is flat against instrumental lifelong learning. However this difference may serve to strengthen the link between economic and social, each with their own sets of knowledge, skills and culture that can be developed through learning and education. Sustainable development can potentially provide an opportunity to re-inject the socio-economic goals, and to humanize the economy because it emphasizes the integration of economic, social and environmental section (Agyeman J., 2005).

2. Sustainable materials

The creation of sustainable industrial materials, especially organic, inorganic materials and metals, enabled significant development of society, so that today industrial materials are necessary in everyday life and welfare. Industrial materials are infrastructure that supports the current society, in terms of providing energy, water, transportation, shelter and information and communication technologies. They are an integral part of almost every aspect of daily life, in the clothes to wear, the food we consume, the pharmaceutical products etc. It should be noted that some material developments had unanticipated adverse impacts on the environment and human health. Specific characteristics that possess materials are resulting from unanticipated impact. Tetraethyl lead and polychlorinated biphenyls was found to have a negative impact on the environment that is based on the toxicity of the material, which is determined by the

chemical structure and composition of the material. Chlorine fluoro carbons because of their volatility, persistence and reactivity in the atmosphere, (largely governed by their physical characteristics), are disturbed the sensitively balanced chemistry of the planet. Sustainability of materials is possible through innovations that will have to deliver materials and technologies of the future which in striking the balance between its economic, social, environmental, operational and technical factors. Most effective innovations lead to the provision of sustainable materials, products and technologies of the future. In one respect, the current innovation processes need to be placed in a broader, life cycle and sustainable development context to then deliver sustainable results.

Particularly important for the sustainability of materials is eco-efficiency, whose essence is using natural resources more productively in ongoing operations, or to "do more with less." Eco efficiency is actually based on: the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, at least in line with the country estimated carrying capacity. The goal is actually simultaneously reducing the use of natural resources, increase product and service values and reducing the impact on nature.

Each category of material requires a different approach to eco-efficiency:

- wood/paper main goal is to maintain the integrity and productivity of living resources stocks.
- for metals main goal is to maximize the utility of the metal element. Creating value from the material stock should be maximized through the use and reuse of each atom.
- for plastics primary goal is to increase the value of the product, taking advantage of the flexibility offered by plastics in their application in different production cycles.

Mild alkaline hydrolysis of poly(vinyl chloride-co-vinyl acetate) in an organic solvent, accompanied with a acceptable level of dechlorination, was our study of chemical recycling of poly(vinyl chloride-co-vinyl acetate). The resulting hydrolysis product was another polymer, poly(vinyl alcohol) with slightly chlorine content. The only one by-product was sodium chloride and no other harmful products were produced (Blazevska-Gilev J., Spaseska D., 2009).

Recycling of PVC and plasticizer, by separating plasticizer using alkali solution and leaching process at low temperature was our next experimental study using various concentrations of NaOH solutions at different temperatures and processing time gives a selective separation of the plasticizer almost without dechlorination of PVC (Blazevska-Gilev J., Spaseska D., 2007).

Remediation of poly(vinyl acetate) from waste products with separation of poly(vinyl acetate) from the formulation, released from the plasticizer, undergoes degradation with a conservation of the almost the original structure of polymer was our next research study (Blazevska-Gilev J., Spaseska D., 2009).

3. **Sustainable development**

Commonly cited criteria for sustainable development is characterizing as "development that meets present needs without compromising the ability of future generations to meet their own needs". It is essentially a new way of viewing the world, based on considerations of inter-generational and intra-generational justice and shared responsibility. The goal of sustainable development is to meet human needs today and tomorrow, which requires consideration of the means of production of material and immaterial heritage, and its distribution among the members of our generation, especially at international level, by sex and ethnicity and its distribution among future generations.

Two main objectives are defined for achieving sustainable development of materials:

- Reduction of toxic characteristics of materials used in products and processes: by reducing the volume of toxic materials used in a process or production, or by substituting more benign substances toxic by chemical changes that reduce or eliminate their toxic properties.
- Increase the intensity of service received by each unit of material used. This can involve recycling and reusing materials or redesigning products that use less material (R van Berkel, 2006).

4. Lifelong Learning for SustainableTechnologies

In order to achieve a quantum reduction of waste generation and material intensity of current production methods, technology plays a particularly important role. Possible sustainable technological options are: environmental care and optimization, process improvement and renewal. Each of technological options has its own distinctive sets of goals, organizational and strategic requirements. The near future period or short term activities (environmental protection and optimization) industry fits fine tuning operations through mechanisms such as quality management, auditing and efficiency drives, which usually have a time horizon of five years. Middle future period (process improvement) deals with integrated technological process improvement, innovation and reorganization. It usually remains limited to the existing infrastructures and technologies. The typical time scale is 5-20 years. Third - far future period or long term activities- (system recovery) deals with basic recovery technologies and organizational structures. Innovation for technology renewal involves redefining existing technology development trajectories and creating new ones. In principle, renewal can bring sustainable technologies that are designed from the outset to be essentially compatible with eco-capacity constraints.

This concept of lifelong learning for sustainable development of complementary technology can adapt to innovation framework for various industrial sectors. Basically, there are three innovation platforms:

a. Procedures (finding better ways to run existing businesses to improve their eco-efficiency)
b. Design (driving and guiding the development of new businesses by the eco-efficiency and industrial ecology goals and tools), and
c. Technology (applying novel technologies that provide step improvements in eco-efficiency).

Innovations are usually directed to:

- Operations and maintenance: better operation and maintenance procedures and practices to improve process efficiency, minimizing the use of process reagents and generation of waste and emissions, and minimize process downtime.
- Process inputs: better control of incoming materials to minimize entry of dirt in the process and use more effective, less toxic and/or renewable process inputs.
- Reuse, recycling and recovery: adding reuse, recycling and recovery processes and loops back the materials, reagents, water, heat and/or other valuable materials (Fig.1).

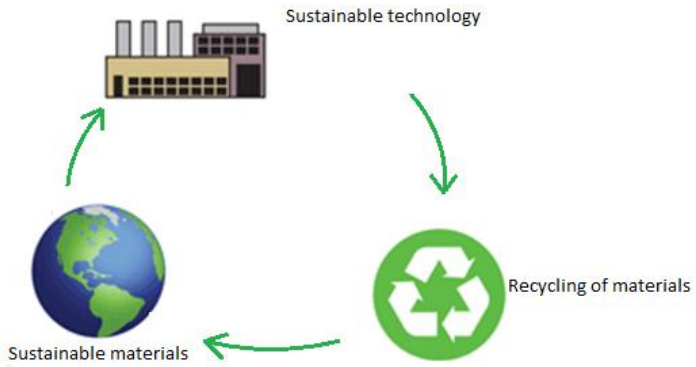

Figure 1. Sustainable technology

The concept of lifelong learning for successful sustainable technologies can be divided into three main topics:

- Develop technologies and practices to facilitate progression through investigating interoperability and relations between students, educational institutions and industry.
- Development of practices and technologies to address collaboration and sharing of teaching resources.
- Develop student technology practices in support of independent lifelong learners.

Activities that are undertaken for successful realization of the concept are:

- Preliminary activities: research issues, new technologies and new approaches.
- Prototyping activities: building prototype systems or processes.
- Demonstrator / piloting activities: using the new practice or technology in order to feed back into its development or inform the decision to move to larger-scale use.
- Transformational activities: implementing and supporting long-term changes in industrial complex.

5. Conclusion

- Especially important element for the sustainability of materials such as manufactured is what will be the impact of these materials once they are released to the environment and/or people who are exposed to them. If we apply less toxic materials in production processes, products will have less harmful dissipation into the environment.
- It is important to note that during the production of materials with the procedures for their processing in many cases requires enormous amounts of energy, raw materials, water and waste discharges and emissions. Therefore particularly important procedure is closing material cycles and improved materials for processing phases that can be supplemented by more focused materials sustainability reviews in each of the material phases. Recycling of plastic materials has been the subject of our research, ie reduction of waste generation and resource consumption in production processes.
- One of the most important goals of sustainable technologies is actually a waste of one industry can be a raw material for another, with a minimum of transport, storage and

preparation of raw material taken into account three main criteria for sustainable development, namely environmental, economic and social dimension.

- Creating a network of lifelong learning should be to achieve the learning needs of groups engaged in combat, and generate a dialogue with these groups, professional knowledge and wider learning. Especially important is a form of education, both original education and lifelong education, the core of generic conceptual and practical skills.
- Sustainable lifelong learning can be effectively addressed by a broad network of providers working co-operatively and jointly and new directions needed-drawing of new disciplines and methodologies, develop and support new networks and partnerships, and bringing together public, private and other sectors to improve quality and address the content and nature of lifelong learning and training. If they are successful, as we move from the era of access to deeper culture of quality, there is a possibility that these new guidelines will help to bring about a prosperous, secure and sustainable future for the next generation of students, citizens and workers worldwide.

6. References

1. Azapagic A., Emsley A., Hamerton I., Polymers - The Environment and Sustainable Development, University of Surrey, Guildford, UK2003 John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England, 2003.
2. Agyeman J., Sustainable Communities and the Challenge of Environmental Justice. New York University Press; London, 2005.
3. Blazevska-Gilev J., Spaseska D., Chemical recycling of poly(vinyl chloride): alkaline dechlorination in organic solvents and plasticizer leaching in caustic solution, Journal of the University of Chemical Technology and Metallurgy, 42, 1, 2007,29.
4. Blazevska-Gilev J., Spaseska D., Feedstock recycling of poly(vinyl chloride-co-vinyl acetate): alkaline dechlorination in organic solvents, Journal of the University of Chemical Technology and Metallurgy, Sofija, 44, 3, 2009, 2009, pp.253-256.
5. Blazevska-Gilev J., Spaseska D., Remediation of poly(vinyl acetate) from waste product, Journal of the University of Chemical Technology and Metallurgy, Sofija, 44, 2, 2009, 2009, pp.123-126.
6. Van Berkel R., Innovation and Technology for Sustainable Meterials Future, Materials Forum, volume 30, Australia, 2006.