Sustainable waste management - experience of Bulgaria

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Abstract: The overall objective of the Operational Programme "Competitiveness" is to develop a dynamic economy competitive in the European and world market. Economy knowledge and innovation, development of competitive enterprises, increasing investment and exports and creation of a favorable business environment are encouraged to achieve this goal. The possibilities for solving the problems of recovery of waste from the textile industry and water treatment contaminated with oil are considered using the possibilities for funding under European programs, in particular the "European Regional Development Fund" – Operational Programme "Development of the Competitiveness of Bulgarian Economy 2007-2013". The experience of the implementation of Project BG161PO003.1.1.05-0261 "Filter Media of nonwovens" is exposed. The key steps and requirements that must be complied in applying for this program are indicated.

The product concerned by the project proposal is classified as "Eco and energy saving technologies", since it essentially represents utilization of waste products from the textile industry for the purification of contaminated water with various oils, petroleum products and / or fats, as the remaining material - saturated with oil/oil filter medium is fully utilized in combustion plants of various manufacturing companies mainly in the cement industry. Thus the developed product

is wasteless technology for the utilization of two types of inflammable and explosive waste. Filter Media of nonwovens provide elegant and quick solution to the global problem of oil spills in large water bodies on the planet. The innovative product on the one hand easily and effectively adsorbs leaked petroleum product, destroying aquatic ecosystem and on the other hand saves energy resources because it does not adsorb water and the saturated filter is fuel applicable in industry.

Keywords: waste management, textile waste, nonwovens, filter media

1 Introduction

Continuous growth of industry leads to an increase in the volume of waste being formed, their cost of storage, concentration, collection and utilization. A large part of the waste contains valuable components, which requires returning them to the production. Formation, accumulation of waste and planning of their use is associated with solving a series of methodical, scientific, logistic, economic, statistical and other issues and knowledge. Textile waste are some of the waste streams for which may be adopted criteria for "end of waste" by the EU Member States - to indicate when certain waste ceases to be waste and acquire the status of products (or secondary raw materials) which can be put on the market again.

According to the European Commission it should be paid more attention on the waste from the textile sector and stimulate the market for recycling. However, it is stated that "the management of textile waste is not a priority at the moment" and will not be developed specific legislation. There are not observed large amounts of

traffic between Member States of used clothing and other textiles. Recycling means not only processing in new production. The term covers any activity that prevents the entry of textile waste in municipal landfills - such as charity provision of used clothing, second hand clothes, etc.

Groups of textile waste:

- Export of second hand clothes (48%) - The largest share have goods destined for the markets of second hand clothes, mainly for export to developing countries or as disaster aid.

- Transformation into new products (29%) - When transforming into new products, there are two categories - open recycling and re-design.

- Cleaning and polishing cloths (17%) - Clothing already unfit to wear, can be turned into rags for industrial use. Cotton shirts are the main source for this category as they are suitable for making absorbent rags and towels and are widely used. Some types of synthetic fibers (especially the olefinic) have very good oleophilic properties so towels made to them absorb oils or spilled fuel.

- Landfilling and incineration (< 7%) - This category of waste textiles has two components. For some of the waste textiles markets do not exist, so they need to be landfilled. But this is unprofitable, both from an environmental and an economic point of view and is applied as a last alternative. Incineration of used fabric, as an alternative source of fuel is a common practice in Europe, while in the United States is less common.

- “Diamonds” (1–2%) – The category of "diamonds" in the model corresponds to approximately 1% of the total volume of products that fall into the stream of textile recycling. It is a source of the greatest profit for companies. It is the most profitable source for the companies. Many buyers of “diamonds” are known designers or wealthy people.

Project BG161PO003.1.1.05-0261 "Filter Media of nonwovens" with beneficiary: “E-Solar” Ltd. has been funded with the financial support of Operational Programme "Development of the Competitiveness of Bulgarian Economy 2007-2013", cofinanced by the European Union through the "European Regional Development Fund". The financial support from EU funds amounts up to 90% and the remaining 10% is financed by „E-Solar” Ltd. The project will be implemented in the period 2013-2015. This project represents the second phase of the development of innovative products, by performing a series of tests and studies. The overall objective of the project is competitive and efficient incorporation in manufacturing an innovative eco and energy-saving technology „Filter media of nonwovens“, to achieve sustainable results while protecting the environment and increasing the economic effect.

In particular, the team has the following specific objectives in the development and implementation of the project:

- to provide cost-effective and easily accessible commercial decision of environmental problems with waste from the textile industry and petroleum liquids and oil waste;

- to implement the second phase of research on the development of the innovative product „Filter Media of nonwovens“, namely experimentally to demonstrate the sorption properties of the product and fuel properties of the saturated with oils filter media at a pre-industrial level;
- the candidate „E-Solar” Ltd. to implement successfully the scientifically and experimentally developed innovative product and to encourage the development and deployment of innovation in companies after completion of the project;
- The scientific work to be patented, thus to protect industrial property rights of the applicant's research team „E-Solar” Ltd.

To achieve the objectives of the project proposal the following activities are intended to be undertaken:

1 - preparation of project proposal;

2- organization and Project Management;

3- operating tests;

4- analysis and evaluation of the developed innovative product;

5- finalization of test samples;

6- preparation of patent files;

7- product marketing;

8- information and publicity;

9- audit of the project.

Materials and methods

In the performance of the project following basic methodology is used:

1. Methods of organization, coordination and management:

- Planning the implementation of project activities and developing a detailed timetable;
- Definition of job descriptions for team members and preparing tasks, responsibilities and deadlines for implementation;
- Communication, coordination and administration of tasks among the members of the project team and the contractors;
- Preparation, negotiation, management and control of the project signed performance contracts;
- Preparation of periodic reports;
- Planned and convened on necessarily workshops.

2. Methods of financing the activities

- Advance payment by the Managing Authority to the applicant in the amount of 20% of the total grant;
- Financing the project activities with funds from the advance payment and own funds
- Four interim payments by the Managing Authority to the applicant at the amount of actually paid costs for separate project activities and the issuing of interim technical and financial statements, but no more than 80% of the grant

- Final payment by the Managing Authority to the applicant in the amount of 90% of the payments actually made.

3. Methods for financial management, reporting and control:

- Operational Plan for the implementation of the project budget;
- Detailed reports for implementation of the planned project budget;
- Technical specifications and terms of reference for the award of activities;
- Double-check of the contracts, accounting documents and records prepared for the procedures for selection of contractors;
- Duly storage and completion of primary documents from the applicant and provide the opportunity to access of the Managing Authority.

4. Methods for providing publicity and transparency:

- Presentation of the project through the website of the candidate and marking of the purchased assets with stickers and the experimental sites with tables according to activity № 8;
- Ensuring transparency in the selection of suppliers through the selection procedure for contractors according to activity № 2.

5. Reporting and control

Interim Report - presented on every request for interim payment, and in the cases specified in the special conditions of the grant contract. It consists of an interim technical report and interim financial statements. The interim technical report will contain detailed information about all aspects of the implementation for the period

(description and evaluation of activities under the contract, including reporting of results through the implementation of project indicators, partners, and other forms of cooperation, publicity and visualization, etc.). The interim financial report contains information on: project budget, adjustments in the budget, expenditure incurred for the reporting period, request for interim payment and percentage of requested funds over the contract and other.

Final Report - covering the reporting period subsequent to the last approved interim report, and consists of a final technical report and financial final statement. The final technical report shall contain a detailed description of all activities performed and the conditions under which they were met; results, information on steps taken to ensure the transparency of EU funding, as well as information with which to be assessed the impact of activities. The final financial report contains information about the project budget, adjustments in the budget, expenditure incurred for the reporting period, the request for payment, the percentage of requested funds over the contract and other.

Results and discussion

Waste arises as a result of industrial activity and the consumption of products. The results of the wrong attitude of man to waste require the view that a comprehensive and reasoned approach to this problem is needed. In the Bulgarian legislation are introduced also mandatory targets for preparing for re-use and recycling of waste materials, including paper and cardboard, metal, plastic and

limiting the amount of landfilled biodegradable municipal waste to 35% of the total quantity of the same solid waste generated in the Republic of Bulgaria in 1995.

A National Programme for Management of waste activities, 2009-2013 is elaborated where the good development of the textile and clothing production is pointed out. In the presented morphological analysis of household waste 4% content of textile waste is reported. Co-incineration in cement plants in place of some of the traditional fuel used is described as an existing practice for the treatment of textile waste. The composition and volume of municipal solid waste is very different and depends not only on the country and region, but also on the seasons and many other factors (Tabl. 1).

Table 1. Principles of management, maintenance and treatment of municipal solid waste flows.

Organic fraction	Inert mineral large-volume waste	Potential material sources	Hazardous waste
Principle of alternative coercion for separating given fraction in the process of formation	Principle of material interest of the entity initiating the formation of waste and organization dealing with transportation	Principle of the economic viability of the chain "producer of waste" – "waste sorter" – "processor of secondary material resources"	Principle of the perceived safety: the entity initiating waste generation prevents their uncontrolled release into the environment and mixing with other material flows

Paper and cardboard are the most important part of the municipal solid waste (up to 40% in developed countries). The second category in Bulgaria is metals, glass, plastic and organic (food) waste. Average 4% of the total mass of waste is from wood waste, textile waste and waste of used tires.

According to data from 2011, in Bulgaria have been generated 3,107,969 tons of production and households the waste, which are landfilled in 164 depots with a total area of 5045 hectares, which is about 70% of the household waste formed (Tabl. 2).

Table 2. Quantities of waste types for 2011.

Types	Generated	Disposal	Exported out of the country
Household	3 107 969	978 950	2 129 019
Hazardous	202 125	39 258	126 039
Industrial	12 941 714	1 487 986	11327689
Construction	289 315	66981	222334

The first approach in recycling involves recycling of the product in its original form. The second approach is the process of melting the thermoplastic materials and obtaining a new product which has a low level of physical, mechanical and / or chemical properties. The third approach involves processes such as pyrolysis and hydrolysis, which transform plastic waste for example, in basic chemicals or fuels. The fourth approach refers to the combustion of solid waste and use of waste heat. Each of these four approaches can be applied to the recycling of waste fibers. Caloricity of textile waste is 15.5 - 16.2 MJ/kg.

In discussing the opportunities and systems for recycling textile waste should be payed attention to the global nature of the system. There are two ways:

(I) All over the world the amount of textile waste is increasing because increasing disposable income in developing countries, и

(II) A large part of the market for used clothing is in developing countries, where annual salaries are lower.

Highly industrialized countries can transform their excessive consumption into a useful export. Manufacturers of textile and especially clothing should comply with certain rules, which include:

• development, manufacture and sale of textile products which at the end of life can be recycled or disposed in an environmentally friendly way;

• to implement the Integrated Product Policy;

• to develop new textile products, based on recovered fiber or secondary raw materials;

• at the end of the life of the product, it can be taken back by its manufacturers.

The simplest method for waste treatment that is applied across is its burial or storage at certain polygons - landfills. This is the cheapest way, but thus stored wastes do not to decompose dozens of years and lose the resources that are invested in them. This practice has other drawbacks: it requires disposal fee; due to the environmental problems in landfills disposal of certain polymers is already banned; disposal of textiles is loss of energy and raw materials. Textile industry dealing with recycling has many actors with different interests, including consumers, policy makers, managers of municipal solid waste, non-profit organizations, small businesses. Textile companies sort known as "rag" accept, sort, process and export

domestic textile products after their use. They distribute them for export to different markets.

In many countries a system is introduced where consumers often give worn clothing that is out of fashion or is the wrong size to charity organizations. Charity agencies sort clothes, choose those for selling and "residues" are sold for recycling or incineration. Regularly scheduled transportation companies or gatherers themselves accept and transport the textile material to textile recycling companies, often located near large cities to reduce transport costs to a minimum. It was found that the cost of transporting and sorting are crucial criteria for organizing a profitable business in textile waste.

As a result of implementation of the project activities are expected:

- after project implementation the beneficiary successfully to launch innovative business, supported by funds from the Operational Programme;
- to create five new employment, 4 of which in the field of research and development activities;
- to be successfully implemented the project „ Filter Media of nonwovens“
- the project to be successfully implemented in cooperation between the beneficiary "E-Solar Ltd" and research institution – Technical University-Sofia;
- to prepare the successful incorporation in the market of an innovative product - filters of nonwovens;

- to be carried out all necessary actions to register the patent /1/ for the innovative product "filter media" and for utility model /1/ for the installation that manufactures the product.

The project is directly related to the environment, as it was developed in the field of ecological and energy saving technologies, particularly water conservation, recycling of solid waste and the development of alternative fuel from waste (Waste to energy).

Strategic role in this respect has the introduction of waste-free and low-waste technologies. However, sorption process for the purification of waste water retains its role as a growing tendency for the use of non-woven fabric in the manufacture of filters. Filter media of nonwovens have a number of advantages such as advanced surface, high sorption efficiency, ease of operation, recyclability. Technologies for producing nonwoven filters with different functions are characterized by high productivity, low production cost, waste-free and allow the use of waste or reclaimed fibers as raw material.

Conclusion

In conclusion, the analysis of the situation of the textile and clothing industry, the ability to collect and sort waste from textile and ready-made manufacturing and household is not yet regulated and organized in accordance with European and international practices.

The country has sufficient resources of textile waste and providing a market for products made of secondary raw materials will solve both the problems of

environmental protection and finding economically reasonable way to use waste in various areas of human activity.

Companies for the production of nonwovens have the capacity and competence to produce products that may be integrated in different areas of production and household.

A method and an installation are developed for utilization of textile waste that will be incorporated in industry for minimization of generated waste.

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