STUDIES ON PLASTIC WASTE MANAGEMENT

Camelia Căpăţînă, Daniela Cîrţînă, Ramona Violeta Cazalbaşu
„Constantin Brâncuşi" University of Tg-Jiu, Faculty of Engineering, 3, Geneva Street, Tg-Jiu, 210135, Gorj, Romania; E-mail: camelia_capatina@yahoo.com

ABSTRACT: Among all materials, the plastics seem to be reflected in all fields because they are lightweight, cheap, hygienic, durable and resistant to environmental factors. However, very short life cycle of many plastic products is a problem for the environment when they become waste. This paper presents studies on the management of plastic waste. Recycling of plastics is a rather complex process that involves more stages .The management of plastic waste has a main advantage that of respecting the principle of sustainable development.

Keywords: materials , plastic waste, monitoring, environment

1. INTRODUCTION

Waste management is a priority for many states, and the answer that human society has for this major problem concerns in particular:

- Prevention of waste of any kind by applying the most advanced technologies in all sectors that produce waste;
- Waste reduction based on the use of the best technologies available at the time in the world in each field that is generator of waste;
- Use of all types of recyclable waste collection, reuse and recovery;
- Treatment waste disposal, incineration, storage.

Given the continued reduction by exploiting natural resources and their intensive use, but also the need to preserve for future generations, it becomes increasingly obvious that an economic and ecological approach to waste management is vital by reducing the quantities produced and by increasing their capitalization. Under the new strategy Waste Management several main objectives were raised, which represent at the same time the coordinates of the national strategy.

The indicators set will enable the monitoring on how Romania contributes to the U.E. policies for sustainable development.

Regarding the management of waste in the European Union Member States, there are significant differences between them.

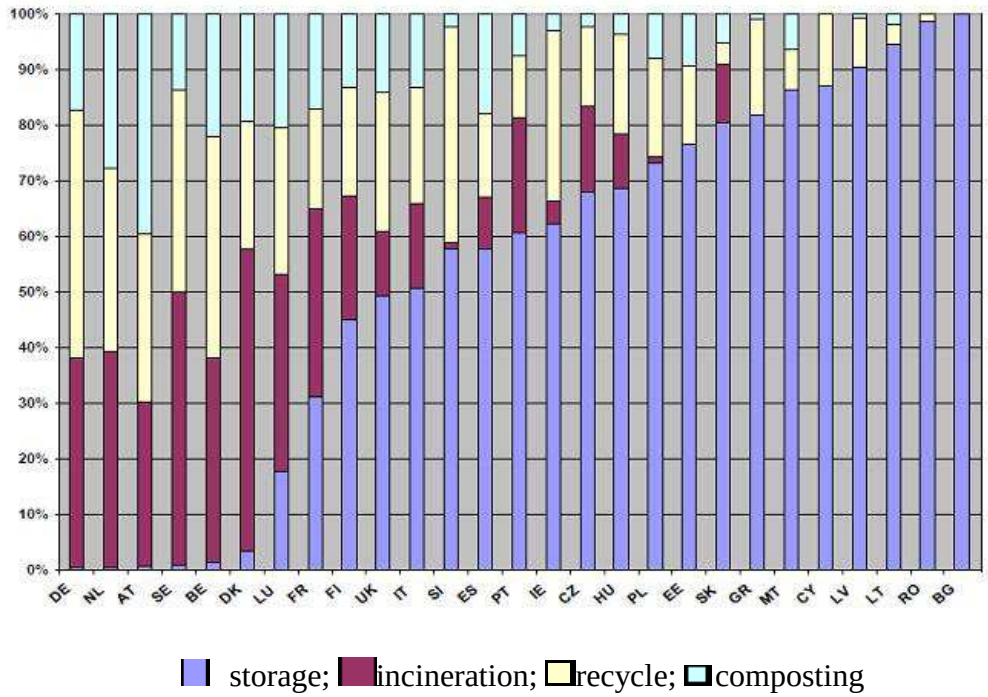

Figure 1. Municipal waste management in the U.E. Member States[12]

Thus, in some U.E. Member States (59% of them), storage as the management of waste is done in a percentage of more than 50. Among them Bulgaria has the highest percentage of waste disposal, which is of 100%, followed by Romania with 99%, Lithuania with 94% and Latvia with 91%. In other U.E. Member States (41%), the storage occupies more than 50% in the waste management. Thus, in Denmark over 54% of waste is recycled in the Netherlands 39% and Belgium 37%.

Analysis of these data highlights that in both Romania and other new EU Member States, the largest amount of municipal waste collected is removed by storage, recovery through recycling or other operations being practiced to an extensively low rate, even insignificant sometimes. Municipal waste management involves the following operations: collection, transport, recovery and disposal, including landfill post-closure monitoring.

Categories of waste plastic.

Plastic materials have a complex composition, the base product is a macromolecular compound (obtained by polymerisation or by polycondensation), and along with it there are plasticizers, pigments, fillers and possibly additives, such as stabilizers, lubricants, substances retardants, fungicides.The management of waste plastics depends, among others, on the source or origin. From this point of view, the waste plastics can be grouped as follows:

- waste from the processing of plastics. Results from certain operations within the process technology and can be used directly as raw materials in the same process;
- waste from manufacturing processes, but cannot be returned directly to the process because after applying certain treatments theyhave become incompatible.
- waste from products that have completed their cycle of use and are collected for recycling.

This last category contributes in the largest proportion to the increasing volumes of waste and this type of plastics recycling is subject to specific technological processes, depending on their nature. One of the sectors producing solid urban waste is the fastest growing packaging process, packaging waste in some countries representing just 50% of the municipal waste stream.

Instead, recovery and recycling of packaging waste plastics showed an increasing trend from year to year. There are several categories of plastic waste resulting from various activities, the most common being: Polypropylene (PP) The majority of Polypropylene waste comes from carcasses of recovered batteries (batteries for vehicles), of which 40% is recycled in new housing for such batteries. Polypropylene is also used quite often as thermal insulation.

Polyethylene (PE) is used in the production of plastic bags, plastic buckets, toys and foil for agriculture (greenhouses). The primary users of recycled polyethylene are sheet manufacturers, the manufacturers of crates and containers.

Polyvinyl chloride (PVC), also known as vinyl, is one of the most toxic plastic products and should be avoided when possible in order to minimize this waste stream when buying certain products containing it. Market outlet for recycled PVC resins is very low. Polyvinyl chloride can be found in the caps for mineral drinks, credit cards, toys, disks, curtains for showers, pipes and boxes for margarine. Polystyrene (PS) is used for stirofoamglasses and packaging materials.

Polyethylene terephthalate (PET) is found in containers for carbonated beverages. Its recycling is increasing, so supply and demand are growing too in the market for recycled plastic products resulting in fillings of carpets, ropes, fabric, car bumpers, paint brushes and even food packaging remanufacturing. Low density polyethylene (LDPE), is contained in the most discarded plastics and is found in the form of bags, photo films, coatings for food (foil), other packages, school supplies. It is recycled in new bags for food stores and is used for a variety of plastic containers for food or non-edible products. High density polyethylene (HDPE) can be found in foods and pots and in its is recycled form can be found in sewer pipes, crossing traffic cones, flower pots, containers for carbonated water and in crates.

Polycarbonate (PC) is used for automobiles, electronics and construction materials and in recycled form in a special way can be found in similar products in a ratio of 10:90, as new resins: recycled resins. The new use is for reusable milk containers. They have an average number of 100 uses and the added advantage that they crack when petroleum products are stored in them, characteristics related to safety use.

Among the categories of waste plastics presented the most common and most significant are the polyethylenes. The physical structure of the amorphous polyethylenes can be almost completely crystalline. The amorphous form is hard, whereas the crystalline form is elastically deformable. The polymer softens at around 115ºC, becomes brittle and breaks down below 25 ° C to over 300 ° C. Commercial forms of the polyethylene is to be processed in the form of granules, but having certain additives, additives such as stabilizers, lubricants, dyes, etc .

Low density polyethylenes have a degree of crystallinity of 50-85%, while the high density polyethylenes are up to 95% crystallinity.

- The most crucial polyethylene derivatives are polyethylene oxide;
- Cross-linked polyethylene;
- Chlorinated polyethylene;
- Chlorosulphonated polyethylene;

These types of polyethylene can be processed by compression, injection, extrusion nitrovanie, sulfirovanie,, thermoforming, blowing coverage. In accordance with the standard vigor polyethylenes are encoded with letters and numbers. The letters represent the type of polymer processing and the possible mode of use of the polymer and the polymer is that if no additives (A) or with additives (B). The figures symbolize density and fluidity index respectively. The collection, storage and recovery of waste plastics.

Most plastics have a short life cycle, therefore, the waste is an important part of the total weight of the waste - more than 10% by weight and 25% by volume.

Currently the collection and reuse or disposal of waste plastics is a major concern of all countries, with quantities of such waste and their diversity constantly rising. Although the

collection and recovery of plastics has both economic and environmental advantages, the difficulty lies in the fact that a centralized system for collecting, selecting plastics by type of material is not yet developed, given that most are mutually incompatible.

Collection and processing infrastructure for plastics should not be established at national level. In general, it is limited to local areas. However, many consumers who want to collect and recycle plastic waste find no specialized centers.

Given that the ratio volume / weight of plastic waste is very high, especially for polystyrene, many consumers, especially in remote communities cannot afford to collect and transport the separated plastics.

From a theoretical standpoint plastics recycling and reuse should include the following steps:

- separating plastic waste from the rest of the materials;
- sorting plastics material types;
- treatment by washing plastics;
- removal of foreign substances;
- establishing their destination.

The cost of collecting plastics in small quantities from a variety of sources is the main obstacle in accelerating the process of recycling these materials. In some countries, administrative policies assume a great responsibility in collecting recyclable materials from the public. Waste from collected plastics must meet certain technical requirements. Rule NTR technical branch. No 16/1980 establishes the conditions for the quality of recyclable materials from high density polyethylene and low density polyethylene from units and households as well as for delivery by producer units.

Reusable materials from polyethylene of low and high density, which can be collected are**:**

a) film, bags, bags, covers of polyethylene of low and high density, from:

- Packaging textiles;
- Food product packaging;
- Packaging of chemicals that are not toxic and can be dissolved in water;
- Films that were exposed to radiation.

b) Low density and high density polyethylene foils from greenhouses and solariums, which were exposed to solar radiation.

c) Films, bags, pouches, foils made from recovered materials specifically marked or colored.

Other products of high density polyethylene are:

a) Crates divided and undivided;
b) barrels, cans, flasks, cylinders;
c) reusable materials of high density polyethylene in the manufacture of shoe shapes or other high-density polyethylene.

Packaging that contain toxic products can be recovered only in the specialized units. Reusable materials of low and high density must be free of impurities such as: stone, wood, paper, rope, cloth, straw, sand, metal bodies. Dust impurities are allowed up to a maximum of 1% by weight. Reusable plastic materials are stored on clean platforms, separate according to types and articles. Delivery will be in bulk or in bales. Reusable materials that are shredded, ground or granulated will be delivered in bags labeled with the product name, group classification, type of material and weight. In Romania, in approx. 2m3 of household waste there are on average 4 kg polyethylene debris. One ton of polyethylene that is recovered saves approx. 8t oil. From this recovered ton 6000 m2 of factory foil of opaque polyethylene or 3000bags for packaging can be produced.

The primary route of use of waste plastic is by their recycling. Capitalization is any transaction which has as principal result the fact that the waste serves a useful purpose by replacing other materials which would have been used for a particular purpose or when the waste is prepared to serve a goal in enterprises or the economy in general. In the same note, recycling means any recovery operation by which waste materials are reprocessed into products, materials or substances to fulfill their original function for other purposes. Recycling plastics in developed countries is motivated by the following:

- raw materials obtained from recycled polymer waste are cheaper than raw materials that are obtained;
- labour cost for recycling is less than the extraction of raw materials;
- the cost of energy used for recycling is less;
- storing them for a long time requires large expenditures and triggers environmental destruction;
- recycling policies are established by legislation and government regulations.

Before processing the waste plastics are subjected to washing followed by sorting according to the coding system. The following physical processing includes several stages;

- **Cutting and chopping** - waste plastic are cut and chopped with various equipment (scissors, special installations grinders). They are chopped into small flakes to a consequent processing
- **Separating and sorting** by types of polymers, cyclone separators.
- **Decantation, washing and drying**, by introducing them into tanks with water and surfactants, flakes of various types of plastics being separated on the basis of the difference of density, then washed and dried.
- **Extrusion** - flakes introduced into the extruder where they are heated, melt and conversion takes place in a continuous polymeric material (wire).
- **Pelletizing** - the wire is cooled with water and cut into pellets which can be used for the manufacture of new plastic products.

In principle, recycling facilities are presented in Figure 2 [2] of the waste plastic, based on achieving the plastic pellets, which are then delivered to plants in the field.

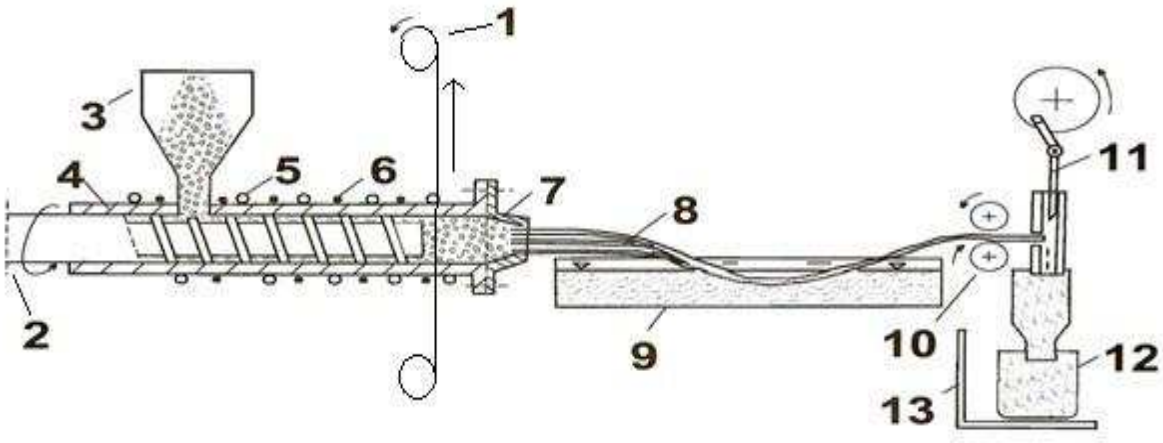

Fig 2 . Schematic diagram of a plant for producing plastic pellets

1, the magnetic separator; 2-screw extractor device; 3-grain silo waste plastic; 4-ferromagnetic core; 5, the cooling water pipes; 6, the electric winding; 7-extractor head; 8 plastic form of thread; 9-water bath; 10th pinch rollers; 11 rod with knife; 12 bags of pellets; 13-scales.

It has been found that the methods used in the case of recycling of waste plastics modify their characteristics.

Numerous studies have been conducted recently to determine the influence of the number of recycles on the rheological properties of MP (plastics) in order to establish limits determined to amend processing parameters and the quality of products that are obtained from recycling. Plastics subject to a number of

In this respect, table 1, shows the advantages and disadvantages of classical recovery of plastics in blast furnaces, power plants and waste incinerators.

recycles suffer a destruction of the inner structure, and change their elastic properties and become more sensitive to thermomechanical degradation

Table 1 Advantages and disadvantages of plastics capitalization

Area of use	Classical furnaces	Power stations	Waste incinerators
Total usage [%]	79	40	30
Loss [%]	21	60	70

It is noted that the lowest losses by using waste plastics other combustion processes are if their furnaces burning, and the highest when burnt in waste incinerators.Another recovery method is to obtain the thermal decomposition of macromolecular compounds such as alcohols, ketones, hydrogen chloride, hydrocarbons, monomers, engine oil, differentfuels.

Dissolution of plastics in different solutions is another way of recovery, involving two application possibilities:

- Using solvents to obtain macromolecular compounds free of impurities, which can then be used in various processes of synthesis. Thus polyvinyl chloride (PVC) can be recovered
- Using solvents to obtain solutions with tackiness or corrosion proof solvents or emulsions for lubrication.

The recovery of waste plastics by using them with sand and cement in fillings, thereby producing lighter concrete, is a method successfully used nowadays.

CONCLUSION

Better waste management of plastics together with other actions to protect the environment, contribute greatly to:

- cut down greenhouse gas emissions resulting from processes taking place inside the landfill (especially gas) and carbon dioxide emissions (by reusing and recycling);
- increasing resource efficiency - saving energy and reducing consumption of materials through waste prevention, recycling and
- recovery of energy from renewable sources;
- protecting public health by safe management of potentially hazardous substances;
- protecting ecosystems (soils, groundwater, air).

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