

MANAGEMENT AND RECOVERY OF MIXED POLYMER WASTE

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Proper management and recovery of polymer waste have become a growing concern for all industrialized countries. Aside from the lack of capacity, developing countries are faced with another problem – lack of know-how. The recovery of mixed polymer waste represents a particular difficulty, equally from technical, environmental and economic points of view. Aside from the broad variety and mutual incompatibility of polymer materials, the presence of other non-polymeric materials in mixtures or blends, additionally makes recovery tedious. Furthermore, such commingled waste may pose a large threat to the environment. In this paper various methods for the treatment of mixed polymer waste are discussed, considering mixtures of polymers alone, as well as the combination of these materials with another. Possibility of the recovery of both separated and unseparated waste is discussed, thus presenting different separation techniques and analyzing conditions for their applicability. Attention has also been paid to identification of sources of mixed polymer waste, with emphasis on those sectors having traditionally low polymer recycling rates. Considering possible products, different processes for recovery are presented and their environmental acceptability is discussed. This study has shown that appropriate management of mixed polymer waste can reduce its environmental impact and provide quality and environmentally acceptable products.

Introduction

In the world which increasingly becomes buried by different kinds of waste, it is not surprising that measures of waste reduction have gain popularity in the recent years. Recycling is considered to be an important way to reduce the waste and, at the same time, to preserve natural resources (1). However, despite successful examples on single materials recycling, problems related to mixed polymer waste influenced creation of general opinion that these materials are inconvenient for recycling. An important step toward successful recycling was an understanding that polymers are not all the same, and that their different properties and mutual incompatibility require application of different techniques for recycling. Another important moment was understanding of the significance of other related issues (socio-economic characteristics, collection programs, market development, legislation, etc), and giving priority to the waste management.

Methods

In order to find solutions acceptable for mixed polymer waste, it was necessary to identify sources of this kind of waste and to make their classification. Aside from critical review of developed processes, also broad analysis of current situation was carried out. Finally, identification of possible solutions was made, with particular emphasis on the countries of the region.

Results and Discussion

Considering mixed polymer waste, it is necessary to understand that aside from the mixtures of different sorts of polymers, mixtures of polymers with other materials also represent serious problem. Particular problem represent laminates, composites, blends, and alloys, because of their tedious separation. Owing to different techniques for waste recycling (2), it is possible for some sorts of polymer mixtures to be recycled even without separation. Separation techniques, however, can be applied at macro, micro or molecular level.

Automotive sector, packaging, electronics, etc. are considered to be the main source of mixed polymer waste.

Owing to excellent properties and contribution to the reduction of fuel consumption and air pollution, polymer materials have found broad application in the automotive industry. However, this created new problem – waste recovery. The main characteristic of automotive polymers is low recycling rate. The 75 % of scrap vehicles that is capable to be recovered today, generally is related to metals, representing almost 100 % of consumed materials, but only 8 % of plastics in cars are recycled presently (3). The reasons for this are difficulties related to the broad variety and diversability of materials (thermoplastics, thermosets, elastomers), as well as to the types of products (composites, laminates, etc.) (2).

Another source of mixed polymer waste are electronics, which are composed of 17 – 33 % of polymer materials. However, just a small portion of it is suitable for reprocessing. Aside from the variety of electronic products and the variety of polymer resins used for them, important characteristic is also high rejection rate of whole parts during separation.

Although materials used for packaging products such as PET (poly(ethylene terephthalate)), HDPE (high density polyethylene), LDPE (low density polyethylene) are considered to be suitable for recycling, the main problem represent multilayer packaging, particularly food multilayer packaging. However, in comparison to other fields, polymers used for packaging have higher recycling rates.

Processes which can be used for recovery of mixed polymer waste (both separated and separated) (2) are shown in Fig. 1. It is obvious that these processes give different products and have different economic and environmental characteristics.

The choice of appropriate process is one of the main tasks of waste management. However, it must take into account also other related issues, such as collection

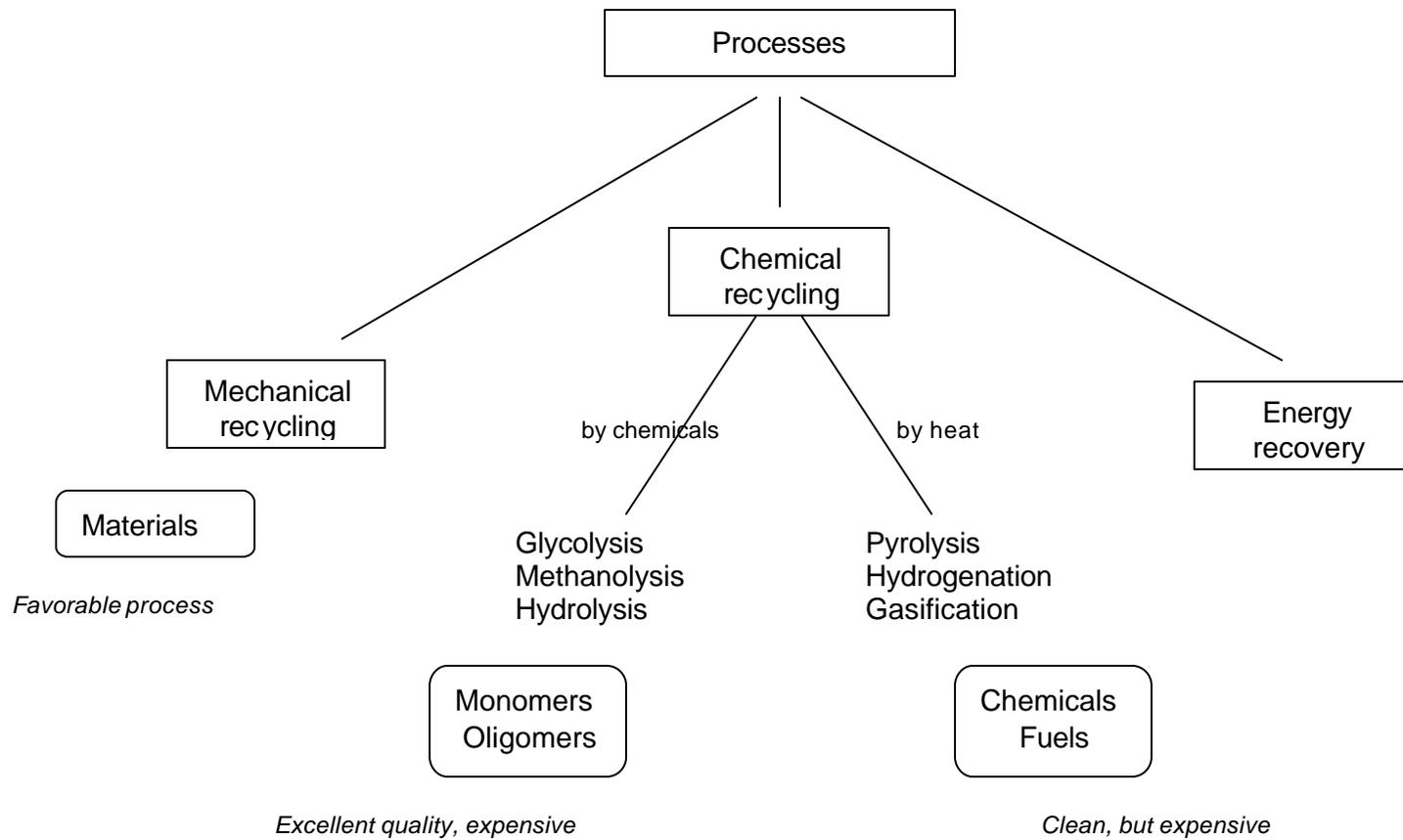


Fig. 1. Processes for mixed polymer waste recovery

programs, market development, education and professional training, legislation, etc. (2, 4, 5, 6). Decision-making systems are also of crucial significance (5), since just appropriate management of waste can reduce its environmental impact and provide quality and environmentally acceptable products.

Conclusions

Owing to new technologies for waste recycling developed in the recent years it is possible to provide quality and environmentally acceptable products, but it is necessary to understand that proper management of waste is crucial for its successful recovery. Particular attention is to be paid to better identification and sorting systems, more efficient dismantling procedure, the choice of appropriate recycling technology, market development and design for recycling. Although in the countries of the region (CEEC) recycling rates are very low, they also need to join the world trends in waste recycling and adjust to the EU legislation requirements.

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