Recycling solid wastes as polymer composites

Article *in* Studia Universitatis Babeș-Bolyai. Chemia 58(4):213-225 · November 2013

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Abstract

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STUDIA UBB CHEMIA, LVIII, 4, 2013 (p. 213-225)
(RECOMMENDED CITATION)

Dedicated to Professor Liviu Literat
On the occasion of his 85th birthday

RECYCLING SOLID WASTES AS POLYMER COMPOSITES

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ABSTRACT. Recycling and / or reuse of by-products (waste) is a goal to be achieved under the current economic and ecological crisis. The reuse of waste leads to saving energy and raw materials reduces environmental pollution and risk factors for public health and so on. The solid organic or inorganic wastes have been immobilized in polymer resins used as a binder matrix. All obtained composites present very good physical-mechanical properties: high hardness, good strengths at abrasion and the compressive strengths are all above 90 MPa. They also have good thermal stability at high temperature variation and high stability in different aggressive media. Some of such polymeric composites have good sound absorption capacity depending on the proportion and nature of the waste used.

Keywords: *Solid wastes recycling, polymer composites, noise attenuation, organic wastes; inorganic wastes*

INTRODUCTION

Composites are materials made by the association of at least two components whose properties complement each other, thus results a material with properties superior to either component alone.

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A special class is represented by the polymer composites [1]. Of all composites, the metal ones occupy 10 ÷ 15%, the ceramic composites 15 ÷ 20% and the polymer composites represent 70 ÷ 75%.

The polymer composites have expanded because they have a number of technological advantages compared to ceramics and metals: doe not require high temperature, long period of times and complicated processes for obtaining and finishing. They can be easily processed at low temperatures, with no danger of destruction of reinforcement materials.

Solid wastes recovery in various types of composite materials has many environmental impacts and represents an economic advantage. Every type of solid waste results from processes which requires significant quantities of resources, primarily fossil fuels, both as a raw material and as a source of energy for the manufacturing process. Therefore, their recovery in such special composite with high durability involves significant economic and ecological effects.

Recycling and/or reuse of by-products (waste) is a goal to be achieved under the current economic and ecological crisis. Ecosystem problems are acute problems in the current context of sustainable development. The reuse of waste leads to important savings of raw materials and energy. Also reduces pollution of the environment factors and decrease risk factors for public health.

To date, the purpose of the composite materials technology is to recover wastes and other recycled substances and to obtain new and performing materials with long life cycle [1-3].

The fields of application of polymer composites can be enlarged depending upon the properties of composite materials [1,2,4-6]. For example, dense materials can be obtained very resistant with high durability in an epoxy polymer matrix or unsaturated polyester type resin, but also, some porous composites polyester or formaldehyde resins can be obtained with good sound absorption capacity.

The waste composition is influenced by many factors [7] as: the level of economic development, the cultural norms, the geographical location, energy sources, climate and others.

Global composition of wastes in 2009 [7] is illustrated in Figure 1:

Table 1. Types of waste and their sources [7]

Type	Sources
Organic	Food scraps, yard waste, wood, process residue
Paper	Paper scraps, cardboard, newspapers, magazines, bags, boxes, wrapping paper, telephone books, shredded paper, paper beverage cups.
Plastic	Bottles, packaging, containers, bags, lids, cups

Type	Sources
Glass	Bottles, broken glassware, light bulbs, coloured glass
Metal	Cans, foil, tins, non-hazardous cans, appliances, railings, bicycles
Other	Textiles, leather, rubber, multilaminates, appliances, ash, other inert materials

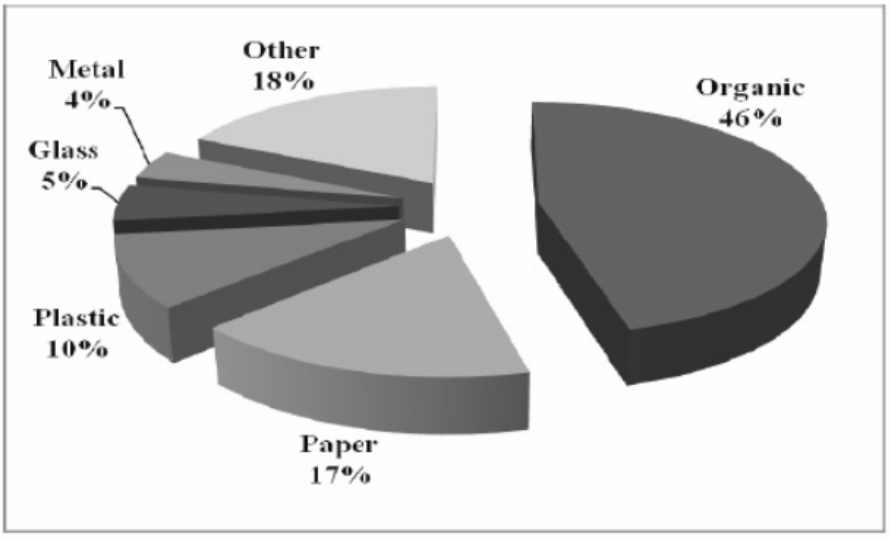

Figure 1. Global waste composition.

Table 2 shows the countries that produce the most trash in the world [8].

Table 2. The countries that produce the most trash in the world [8].

No.	Country	Quantity of trash/year, [million tons]
1	China	300
2	United States	236
3	Russia	200
4	Japan	52.36
5	Germany	48.84
6	United Kingdom	34.85
7	Mexico	32.17
8	France	32.17
9	Italy	29.74
10	Spain	26.34
11	Turkey	25.99

According to European Trade Association for Plastic Manufacturers, 265 millions tones of plastic are produced globally each year. The impacts of plastic waste on our health and the environment are only just becoming apparent. Most of our knowledge is around plastic waste in the marine

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