Novel organic waste based hybrid polymer materials

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Abstract

This work is aimed at the valorization of the organic fraction of urban solid waste through the stabilization and the inertisation in thermoplastic and thermoset resins. After being ground, the organic waste was subjected to a stabilization process; different procedures were used in order to obtain a partial or complete removal of the bacterial activity. Afterwards, the inertisation process was carried out through the incorporation of the organic waste into water soluble thermoplastic and thermoset matrices. Samples produced were tested by using differential scanning calorimetry (DSC), and thermogravimetric analysis (TGA), in order to evaluate the water content of the mixture. The viscosity of the material was then assessed through rheological analysis, thus allowing to understand times and temperatures necessary for the polymerization, in case of the thermoset matrix, or for the evaporation of water, in case of the thermoplastic one. Flexural and compressive tests were carried out on samples obtained after inertisation. Results showed good values of flexural and compressive strength. Also, the influence of the residual water content on the mechanical properties was studied, and an increase of the compressive modulus with the increase of the water content was found. Finally, different amounts of foaming agents were added to the mixtures during the inertisation; compressive tests were then carried out to evaluate the influence of the voids on the mechanical properties

A wide variety of toxic inorganic and organic chemicals are discharged into the environment as industrial wastes, causing serious water, air, and soil pollution. Water pollution caused by toxic heavy metal ions has become a serious environmental problem. Heavy metals (such as Pt, Pd, Ag, Cu, Cd, Pb, Hg, Ni, Co, Zn, etc.) are natural constituents of the earth crust and present in the environment as a result of weathering and erosion of parent rocks In addition to natural sources, they are introduced in ecosystems through wastewaters originating from anthropogenic sources such as chemical manufacturing, metal finishing, welding, alloys manufacturing, painting, mining, extractive metallurgy, plating, tannery and battery industry and using metal-containing fertilizers and pesticides

These toxic metal ions, even at low concentrations, have deteriorated water resources and drinking water and easily accumulated in the human body throughout the food chain, causing a variety of diseases and disorders . So, it is necessary to remove these metal ions from industrial effluents for their subsequent safe disposal.

The removal of heavy metal ions from wastewaters has been a subject of extensive industrial research. At the same time, some of them (e.g., Pt and Au) are precious and can be recycled and reused for extensive applications The recovery of heavy or valuable metals from water or wastewaters can often result in considerable cost savings and have both ecological and economic benefits.

Different methods, such as precipitation [solvent extraction chemical and electrochemical techniques ion-exchange methods ultrafiltration and reverse osmosis flotation and coagulation have been developed for the removal of toxic metal ions from industrial effluents and wastewaters. However, most of these processes are unacceptable, owing to the disposal of sludge, their high cost, low efficiency and inapplicability to a wide range of pollutants .

Adsorption is a well-known separation method and recognized as one of efficient and economic methods for water decontamination applications. In addition, owing to the reversible nature of most adsorption processes, the adsorbents can be regenerated by suitable desorption processes for multiple uses and many desorption processes are of low maintenance cost, high efficiency, and ease of operation

However, the major problem in this field is to select novel types of adsorbents. A number of adsorbents such as activated carbon zeolites clays and agricultural residues have been used for the removal of heavy metal ions. However, the major disadvantages of these adsorbents are their low adsorption capacities, their relatively weak interactions with metallic ions and difficulties of separation and regeneration of some of them from water. Ion-exchange resins can remove metal ions substantially; however, they have low selectivities and show a high degree of swelling combined with poor mechanical stability.

Biography:

Antonio Greco has received his Master's degree in Materials Engineering at University of Lecce in October 1998. He has received his PhD degree in Materials Science and Technology in May 2001. From December 2002, he become an Assistant Professor at University of Salento. He keeps scientific collaborations with several Italian and International research institutions. He has around 80 papers in international journals (h-index=21) and 60 presentations at international conferences, most of them are about innovative polymer based materials

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