Environmental Engineering and Management Journal, June 2006, Vol. 5, No.2, 203-212
http://omicron.ch.tuiasi.ro/EEMJ/

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REGENERATION OF VEGETAL ACTIVATED CARBONS EXHAUSTED WITH CHLOROPHENOLS

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Abstract

Activated carbons (ACs) made from peach and plum stones were oxidized and impregnated with salts of Cu(II), Fe(III), Ni(II) and Cr(III). The chemically modified ACs, along with a commercial AC (S208c), were saturated with ortho- (OCP) and meta-chlorophenol (MCP) to investigate the potential for thermally regenerating the spent ACs. The thermal regeneration process was monitored by thermal analysis (TGA/DSC), gas chromatography and mass spectrometry (GC/MS). Thermal desorption profiles showed that in most cases weight losses occur in two steps (weak physical sorption at ~220°C and strong chemosorption at ~620°C). Intermediate steps at ~400°C appeared in samples whose chemical treatments successfully weakened the interactions between strongly chemosorbed CP molecules and AC surfaces. The type and quantity of products of OCP and MCP desorption during the thermal regeneration of a spent AC depend on the chemical modification given to the AC prior to its use as CP adsorbent. Besides the original chlorophenols, thermal regeneration products can include chlorobenzene, dichloro-dibenzofuran, phenol, aliphatic and aromatic hydrocarbons, water, chlorides, carbon oxides, hydrogen, and char deposits. Mechanisms for the formation of these compounds were discussed. The char deposits built during this study did not appear to diminish the surface area or porosity of the chemically modified ACs following their thermal regeneration.

Keywords: activated carbon, impregnation, oxidation, thermal analysis, adsorption properties