

Characterization and feasibility assessment of recycled paper mill sludge for land application in relation to the environment

ABSTRACT

The disposal of industrial paper mill sludge waste is a big issue and has a great importance all over the world. A study was conducted to determine the chemical properties of recycled paper mill sludge (RPMS) and assess its possibilities for land application. RPMS samples were collected from six different paper mills in Malaysia and analyzed for physical and chemical properties, heavy metals, polycyclic aromatic hydrocarbons, ^{13}C -NMR spectra and for the presence of dioxins/furans. The RPMS was dewatered, sticky with a strong odour, an average moisture of 65.08%, pH 7.09, cation exchange capacity (CEC) 14.43 cmol (+) kg⁻¹, N 1.45, P 0.18, K 0.12, Ca 0.82, Mg 0.73, Na 0.76 and Al, 1.38%. The polycyclic aromatic hydrocarbons (PAHs) and heavy metals levels were below the standard Class 2 limits. The dioxin and furan were in below the standard concentration of Class 1. The most prominent peak in the ^{13}C -NMR spectra of RPMS was centered at 31 ppm, proving the presence of methylene (-CH₂) groups in long aliphatic chains, with lipids and proteins. The signal at 89 ppm and highly shielded shoulder at 83 ppm were due to presence of cellulose carbon C-4, and the peak at 63 and 65 ppm was due to the cellulose carbon spectrum. The RPMS therefore contains significant amount of nutrients with safe levels of heavy metals and PAHs for environment and can be used as a fertilizer and soil amendment for land application.

Keyword: ^{13}C -NMR spectrum; FTIR spectrum; Concentration; Heavy metals; Land application; Nutrients; Soil properties