Environmental Engineering and Management Journal *January 2014, Vol.13, No. 1, 51-60*
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

COMPUTER-AIDED IMAGE ANALYSIS AND EPR CHARACTERIZATION OF TRANSFORMED ASBESTOS CONTAINING WASTES

Yan Yvon*, Sarah Ghandour, Patrick Sharrock

Université Paul Sabatier (Toulouse III), Laboratoire d'Etudes et de Recherche en Imagerie Spatiales et Médicales (LERISM), UFR PCA, 118, route de Narbonne, 31062 Toulouse Cedex 09 France

Abstract

Investigations on thermochemical transformation of asbestos fibers followed by computer aided image analysis are presented. Asbestos Containing Wastes (ACW), notably asbestos-cement, were characterized before and after microwave heating with additives aimed at reacting with and transforming asbestos fibers. Microprobe analysis helped determine the chemical compositions. X ray diffraction (XRD) was used to confirm decomposition of asbestos fibers during microwave heating. Electron paramagnetic resonance (EPR) spectroscopy was used to determine the environments surrounding the iron ions present in asbestos fibers. Analytical results show the presence of magnesium silicates in ACW samples, which is typical for asbestos fiber composition (chrysotile). Electronic microscopy observations show a difference in morphology between raw and treated materials. Characteristic XRD reflections of asbestos fibers disappeared in the treated samples demonstrating the transformation of asbestos fibers into other types of solids. Computer-Assisted-Image analysis allowed confirming automatically the absence of fibers following heating according to the isoperimetric index of observed particles. EPR spectroscopy confirmed the transformation of anisotropic fibers into more isotropic symmetry following melting. Thermochemical treatment was effective in transforming asbestos fibers in ACW into non-asbestos products. The advantage of microwave heating lies in the possibility to transport the lightweight oven to the ACW dismantling site thus avoiding transportation hazards. Computer aided Image analysis would allow screening more images automatically to ascertain the absence of risks related to remaining fibers in numerous treated ACW samples.

Key words: asbestos containing wastes, image segmentation, microwaves, thermal treatment

Received: November, 2011; Revised final: April, 2012; Accepted: April, 2012

* Author to whom all correspondence should be addressed: e-mail: yan_yvon@yahoo.fr; Phone: +33 (0) 5 61 55 65 45