Environmental Engineering and Management Journal March 2021, Vol. 20, No. 3, 377-388
http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu

"Gheorghe Asachi" Technical University of Iasi, Romania

APPLICATION OF THERMAL ANALYSIS TO IMPROVE THE PREPARATION CONDITIONS OF ZEOLITIC MATERIALS FROM FLYING ASH

Gabriela Buema[1], Gabriela Lisa[1], Olga Kotova[2], Gabriela Ciobanu[1], Liliana Ivaniciuc[1], Lidia Favier[3], Maria Harja[1*]

[1]"Gheorghe Asachi" Technical University of Iaşi, Faculty Chemical Engineering and Environmental Protection, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]N.P. Yushkin Institute of Geology of the Komi Science Center of the Ural Branch of the Russian Academy of Sciences, Pervomayskaya st. 54, 167982, Syktyvkar, Russia
[3]University Rennes, Ecole Nationale Supérieure de Chimie de Rennes, CNRS, ISCR – UMR6226, F-35000 Rennes, France

Abstract

The aim of this study is to gain a better understanding of ash properties that makes it suitable for obtaining geopolymeric/zeolitic materials, as well as to demonstrate that thermal analysis can be used as an innovative procedure to compare different activation methods. Establishing a relationship between the physical and chemical characteristics of ash and materials obtained from fly ash is an important step towards producing large quantities of zeolitic materials with pre-established properties. In this paper, a direct relationship between TG analysis and the type of materials obtained from the local fly ash, by different methods, was proved for the first time. The experimental results demonstrated that the materials with a surface area over 40 m^2/g and pores volume over 0.12 cm^3/g exhibited the highest thermal loss. The samples exhibiting thermal loss over 10% contained zeolites phases, a fact confirmed by FT-IR and XRD, and more than 7% sodium in samples structure, as demonstrated by EDAX analysis. The results shown that thermal analysis allowed identification of the materials, as well as elucidation of the processes occurring during the thermal heating. Concordant to this study, the conditions for the optimum activation method consisted in: direct activation method, temperature equal to 363 ^oK, contact time 4 h, 1/3 solid/liquid ratio and use of 5M NaOH activation solution. It is known that TG/DTG analysis is an easy and the economic feasible method. TG analysis for establishing the zeolitization degree on the base of the number of stages (four stages), but more important, on the base of total mass losses (over 10%) is recommended.

Key words: activation, characterization, fly ash, thermal analysis, zeolite

Received: June, 2020; Revised final: December, 2020; Accepted: January, 2021; Published in final edited form: March, 2021

* Author to whom all correspondence should be addressed: e-mail: mharja@tuiasi.ro