Volume 3, issue 1

Olive Stones Characterization And Analysis Of Their Use As Raw Material In Construction Industry

Nancy Quaranta,
National Technological University, Argentina.

Abstract

Olive stones is a waste that had been widely used vas biofuel in diverse industries and as heating in homes, hotels and municipal facilities. The crushed olive pit is also used as an adsorbent after being converted to active carbon by increasing its specific surface area. This material, in the form of powder or granular, has various applications as a filter for water treatment in chemical and pharmaceutical industries. In recent years, this residual material has been used as an adsorbent without pretreatment or with a series of pretreatments for the removal of metal ions in industrial wastewater.

The objective of these investigations is the physicochemical and environmental characterization of this residual material and the feasibility analysis of its use as a pore former in ceramic matrices. This waste material has been characterized with the following techniques: optical microscopy (OM), scanning electron microscopy with semi quantitative chemical analysis (SEM-EDS), differential thermal and thermogravimetric analysis (DTA-TGA), X ray diffraction (XRD), ecotoxicity, among others.

Figure 1 shows the microscopic appearance of the broken stones by OM (left) and SEM (right). The fibrous structure of the biopolymers can be observed by OM.

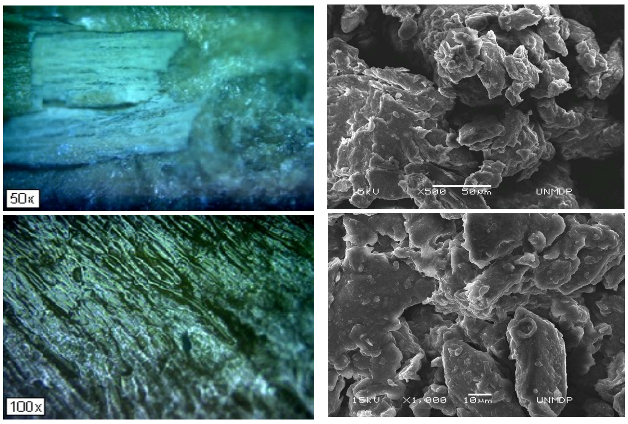
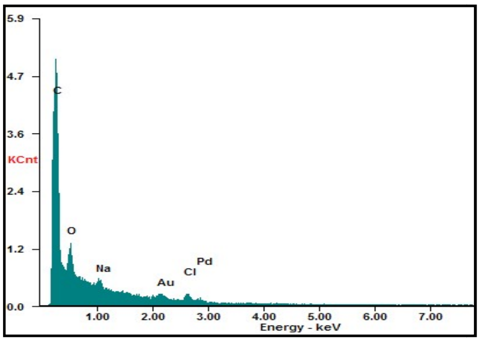


Figure 1: Microscopic appearance of broken stones.

Figure 2 shows the elemental composition of the olive stones, obtained by EDS analysis. The presence of Na and Cl is due to this discard material comes from brine products, and despite repeated washings still contains these elements.



Element	Composition %
C	82.0
O	15.6
Na	1.1
Cl	1.3

Figure 2: EDS analysis of olive stones.

DTA-TGA analysis of this material is shown in Figure 3. It can be seen some exothermic peaks corresponding to the combustion of hemicellulose (HC), cellulose (C) and lignin (L) phases. This organic material burned in a wide temperature range, between 250°C and 550°C. This is important to ensure that when this material is incorporated into clay mixtures as pore former, the sintering process takes place without crack formation in the brick.

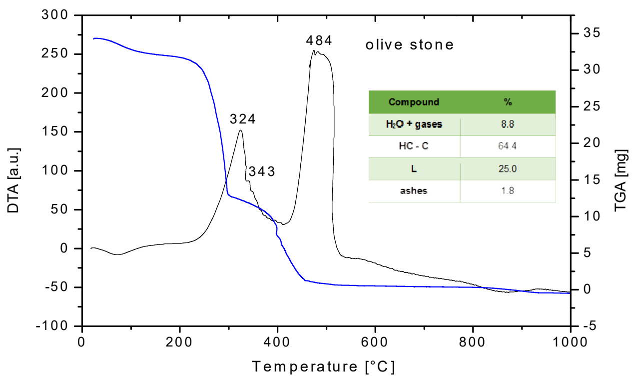


Figure 3: DTA-TGA of this residual material.

The table into the Figure 3 shows an estimated composition, obtained taking into account the weight losses and the peaks temperature ranges of DTA-TGA curve.

XRD analysis presents some peaks corresponding to semi crystalline cellulose at 21.8, 31.7, 34.5 and 45.3 degrees.

In the FTIR spectrum a large number of peaks can be observed, as expected in organic structures of this type of lignocellulosic biomass (Figure 4). The assignment of these peaks corresponds to bonds present in biopolymers C, HC and L, and to adsorbed water and CO_2.

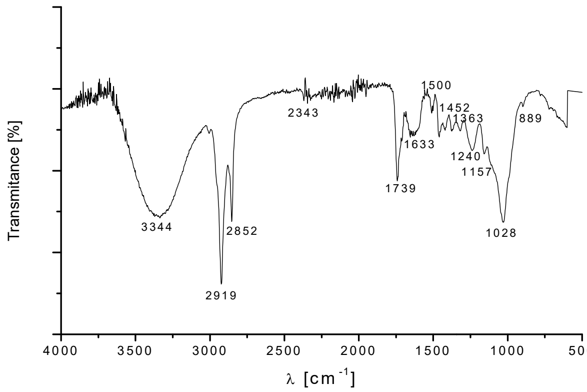


Figure 4: FTIR analysis of this residual biomass.

Figure 5 presents the results of the ecotoxicity essay. For this study, elutriates of the residual material are made, which are then placed in contact with rye grass seeds, in different concentrations. Similar tests are carried out with distilled water as a reference and in direct contact with the residue. The experience is made for 5 days at constant temperature of 25°C, in the dark. Then, the inhibitions in the radicle and seedling growths are analyzed.

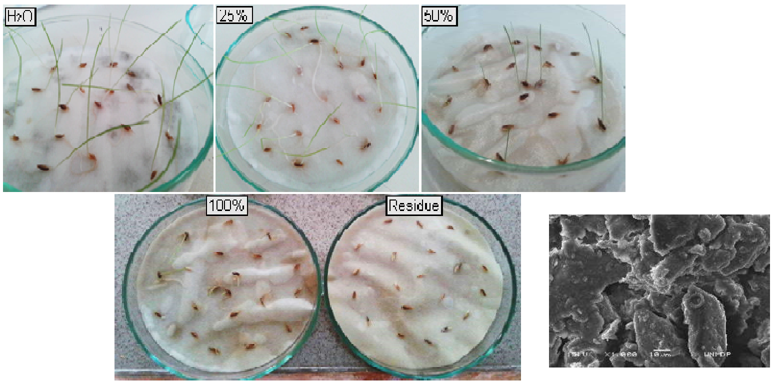


Figure 5: Ecotoxicity behaviour of the waste.

The ecotoxicity essay demonstrates that this type of waste can influence the development of sensitive species, when it is deposited on land without control. Therefore, special care must be taken during the stocking of this material when it is used as raw material of other processes, for example in construction industry.

As conclusions from the results of these characterizations, a high feasibility of using these residues as pore forming material in the ceramic industry can be determined. The wide range of combustion temperatures of this biomass and the small amount of ashes remaining indicate that the possibility of cracking of the bricks during cooking is very low. The sintering temperatures will correspond to those of the clay, whereby the determined treatment curve for this commercial clay can be used. Just, special care should be taken during the stoking stage because of the ecotoxicity observed for sensitive species in the deposition sites.

On the other hand, preliminary experiences show that this powder material is homogenously integrated in the clay mixtures, and allows a uniform shaping.

Recent Publication

1. Moubarik A, Grimi N (2015) Valorization of olive stone and sugar cane bagasse by-products as biosorbents for removal of cadmium from aqueous solution Food Research International 73:170-174.
2. Vera D, Jurado F, Margaritis N, Grammelis P (2014) Experimental and economic study of a gasification plant fueled with olive industry wastes. Energy for Sustainable Development 23:248-256.
3. Martín Lara M, Blázquez G, Trujillo M, Pérez A, Calero M (2014) New treatment of real electroplating wastewater containing heavy metal ions by adsorption onto olive stone. Journal of Cleaner Production 81:121-127.
4. Hodaifa G, DrissAlami S, Ochando Pulido J, Víctor Ortega M (2014) Iron removal from liquid effluents by olive stones on adsorption column: breakthrough curves. Ecological Engineering 73:270-275.
5. Mahmoudi M, Dentzer J, Gadiou R, Ouederni A (2017) Evaluation of activated carbons based on olive stones as catalysts during hydrogen production by thermocatalytic decomposition of methane. International Journal of Hydrogen Energy 42:8712-8720.
6. Boufi S (2017) Biocomposites from olive stone flour: A step forward in the valorization of the solid waste from the olive oil industry. Lignocellulosic Fibre and Biomass-Based Composites Materials 387-408.

Email: nquaranta@frsn.utn.edu.ar