MOROCCAN TWO-PHASE OLIVE MILL WASTES HYDROTHERMAL CARBONIZATION: EFFECT OF WATER PHASE RECYCLING ON HYDROCHAR YIELDS AND PROPERTIES.

Akram DAHDOUH, CNRS-University of Lorraine, LRGP, 1 rue Grandville, France
akram.dahdouh@univ-lorraine.fr
Yann LE BRECH, CNRS-University of Lorraine, LRGP,, 1 rue Grandville, France
Ismail KHAY, International University of Rabat, College of Engineering and Architecture, Morocco
Anas EL MAAKOUL, International University of Rabat, College of Engineering and Architecture, Morocco
Mohamed BAKHOUYA, International University of Rabat, College of Engineering and Architecture, Morocco

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Olive oil industry is associated with the production of large quantities of wastewater, semisolid and solid residues. Indeed, two-phase olive oil extraction method generates wastes with high moisture content >65 wt.% which are still not managed properly. Thus, a management policy is required to the producing countries in order to mitigate the produced wastes environmental impacts. In this regard, hydrothermal processing is reported as a promising conversion technique to deal with high moisture content biomasses. Hydrochars produced from hydrothermal processes are carbon rich materials that can be used as soil amendment, solid fuel or low cost adsorbents [1,2]. In this study, hydrochar was produced from hydrothermal carbonization of two-phase olive mill waste from the area of *Ksar El Kebir* (Morocco). The produced aqueous phase was recycled after each carbonization process to evaluate its effects on hydrochar yields, structure and composition. The hydrothermal carbonization experiments were conducted at 250 °C for 3 hours in a stirred batch autoclave (500 rpm). Four recycling runs were done at these fixed operating conditions. The obtained hydrochars were characterized to determine the elemental composition (CHNS-O), functional groups using Fourier Transform Infrared Spectroscopy (FTIR), and surface morphology by Scanning Electron Microscopy (SEM). Results show that hydrochar yields increase from 47 wt.% to 53 wt.% (of the initial dry matter) after the first recycling and stabilize for the following runs. Elemental composition of the produced hydrochars do not vary significantly with recycling experiments. Indeed, carbon and oxygen content ranged around 71 wt.% and 20 wt.% (of hydrochar dry matter) respectively. Concerning the hydorchars energy content, HHV values did not vary with the recycling runs and was about 30 MJ/kg. In the other hand, hydrochar morphology varied with increasing recycling runs and changed from being a solid residue to an oily slurry-type texture (Figure 1). In fact, hydrochars produced from water phase recycling presented a porous flat surface (Figure 1, image b to e) compared to the ones produced with pure water (Figure 1, a). Additionally, FTIR spectroscopy showed that the obtained hydrochars are rich in functional groups (C-H, O-H, C-O, and aromatic C=C) while peak intensities did not vary significantly through the recycling runs. These findings suggest that water phase recycling can be beneficial for the hydrothermal processing of two-phase olive mill wastes viability by increasing the hydrochar yield (by ~6%) and reducing the amount of the process wastewaters.

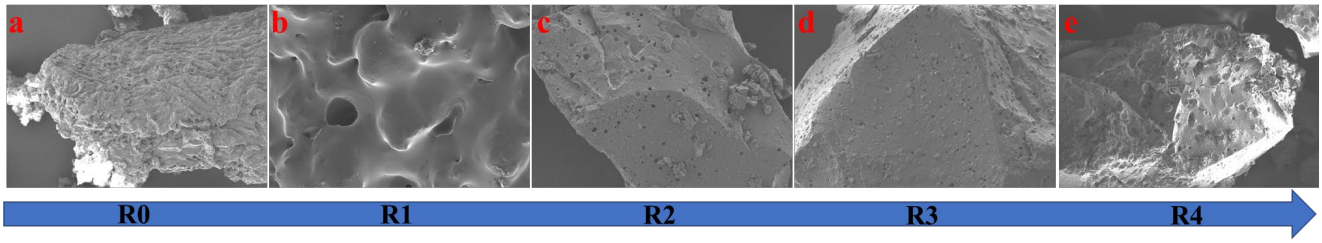

Figure 1 – Hydrochars morphology variation with water phase recycling runs

References

[1] Á. Fernández-Sanromán, G. Lama, M. Pazos, E. Rosales, M.Á. Sanromán, Bridging the gap to hydrochar production and its application into frameworks of bioenergy, environmental and biocatalysis areas, Bioresource Technology. 320 (2021) 124399. https://doi.org/10.1016/j.biortech.2020.124399.
[2] M. Tsarpali, N. Arora, J.N. Kuhn, G.P. Philippidis, Lipid-extracted algae as a source of biomaterials for algae biorefineries, Algal Research. 57 (2021) 102354. https://doi.org/10.1016/j.algal.2021.102354.