Biochar and activated carbons from free-metals leather solid waste: characterization and engineering

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Solid waste generated by the municipal and industrial sectors is a major problem worldwide due to issues associated with collection, transportation, treatment, and disposal [1]. The recycling and re-use of solid waste represent a great opportunity in terms of resource-saving, environmental protection and economic development. Leather manufacturing is classified as water, energy, and waste intensive and it is considered an activity demanding for integrated prevention and control of pollution. Along the whole process from raw hides to finished leather, a huge amount of solid and water waste is generated. One of the most abundant solid wastes (ca. 25% in weight of leather) is the shaving waste which results from the mechanical process that aims at reducing the tanned skin to a specific thickness [2].

The ongoing work proposes the optimization of an effective pyrolysis approach to convert metals-free leather shaving waste (by GOAST technology) into biochar and its subsequent physical activation process to design activated carbons [3]. Firstly, this study discusses the effect of pyrolysis parameters, such as temperature, residence time, heating, and inert flow rate on the biochar production.

Secondly, the attention was focused on the feasibility of using a physical activation process to engineering activated carbon starting from the biochar previously obtained. Therefore, the obtained materials were characterized by CHNS analysis, N_2 physisorption, FTIR, and XRD.

This study demonstrates as leather-shaving waste is a suitable carbonaceous precursor for the production of activated carbon. Furthermore, by defining the treatment parameters and selecting the activation agent, it is possible to modulate the morphological and chemical properties of the resulting activated carbon. This aspect provides useful information for the design of carbon materials that have the right characteristic according to the required application, such as catalysis, anodes for batteries, or supercapacitor.

[1] M. Velusamy, B. Chakali, S. Ganesan, F. Tinwala, S. Shanmugham Venkatachalam, *Environ. Sci. Pollut. Res.* 2019, 27, 29778-29790.

[2] S. Tieuli, M. Signoretto, E. Ghedini, A. Carlesso, A. Costantini, Claudio Bortolati, R. Pasquale, M. Silvestri, L. Frighetto, 2020, 3, LA CHIMICA E L'INDUSTRIA online, 36-43.

[3] https://www.lifegoast.eu