VALORIZATION OF AGRO-INDUSTRIAL RESIDUES THROUGH PYROLYSIS

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Abstract

Specific objectives of the studies carried out within the doctoral thesis (***Valorization of agro-industrial residues through pyrolysis***) were the production, characterization and use as an adsorbent of volatile organic compounds (VOCs) from the air and a soil amendment of biochar obtained through slow pyrolysis of plant residues. The thesis comprises 2 main parts, a literature review, which contains relevant aspects on the pyrolysis process, and a chapter (***Original contributions***) in which the results obtained in the own research regarding the production, characterization and testing of biochar obtained in a laboratory facility, respectively in a laboratory-scale pilot facility, are presented.

Three types of residual materials, *i.e.*, vine pruning residue, marc, and chrysanthemum residue, were pyrolyzed in a laboratory facility at different levels of process factors. Based on the results of the physicochemical characterization of biochar samples, vine pruning residue was selected as the raw material for further studies. The effects of the factors on the pyrolysis process performances of vine pruning residue, either non-impregnated or impregnated with H_3PO_4 solutions, resulting in the production of biochar (BC) or activated biochar (ABC), were quantified using regression equations. BC and ABC were tested as adsorbents of VOC (1,2 dichloroethane) from air stream. The adsorption capacity values of ABC (0.077–0.136 g/g) were higher than that obtained for BC (0.064 g/g).

Strongly alkaline BC (pH = 9.89 ± 0.01) was obtained by pyrolysis of vine pruning residue in a laboratory pilot scale facility, characterized and tested as an organic soil amendment (soil/BC mixing ratio: 4/1 v/v). BC had a significant positive effect on the growth characteristics of tomato plants sown in a strongly acidic soil (pH = 5.40 ± 0.01), but had no favorable effect on the growth of plants sown in weakly alkaline (pH = 8.03 ± 0.03) or weakly acidic (pH = 6.62 ± 0.04) soil, respectively.

Producing biochar from biodegradable residual materials can be an effective strategy for reducing biomass residues, remediating the environment, improving soil fertility, plant growth, development, and health.