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Synthesis and Characterisation of A Porous Material From Lignocellulosic Biomass

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ABSTRACT

In this work, activated carbon was synthesized from biomass by impregnation with orthophosphoric acid (H_3PO_4) followed by carbonization in a microwave oven under inert atmosphere. The porous material obtained was characterized by X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FT-IR), and methylene blue index.

Keywords:. Biomass, Activated carbon, Characterization, Microwave.

1. Introduction

The main objective of this work is to recover a vegetable waste which is abundant in Algeria, by using it as a precursor for the preparation of an activated carbon for use in the adsorption of pollutants in solution, as part of water treatment and environmental protection. For the preparation of the latter, we opted for chemical activation with orthophosphoric acid H_3PO_4 at a concentration and rate of impregnation fixed beforehand. Pyrolysis was carried out in a microwave oven at a specific power and residence time. The porous material obtained was characterised by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR) and methylene blue index. The result of the FTIR analysis shows that our material is rich in oxygen functions and the methylene blue index of 608.8 mg/g indicates that it has a good adsorption capacity. [1-2].

2. Experimental

The raw material used to prepare the activated carbon was cypress cones, which were washed, dried and crushed into small pieces of the order of millimetres. A quantity of 5g was impregnated with orthophosphoric acid at 85% by mass and an impregnation ratio of 1:3, after stirring and drying in an oven at 105C° for 24 hours. The prepared quantity was introduced into a microwave oven under an inert atmosphere at a power of 900W and a residence time of 7 min. The recovered porous material was washed to neutral pH and dried in the oven at 105°C and then characterised by XRD, FTIR and methylene blue index.

3. Results and Discussion

The result of the FTIR analysis revealed that the material obtained is rich in oxygenated functions such as hydroxyl groups (OH), ether groups (C-O-C) and carbonyl groups (C=O). These functions may play a role in the chemical and physico-chemical properties of the material as well as in its interactions with other organic and inorganic substances. The methylene blue index, which represents the adsorption capacity of medium-sized molecules and enables mesopores and macropores to be evaluated, given by UV-visible analysis, is 608.8 mg/g. Such a high methylene blue index value indicates that the material has a specific interaction capacity with certain chemical compounds, which can be useful in various fields, such as catalysis, adsorption of pollutants or separation of chemicals.

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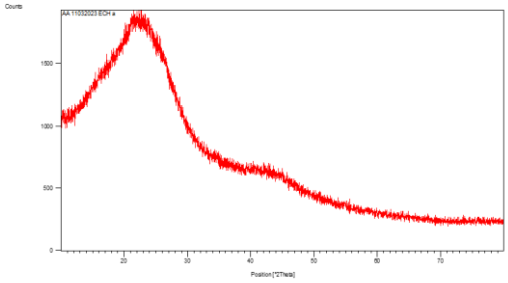

Figure.1 :XRD spectra of precursor

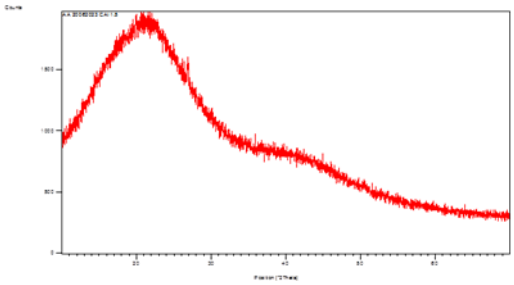

Figure.2: XRD spectra of AC

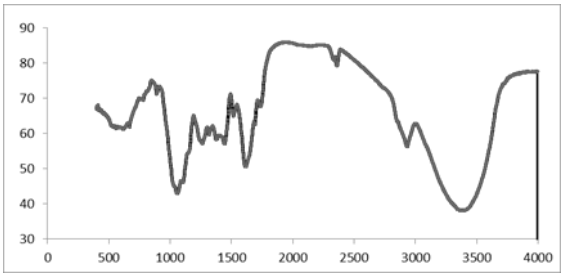

Figure3: FTIR spectra of CC.

4. Conclusions

In summary, the synthesis and characterisation of our activated carbon from cypress cones have shown promising results. The high adsorption capacity and the presence of oxygen functions suggest that this material can be used in various applications linked to the purification and separation of undesirable substances.

5. Acknowledgements

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