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VALORISATION OF NATURAL FIBRES FROM AFRICAN BAOBAB WASTES BY THE PRODUCTION OF ACTIVATED CARBONS FOR ADSORPTION OF DIURON

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ABSTRACT

In this work the potential of natural fibrous materials from African Baobab wastes for the production of activated carbons (ACs) has been evaluated. The wastes tested as precursors for the production of ACs were the bark, wood and seed from the Baobab tree. The activated samples present good structural and chemical characteristics. These features allowed us to test some of the most representative samples in the adsorption of Diuron pesticide from liquid-phase.

INTRODUCTION

The valorisation of renewable bioresources pass through the application of those lignocellulosic materials in the production of added-value products, like activated carbon adsorbents. The wide range of ACs applications is well known, in particular the possibility to remove specific compounds, most of them toxics, from the gas and liquid phases by the adsorption process (Marsh, 2006).

The originality of this work is the use of the novel precursors, namely the bark, wood and seed from the Baobab tree (Angola), containing a high content of natural fibres, in the production of ACs and its application to remove a herbicide with a broad use in agriculture, Diuron (3-(3 4-dichlorophenyl)-1 1-dimethylurea), from aqueous solutions.

The adsorbents were produced by carbonisation under a nitrogen flow and activation with carbon dioxide under different thermal conditions and time of activation. It was possible to produce materials with a range of porous and surface chemistry characteristics (Mourão, 2011). The characterisation of the precursors and ACs samples were done by nitrogen adsorption at 77K, X-ray diffraction, elemental analysis, FTIR, point of zero charge and thermal analysis.

RESULTS AND CONCLUSIONS

The results show that in appropriated thermal conditions, of temperature and time of activation, it´s possible to obtain well developed activated carbon adsorbents.

A detailed analysis of the structural and chemical characteristics of those samples, like apparent surface area, pore volume, mean pore with, and chemical surface groups, among others parameters, like the degree of burn-off and point of zero charge, allows us to predict future applications. As seen in Table 1, the ACs with a high burn-off exhibited a well-developed porous volume and high apparent surface.

Fig. 1 shows an example of the results obtained on the adsorption of Diuron from liquid-phase at 298K, in this case, for samples obtained from the wood Baobab tree Fig. 1.

Table 1 Textural and chemical parameters of carbon samples

Samples	**A_{BET}/m^2g^{-1}**	**A_S/m^2g^{-1}**	**$V_{\alpha S}/cm^3g^{-1}$**	**Burn-off/%**
B-AC1	740	30	0.33	26
W-AC1	875	44	0.34	42
S-AC1	1214	13	0.51	29
B-AC2	1100	19	0.48	32
W-AC2	1148	64	0.52	63
S-AC2	2130	47	0.97	62

(A – specific surface area, V – specific pore volume, BET and S subscripts correspond to BET and αS methods, respectively; B-bark, W-wood and S- seed)

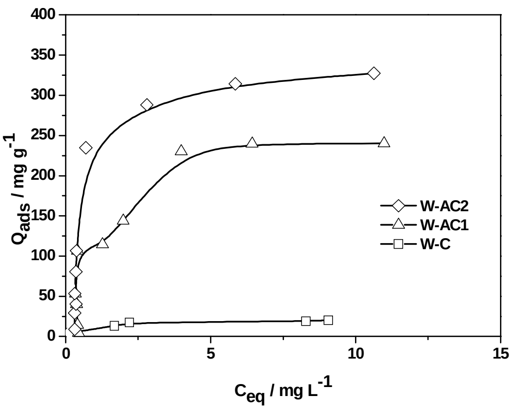

Fig.1 Adsorption isotherms of Diuron from aqueous solutions, obtained at 298.15 K on AC prepared from wood of Baobab tree

This work is relevant as the use of pesticides has not declined, particularly in developing countries like Angola, with the subsequent contamination of soils and water sources. The results presented will help in fighting against the negative impact of the contamination by using ACs made from endogenous materials. This is also interesting from the economical point of view as we aim to create materials with an added value from natural fibrous precursors.

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