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Direct use of agricultural bio-waste in water treatment

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INTRODUCTION

The existence and maintenance of life are associated with the use of water. Daily, water is used by all beings, to meet their metabolic needs, as well as in various agricultural and industrial activities. Globally, there is a growing concern about the scarcity and lack of quality of water that is available to consumers. In underdeveloped or developing countries, the lack of adequate treatments makes water available to consumers of dubious quality [1]. Despite the progress that has been made in Mozambique, acording to UNICEF data, in 2015, 50% of Mozambicans had access to improved water supply and only 20% had access to improved sanitation. In rural areas, 20% of the population uses surface water, without any treatment, for direct consumption [2]. On the other hand, agricultural practices produce large quantities of biomass that are not valued. In this perspective, any solution that can help, effectively, mitigate the problem of lack of quality drinking water and biowaste will be an added value. This work will present the results of the direct use of biowaste from agricultural activities, such as teak and imbondeiro sawdust, stubble, and bamboo flower, in the removal of colored compounds, such as the methylene blue, from the aqueous phase.

The main objective of this work is to find affordable and more economical solutions for the treatment of water that can be implemented locally. The use of local biowaste in the water treatment will allow the use of treated water in various activities and also the reduction of agricultural waste

METHOD

Preparation of the adsorbents

- The adsorbents used in the present study were sawdust from Tectona Grandis and Imbondeiro, Bamboo, bamboo leaves (F.B), Mayan plant leaves and stubble;
- The adsorbents come from Alentejo, a region of Portugal, Angola and East Timor;
- The adsorbents dried in an oven, at 323 K, for 10 hours;
- After drying, the adsorbents were ground, and then the powder adsorbents were washed with distilled water, at 353 K, for 1 h.

Methylene blue adsorption

- A kinetic study was carried out, using a constant mass of adsorbents (50 mg) in equilibrium with 25 or 50 mL of the MB solution;
- The suspensions were placed in a thermo shaker, at 298 K under an agitation speed of 20 r·min^{-1}, for 48h;
- The removal capacity of each adsorbent was evaluated by the difference between the initial and the equilibrium MB concentrations. The MB was quantified by spectrophotometry at 669 nm.

Figure 1. Raw materials used as adsorbents on the MB removal from the aqueous phase (from left - Bamboo flowers, Imbondeiro, Erlenmeyers with the MB solution).

RESULTS & DISCUSSION

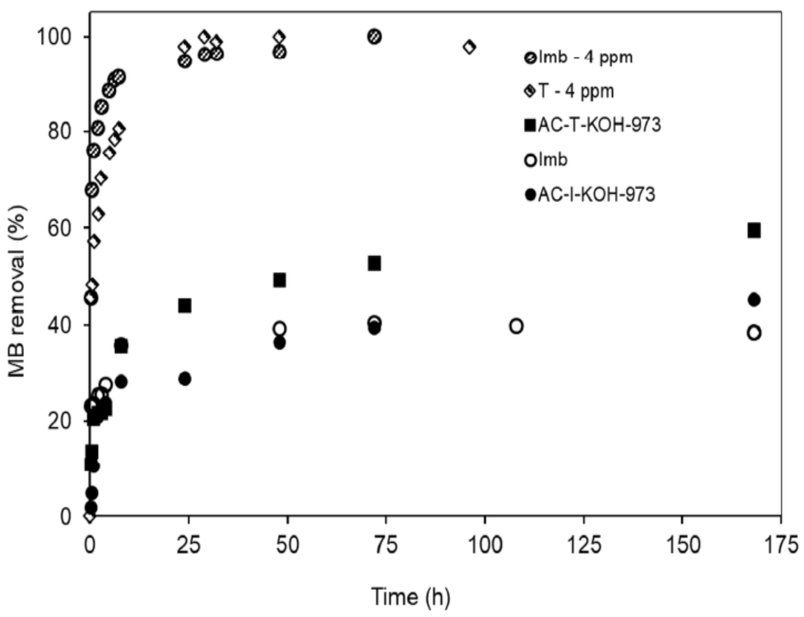

Figure 2. Kinetic study of the MB adsorption on the Imb natural material, and ACs from Imondeiro and Teak (AC-Imb-KOH-973 K, and ImbAC-T-KOH-973 K).

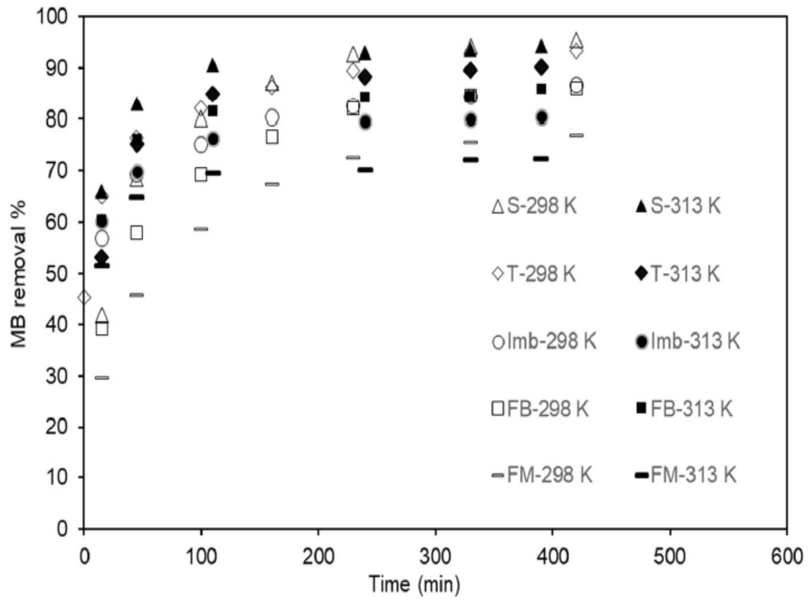

Figure 3. Temperature influence on MB adsorption on natural adsorbents. Open symbols refer to data obtained at 298 K and filled symbols to data obtained at 313 K.

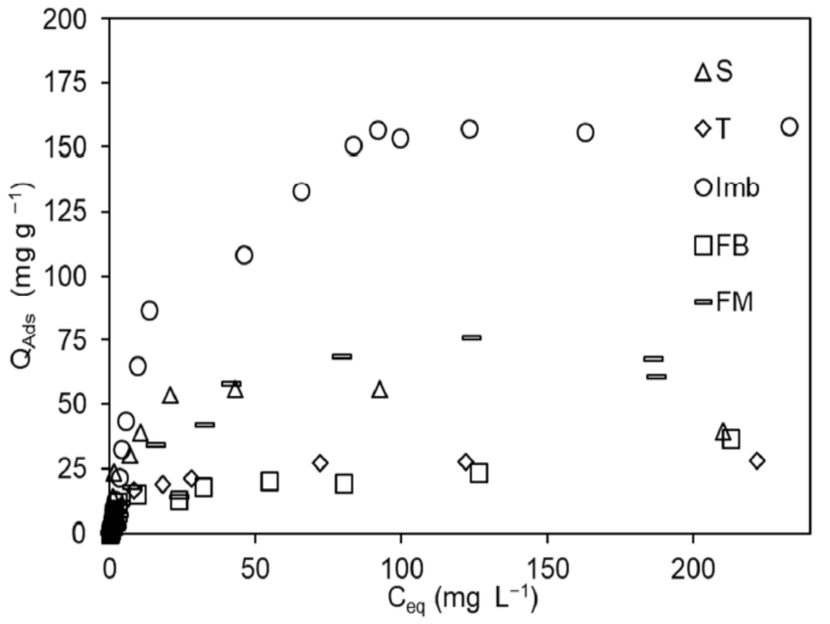

Figure 4. MB adsorption isotherms obtained on the original biomass.

- The adsorption of methylene blue (MB) from the aqueous phase was investigated by a set of natural biomass wastes used as adsorbents.
- The adsorption process showed significant improvement at a pH > 6 and at a temperature of 298 K.
- The five untreated biomaterials tested exhibited a considerable adsorption capacity for MB in both batch and continuous systems.
- Imbondeiro is a low-cost adsorbent for the effective removal of MB, which presented a maximum removal capacity of 188.3 mg MB per g, which is a higher value than those obtained with their respective ACs [3]

CONCLUSION

Agricultural wastes, such as stubble, sawdust from Teak (Tectona Grandis), fibres from Imbondeiro (Adansonia digitata L.), Bamboo flowers, performed well on the MB removal from aqueous medium and Imb performed better than some activated carbons.

REFERENCES

[1] Water Supply Overview (worldbank.org) (consulted on 14-02-2024).
[2]Unicef, Água, saneamento e higiene: Para cada criança, água limpa. (2015). Água, saneamento e higiene | UNICEF Mozambique. Consulted on 27/09/2022.
[3] Cansado, I.P.P., Geraldo, P.F., Mourão, P.A.M., Castanheiro, J.E., Carreiro, E. and Suhas. Utilization of biomass waste at water treatment. Resources, 37, 2024, 1-13.