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Biochars obtained from black wattle (*Acacia mearnsii of Wildemann*) as adsorbents for pesticides removal from water

Tassya T. S. Matos[1] (PG), Juliana Schultz[2] (PG), Muhammad Y. Khan[2] (PG), Bruno R. Araújo[1] (PG), Luciane P. C. Romão[1] (PQ)*, Antônio S. Mangrich[1,2,3] (PQ), Sandro Navickiene[1] (PQ) *lucianeromao@uol.com.br

[1]*Departamento de Química, Universidade Federal de Sergipe, 49100-000 São Cristóvão – SE, Brazil*
[2]*Departamento de Química, Universidade Federal do Paraná, 81531-980 Curitiba-PR, Brazil*
[3] *Instituto Nacional de Ciência e Tecnologia de Energia e Ambiente (INCT E&A) (CNPq), Brazil*

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Introduction

The fate of pesticides used in large scale in agricultural soils is related to processes of sorption, degradation, flows from irrigated agriculture and leaching so causing surface water pollution depositing them into lakes, rivers, wetlands, coastal waters and ground waters [1,2].
The adsorption is one of the most versatile and effective process in removing contaminants. When adsorbents used were of low cost from industrial waste procedures, it becomes an economically and environmentally feasible alternative [3].
Biochar defined, as charcoal obtained from the pyrolysis of biomass in a low oxygen atmosphere is a product obtained through a green chemistry process. It has low density and has both high cation exchange capacity and absorption of no polar compounds, so being perfect for use in agricultural purposes [4]. Using green technology, the utilization of tannin biochar has emerged as a novel method for the green synthesis of magnetic nanoparticles and activated carbon [5].
The adsorbents used in this work, were activated biochar (AB) and magnetic biochar (MB) derived from the exhausted husk and tannin both from *Acacia mearnsii of Wildemann* using pyrolysis process. FTIR, SEM, TGA, CHN, BET and XRD analyses characterized the obtained materials.
Thus, this study aims to pesticides removal of the neonicotinoid class from water using biochars produced of industrial wasteand.

Results and Discussion

The biochars were effective in removing the pesticides thiacloprid (TCL) and thiamethoxam (TMX) with q values of, 0.73 and 0.40 mg g^{-1} for MB and of, 1.02 and 0.90 mg g^{-1} for AB, respectively, for the TCL and TMX.
Fig. 1 shows the performance removal of pesticides by the adsorbent. The monitoring several intervals composed a total time of 400 minutes. Equilibrium for the MB tends to be reached after 270 minutes of contact with the pesticide solution, while the AB reaches equilibrium after 15 minutes of contact time. The good correlation coefficients (R^2) of the calculated value $q_{(calc)}$, of the pseudo second-order model is closest to the experimental value $q_{(exp)}$ showing that the pseudo second-order kinetic model tends to be the most appropriate to describe the adsorption processes of pesticides in these adsorbents (Table 1).

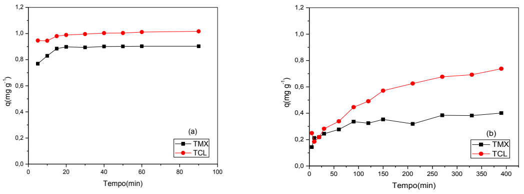

Figure 1. Pesticide sorption capacity TMX and TCL using the adsorbents (a) AB (b) MB.

Table 1. Comparison of models of pseudo-first and second order in the adsorption of pesticides TMX and TCL using AB and MB as adsorbent.

			Pseudo-first order			Pseudo-second order		
		$q_{e(exp)}$	$q_{e(calc)}$	k_1	R^2	$q_{e(calc)}$	k_2	R^2
MB	TMX	0,4016	0,2009	0,0076	0,8567	0,4048	0,0488	0,9883
	TCL	0,7374	1,5427	0,0206	0,5520	0,7977	0,0187	0,9756
AB	TMX	0,9028	0,0919	0,1079	0,4046	0,9113	1,5778	0,9999
	TCL	1,0168	0,4328	0,1142	0,7251	1,0229	1,4197	0,9999

Conclusions

Both biochars showed ability to remove pesticides becoming as potentials alternative to environmental purposes in removing contaminants.

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[1] Júnior, R. P. S. e Rigitano, R. L. O. *Revista Brasileira de Engenharia Agrícola e Ambiental*. **2012**, *16*, 5, 564.
[2] Campo, J.; Masiá, A.; Blasco, C. e Pico, Y. *Journal of Hazardous Materials*. **2013**, *263*, 146.
[3] Bhattacharya, A.K.; Naiya, T.K.; Mandal, S.N. e Das, S.K. *Chemical Engineering Journal*. **2008**, *137*, 529.
[4] Jouiad, M.; Al-Nofeli, N.; Khalifa, N.; Benyettou, F.; e Yousef, L.F. *J. Anal. Appl. Pyrolysis*. **2015,** *111*, 183.
[5] Nune, S.K.; Chanda, N.; Shukla, R.; Katti, K.; Kulkarni, R.R.; Thilakavathy, S.; Mekapothula, S.; Kannan, R. e Katti, K.V. *J. Mater. Chem.* **2009**, *19*, 2912.