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BOOK OF ABSTRACTS

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BIO-RENEWABLE MEMBRANES BASED ON MODIFIED CELLULOSE, LIGNIN, AND TANNIC ACID FOR DIFENOCONAZOLE AND THIOPHANATE-METHYL REMOVAL

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Abstract

Aquatic pollution caused by pesticides as a consequence through run-off, leaching, and sub-surface drainage, may pose a serious health hazard for living being and ecosystems due to pesticides persistent nature and bio-magnification. Since most organic pesticides are non-degradable and carcinogenic, they represent a potent category of water contaminants. The aim of the presented work was to develope functional biodegradable membranes which could be used as an efficient adsorbent for the removal of pesticides (difenoconazole and thiophanate-methyl) from aquatic solutions. The bio-renewable membranes (Cell-El and Cell-El-Ta) based on epoxy-amino reactivity of the Cellulose fibres (Cell) modified with diethylenetriamine (Cell–Deta), (3-Glycidyloxypropyl)trimethoxysilane (Cell-Glymo), Lignin modified with epichlorohydrine (El) and Tannic acid (Ta), as an additional crosslinker, were produced by optimized methods through the application of novel approaches. The membrane preparation was conducted at the appropriate molar ratio of functional groups designed to provide numbers of residual functionalities effective for pesticide removal. The membranes were characterized by Fourier-Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM). FTIR spectral analysis was used to identify the characteristic functional groups of produced membranes and spectral pattern change as a result of the formation of coordination complexes of pesticides with surface functionalities. Controlled modification of Cell fibre and subsequent production of Cell-El and Cell-El-Ta membrane causes change fibres surface and material morphology, and SEM analysis proved successful modification and membrane production with formation a large number of fibres interconnections. The effects of contact time, temperature, and initial concentration of pesticides on adsorption were studied in a batch system. The Langmuir, Freundlich, Temkin, and Dubinin-Radushkevich (D-R) isotherm models were used to evaluate the adsorption process, and to predict the adsorption capacity of the adsorbents. The experimental results were best fitted with the Langmuir isotherm model. The calculated capacities: 32.2, 69.3, 45.1 and 83.2 mg g^{-1} for difenoconazole and thiophanate-methyl using Cell-El and Cell-El-Ta, respectively, were obtained from Langmuir model fitting at 25^{o}C. The thermodynamic parameters indicated spontaneous and low endothermic processes. The present study demonstrates that prepared membranes could be an effective and low-cost adsorbent to prevent contamination of water and consequently help minimize the environmental impact caused by the pesticides.

Key words: *Cellulose membrane, batch study, difenoconazole, thiophanate-methyl;*

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