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PURIFICATION OF ETHANOL PRODUCED BY AL MOSUL STATE COMPANY FOR SUGAR PRODUCTION USING CARBON NANOTUBES

A Thesis

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By

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Abstract

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Ethanol produced by AL Mosul state Company usually used for industrial uses contains impurities such as methanol and formaldehyde. In order to remove these impurities, functionalized MWCNTs were used as an adsorbent in batch and continuous process.

In the present work, multi wall carbon nanotubes (MWCNTs) were prepared by catalytic chemical vapor deposition (CCVD) method, using tubular furnace in which thermal decomposition of acetylene gas has been done under 700 C° for 1 hour in quartz tube using argon as carrier and inert gas.

Purification of carbon nanotubes from impurities of amorphous carbon and metal catalyst has been done by using ultrasonic path in the presence of 6M HCl.

Functionalization of MWCNTs has been obtained by chemical treatment with a high concentration (69% - 72%) nitric acid under total reflux.

MWCNTs were characterized by using a different techniques. The result of SEM showed a well-defined CNTs with 75nm in diameter and several μm in length, this result was confirmed by XRD analyses in which two peaks were observed for MWCNTs at (2θ) 26.1° and (2θ) 42.9° which represent the hexagonal structure of MWCNTs. BET technique showed that carbon nanotubes has a specific surface area of 175m²/g and with pore volume of about 0.91cm³/g. Fourier Transfer Infrared Spectra (FTIR) was used to detect functional group, peak at 3429.34cm⁻¹ characterized hydroxyl group and peak at 3394.72cm⁻¹ characterized carboxyl group.

Abstract

In batch adsorption process experiments, the effect of MWCNTs dosage of (50, 100 and 150) mg/L, pH (3-12) with initial concentration of (10, 20 and 30) ppm for methanol and (20, 40 and 60) ppm for formaldehyde and contact time (5-35) min have been studied.

The maximum removal efficiency was obtained under the following conditions (pH=5, CNTs dosage=100mg/l, contact time=35min and initial concentration=10, 20 for methanol and formaldehyde respectively). Adsorption isotherms were fitted with the Langmuir and Freundlich models. The equilibrium data were best represented by the Langmuir isotherm model with higher correlation coefficient R^2 value of (0.9321, 0.9987) for formaldehyde and methanol respectively.

In continuous experiment MWCNTs has been pressed and formed as a pellet using a Novolak as a binder and after suitable heating treatment pellets were used as a packing material in a bed. Different effects on the adsorption process such as flow rate (1 - 4) ml/min and height of packed (5, 10, 15) cm were studied.

The maximum removal efficiency was found at 1ml/min flow rate and 15cm height of packing.