

## Experimental and analysis study on removal of furfural in synthetic refinery wastewater using an agricultural waste-based modified adsorbent

Luma H. Mahmood<sup>a</sup>, Mohammad F. Abid<sup>b,\*</sup>, Adnan A. AbdulRazak<sup>a</sup>, Bashar J. Kadhim<sup>a</sup>, Ibrahim N. Abdulla<sup>b</sup>

<sup>a</sup>Department of Chemical Engineering, University of Technology, Baghdad, Iraq, email: 80152@uotechnology.edu.iq (L.H. Mahmood), 80036@uotechnology.edu.iq (A.A. AbdulRazak), bashar.j.kadhim@uotechnology.edu.iq (B.J. Kadhim)

<sup>b</sup>Department of Petroleum and Gas Refining Engineering, Al-Turath University College, Baghdad, Iraq, emails: mohammad.fadhil@turath.edu.iq (M.F. Abid), ibrahim.najim@turath.edu.iq (I.N. Abdulla)

Received 5 January 2023; Accepted 14 May 2023

---

### ABSTRACT

The current study was conducted to estimate and identify Fe-doped activated carbon synthesized from empty date palm bunch fibers that may be used for furfural efficient removal. The prepared adsorbent was identified by scanning electron microscopy, X-ray diffraction, and Fourier-transform infrared spectroscopy techniques. The capability of the modified adsorbent for furfural elimination in synthetic wastewater of the Al-Doura oil refinery in Baghdad city was estimated through both kinetic and equilibrium studies with investigating the key parameters such as adsorbent loading, contact time, furfural loading, initial pH, and mixing speed. Experimental results showed that after 125 min of contact time a percentage removal efficiency of 80% and 58% with absorption capacities of 27.04 and 16.80 mg·g<sup>-1</sup> was attained by using Fe-doped activated carbon, and activated carbon, respectively at optimum initial pH of 6. Results showed that the pseudo-first-order fitted well with the system kinetics. Moreover, the Langmuir isotherm model agreed well with the adsorption equilibrium system. The thermodynamic study revealed that the negative value of  $\Delta G^\circ$  marks the spontaneity and feasibility of the sorption operation. A regression model was developed for the percentage removal of furfural as a function of operating parameters with a correlation coefficient of 0.9875 and a standard of deviation = 1.18%.

*Keywords:* Agricultural wastes; Fe-doped activated carbon; Furfural; Synthetic wastewater; Kinetic study, Equilibrium study

---

\* Corresponding author.