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# Impact of $H_3PO_4$-activated carbon from pine fruit shells for paracetamol adsorption from aqueous solution

Imad Hamadneh[a], Rund A. Abu-Zurayk[b], Aseel Aqel[a], Ahmed Al-Mobydeen[c], Lama Hamadneh[d], Yousef Al-Dalahmeh[e], Fayza Hannoon[a], Rula Albuqain[f], Shorouq Alsotari[f], Ammar H. Al-Dujaili[b,*]

[a]*Department of Chemistry, Faculty of Science, University of Jordan, Amman 11942, Jordan, Tel. +962 775500003; email: imad72@hotmail.com (I. Hamadneh), Tel. +962785733913; email: aseelaqel@yahoo.com (A. Aqel), Tel. +962798408852; email: hannonfayza@gmail.com (F. Hannoon)*
[b]*Hamdi Mango Center for Scientific Research, University of Jordan, Amman, P.O. Box: 11942, Jordan, Tel. +962 796 629 774; email: ah.aldujaili@gmail.com (A.H. Al-Dujaili), Tel. +962 799116889; email: r.abuzurayk@ju.edu.jo (R.A. Abu-Zurayk)*
[c]*Department of Chemistry, Faculty of Science, Jerash University, Jerash 26150, Jordan, Tel. +962798962089; email: ahmeddd_mob@yahoo.com (A. Al-Mobydeen)*
[d]*Faculty of Pharmacy, Al-Zaytoonah University of Jordan 11733, Amman, Jordan, Tel. +962777771900; email: lama.hamadneh@zuj.edu.jo (L. Hamadneh)*
[e]*Department of Chemistry, Faculty of Science, Isra University, Amman 11622, Jordan, Tel. +962 795229695; email: yousef.dalahmeh@iu.edu.jo (Y. Al-Dalahmeh)*
[f]*Cell Therapy Center (CTC), The University of Jordan, Amman, 11942, Jordan, Tel. +962798738536; email: buqaien@yahoo.com (R. Albuqain), Tel. +962796605076; email: shalsotari@gmail.com (S. Alsotari)*

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**ABSTRACT**

The synthesis of activated carbon (AC) from pine fruit shells (PFS) biomass (BM) is described in this paper. AC was made from BM by gradual pyrolysis at 600°C. AC was also chemically activated with $H_3PO_4$ (BC-$H_3PO_4$) and pyrolyzed at 600°C. BM, BC, and BC-$H_3PO_4$ adsorbents were characterized by Fourier-transform infrared spectroscopy, X-ray diffraction, scanning electron microscopy, thermal gravimetric analysis, and elemental analysis. The batch system was used to apply the BM, BC, and BC-$H_3PO_4$ to the adsorption of paracetamol (PCM) from aqueous solution. Adsorption was evaluated in relation to adsorbent dosage, ionic strength, initial pH solution, contact time, and temperature. Based on their coefficient of determination ($R^2$), chi-square ($\chi^2$) and error function ($F_{error\%}$) values, equilibrium and kinetic PCM adsorption data revealed that the process obeys the Langmuir, Dubinin–Radushkevich, and pseudo-second-order kinetic equations, respectively. According to the Langmuir model, the highest adsorption capacity for PCM by BM, BC, and BC-$H_3PO_4$ was 99.010, 166.667, and 256.10 mg/g, respectively. Thermodynamic analysis revealed that PCM adsorption by the adsorbents is spontaneous and exothermic.

*Keywords:* Activated carbon; Chemical activation; Phosphoric acid; Adsorption

* Corresponding author.