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Entitled

INVESTIGATION OF THE EFFECT OF SUPERCRITICAL CARBON DIOXIDE TREATMENT ON THE ADSORPTION ABILITY OF DATE PITS

by

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Abstract:

This thesis aims to develop and investigate an innovative use of date pits, a common and abundant agricultural waste in the UAE. It is suggested that date pits may be used to produce date pit oil, and the powder residue from this extraction process may be used as a low cost adsorbent for removal of lead from water. This thesis aims to investigate the effects of the parameters pressure, temperature, and particle size on the extraction yield when using supercritical carbon dioxide (SC-CO2) to extract oil from date pit powder. This oil is a valuable component which has many applications in pharmaceutics and foodstuff. The residue powder, symbolized by CO2-DP, is then investigated as a possible adsorbent for removal of lead ions from water. The adsorption capability of CO2-DP is then compared to that of raw date pits (R-DP) and the residue powder of Soxhlet extraction (S-DP). A Box-Behnken RSM design is used to optimize the adsorption parameters, namely adsorbent dose, lead concentration, and adsorbent type. The highest yield of oil date pit oil obtained from SC-CO2 extraction, 10.29%, was achieved at pressure 500 bar, temperature 40 °C, and particle size range <63 µm. The maximum extraction yield of SC-CO2 is about the same as the extraction yield obtained from Soxhlet extraction, 10.3%, indicating that SC-CO2 extraction is a reliable method for extracting oil from date pits. Furthermore, out of the three adsorbents tested, it was found that CO2-DP has the highest capacity for lead removal. At a constant pH of 4, the optimum adsorption conditions were found to be: dose of 0.0052 g/mL solution, lead concentration 196 ppm, time of 10 hours, and adsorbent type CO2-DP. It is therefore suggested that oil be extracted from the date pits powder and the residue used in adsorption. In this way two useful products are produced from a readily available agricultural waste.

Keywords: Supercritical Fluid Extraction, Date Pits, Adsorption, Response Surface Methodology.