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IMPACT OF DATE-PIT ACTIVATED CARBON IN DIFFERENT APPLICATIONS: BIOMEDICAL AND ENVIRONMENT

by

Betty Titus Mathew

Faculty Advisor

Dr. Khaled Abbas El-Tarabily, Department of Biology

College of Science

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Abstract

Activated carbon (AC) or activated charcoal are black carbonaceous porous solid material with prominent physio-chemical properties such as low volume pore size distribution, high specific surface area, and high-degree of surface reactivity for adsorption and other chemicals reactions. Activated carbons as strong and reliable adsorbent have been reported to be employed in diverse applications stretching from water/air purification, medicine sewage treatment, energy storage devices, catalyst, supercapacitor electrodes fabrication, as biosensors component. In this work, activated carbon was produced from date pits, which is a common biological waste product in UAE and produced activated carbon have been attempted for both biomedical and environmental applications instead of using commercial AC. Date pits based activated carbon was produced by physical activation method followed by thorough characterization for physical and chemical properties analysis. The developed activated carbon was employed for evaluation of bilirubin adsorption capacity and plant growth promoting ability. Date-pit based AC demonstrated highly selective and most effective capacity for bilirubin adsorption as revealed by isotherm-modelling analysis compared to controls, collagen and Matrigel. *In vitro* cell culture studies further indicated cytocompatibility of established date-pit based against liver specific cell lines THLE2 and HepG2 cells with preservation of liver cell integrity. Furthermore, activated carbon coated rhizosphere-competent halotolerant actinobacterial strains were utilized as bioinoculants on seawater-irrigated *Salicornia bigelovii* plants and assessed for plant growth promoting abilities. The three rhizosphere-competent isolates, *Streptomyces chartreusis* (Sc), *S. tritolerans* (St) and *S. rochei* (Sr) capable of producing growth hormones were investigated individually and as consortium (Sc/St/Sr) to determine their effects on the performance of *S. bigelovii* growth in the greenhouse. Herein, the synergetic combination of strains indicated greater effects on *S. bigelovii* biomass (62.2% and 77.9% increase in shoot and root dry biomass, respectively) and seed yield (79.7% increase) compared to the individual strains and control treatment. Taken together, developed activated carbon were employed as biomaterial for removal of protein-bound toxins in bioartificial liver devices and as bioinoculant adsorbent for plant growth promotion. Overall, these works emphasize the potential role of date pits based activated carbon in biomedical and environmental applications and open doors for applications in diverse domains such as healthcare sector and environmental issues.

Keywords: Activated carbon, date pits, biomaterial, adsorbent, bilirubin detoxification, plant growth promoter.