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Sustainable Porous Carbon Electrode Material Derived from Biomass for Utilization in Capacitive Deionization

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The shortage of drinking water is a dilemma faced by our country and the world at large. Whereas approximately 96% of water on earth is rich in salinity, desalination of brackish and seawater is a promising technology for resolving water crisis. However, present desalination technologies are linked with hindrances such as high energy consumption and high maintenance costs. Capacitive deionisation (CDI) has gained popularity as an emerging, energy-efficient, and viable electrochemical desalination technology. CDI consists of two steps: the adsorption and desorption of salt ions from water. When voltage is applied across the cell, ions move to oppositely charged electrodes forming an electrochemical double layer (EDL). When the voltage is reversed the ions are released from the surface of the electrodes, and the electrodes are recovered. The performance of CDI is dependent on the properties of the electrode material such as specific surface area, conductivity, electro-sorption capacity, pore structure, and electrochemical stability. The issue with currently used carbon materials for CDI is that they are derived from non-renewable resources and involve sophisticated and costly synthesis methods. This work proposes the utilization of porous carbon derived from biomass via pyrolysis since it is easily accessible, abundant, and promotes a circular economy. The prepared porous carbon was characterized using Brunauer-Emmet Teller (BET), Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), Raman spectroscopy, and X-ray diffraction (XRD). The porous carbon from coffee waste grounds exhibits properties required for desalination using CDI technology.

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