

### Physical and electrochemical characteristics of brown seaweed-based carbon electrodes

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Brown seaweed-based activated carbons (BS-ACs) for electric double layer capacitors (EDLC) are prepared using the pyrolysis at two different temperatures, 600 and 800 °C, under nitrogen atmosphere. Prior to pyrolysis, the brown seaweed is pretreated by two different rinsing methods. One part is washed with hydrochloric acid solution and the other part is rinsing with distilled water. The final carbon samples are characterized by inductively coupled plasma (ICP), X-ray photoelectric spectroscopy (XPS), and nitrogen adsorption isotherms to quantitatively and qualitatively examine their physicochemical properties. In addition, the electrochemical properties of the BS-ACs are assessed by cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and constant current charge/discharge experiments. The electrochemical performances are greatly dependent on the pretreatment conditions. It is found that rinsing with distilled water is better to get higher specific capacitances than acid washing. Furthermore higher pretreatment temperature and lower acidity are creating larger BET surface area and micropore volume.