Activated Carbon Derived From Rice Husks Enhanced by Methylene Blue and Gamma Irradiation for Energy Storage Applications

Anusontiwong, Thannithi (School: Kamnoetvidya Science Academy)
Suwatanapongched, Natavoranun (School: Kamnoetvidya Science Academy)
Surawattanawiset, Jittiyada (School: Kamnoetvidya Science Academy)

Renewable energy, agricultural waste management, and clean water scarcity are major environmental concerns worldwide. Activated carbon (AC) is a promising material for electrodes used in energy storage devices such as supercapacitors and batteries. In this project, activated carbons were produced from rice husks, a low-value by-product of rice milling. Methylene blue and gamma irradiation were used to enhance the properties of our activated carbon. Methylene blue, a redox dye, was chosen due to its pseudocapacitive effect and its ability to dope N and S atoms to AC. Gamma irradiation has been proven to invoke free radicals in the materials and to improve their AC functionalization. This study is the first to use both enhancements of AC at the same time. This investigation aimed to create highly reactive sites on the surface of AC using various dosages of gamma rays, 25 kGy, 50 kGy, and 100 kGy. To establish a basis for comparison, we also conducted conventional methods such as hydrothermal treatment. From the results, the 25 kGy gamma irradiation dose resulted in a specific capacitance of 127.9 F/g at 0.5 A/g showing a significant improvement of up to 84.8% from non-modified AC. Meanwhile, with the same current density, hydrothermal-treated samples reveal an exceptional specific capacitance of 242.1 F/g. Thus, we can create cost-effective SCs, and extend the effects of gamma irradiation, which have a transformative impact on the biobased AC role model, ultimately addressing the issues of energy storage.

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