

Synthesis of high-carbon content microspheres by microwave carbonization

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Natural coalification was imitated through microwave carbonization. The hydrothermal carbonization of glucose solutions was carried out at 210 °C for 15 min using microwave-assisted heating, resulting in spherical structures with a uniform size. The average diameter varies from 200 nm to 650 nm depending upon the concentration of the glucose solution. The carbon content increased from less than 50% to over 90% by additional microwave irradiation for 1 min on dried spheres. Nitrogen-doping of carbon spheres was carried out by the addition of urea in the glucose solution. The nitrogen concentration of the spheres was controlled by varying the concentration of urea solution. Elemental analyses revealed that these spheres contain 35 % -45 % of carbon by atomic ratio and 5 % - 10 % of nitrogen by atomic ratio. When microwave was additionally irradiated for 1 min on the dried spheres, the carbon content increased to 60 % - 80 %, while the nitrogen content maintained 5 % - 10 %, and the oxygen content decreased to 0 % - 3 %.