From Organic Wastes to Biochar: A High School Student's Practice

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Using microwave heating to produce biochar from organic solid wastes not only recycles wastes but also promotes plant growth and carbon sequestration, and thus has positive implications in low-carbon development and climate change. A small-scale waste collection-compression device and a portable microwave carbonization equipment were designed and developed. Experiments were conducted on the temperature rising of organic wastes after absorbing microwave, screening of cheap microwave-absorbing agents and optimization of the microwave carbonization process. Carbonization effectiveness of raw materials was investigated. And pot culture experiment was conducted to evaluate the soil carbon sequestration effectiveness of biochar fertilizer. The results showed that the temperatures of the three organic wastes used, kitchen wastes, sludge and straw, rose rapidly up to 320 °C after absorbing microwave. When the carbonized material produced by our developed equipment was added as a cheap microwave-absorbing agent at a dosage of 20-30%, the temperature of the three wastes rose rapidly to 700 °C and microwave carbonization was achieved. The pot culture experiment showed that the above biochar fertilizers could promote the growth of eucalyptus and stabilize the soil carbon sink. The height and weight of the eucalyptus trees increased by 186-208% and 138-153%, respectively compared with those in the control. And the decomposition rate of soil carbon decreased by 87.3-88.2%. In this study, rapid microwave carbonization of organic wastes was developed, which is an effective way to achieve carbon sequestration utilizing organic wastes and has been demonstrated and practiced in some schools and communities.

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