

## Hydrothermal carbonization of lignocellulosic biomass for carbon rich material preparation : a review

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### ABSTRACT

Hydrothermal carbonization (HTC) is an active area of research in synthesizing carbon-rich materials because of its ability to transform wet biomass into valuable products. Carbon-rich materials have received a great deal of attention because carbon is a raw material for several industrial products and their production from various biomasses is currently an active area of research. In addition, lignocellulosic biomass has been of great interest as precursors for the preparation of carbon-rich materials because of their low cost and due to environmental concerns. This review exhibits the research on the hydrothermal carbonization of lignocellulosic biomass, production of carbon-rich materials or carbon spheres or hydrochar by the HTC process and the role of water and the proposed mechanism in the HTC process. This research on hydrothermal carbonization mostly focused on lignocellulosic biomass materials and the effect of process parameters including the temperature, pressure residence time, pH, heating rate and substrate concentration are also discussed. The reaction mechanisms of hydrolysis, dehydration or decarboxylation and carbonization are elaborated in detail. Solid carbon-rich materials have a wide range of applications as environmental additives, biofuels, catalysts and energy storage and have been covered in detail. At the end of the review, we deliver an outlook on future research prospects and applications of hydrothermal carbon-rich materials.

### KEYWORDS

Lignocellulosic biomass; Hydrothermal carbonization; Reaction mechanism; Process parameters; Carbon rich material

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