

DOES STIRRING INFLUENCE HYDROTHERMAL CARBONIZATION EXPERIMENTS? A LABORATORY AND COMPUTATIONAL STUDY OF A LIGNOCELLULOSIC BIOMASS

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In the context of hydrothermal carbonization (HTC), the stirring rate is usually overlooked. Regularly, the stirring rate is used as an explanation of the results; however, this hypothesis has not been tested before. In this study, the influence of stirring rate was evaluated on hydrochar's main properties, such as solid mass yield, solid carbon fraction, surface area, morphology, and the fate of inorganics using an anchor shape agitator. A lignocellulose biomass (*Typha australis*) was used as a feedstock in a 2 L scale reactor. In this study, temperature (180-250 °C), residence time (4-12 h), biomass to water (B/W) ratio (1-10%), and stirring rate (0-130 rpm) have been intensively investigated. Surprisingly, the results illustrated that the stirring rate did not influence the studied responses under the investigated conditions. Moreover, the analysis of variance indicated that the stirring rate did not interact with other process parameters in influencing the process and the properties of the hydrochar. Further experiments using short residence time (0.5-2h) have confirmed these results. Additionally, a computational fluid dynamic model was developed to simulate the studied case; the numerical results indicated that homogeneity could be achieved by a stirring rate above 60 rpm rate, consequently leading to the homogeneity of flow inside the reactor.

This study is relevant to the theme of "Bio-char production processes: from torrefaction, slow and fast pyrolysis, gasification and hydrothermal processing"