Nutrient recovery from wet biomass in hydrothermal carbonization as an innovative approach toward the circular economy

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Abstract:

In contrast to the linear economy, the circular economy aims to tackle globally environmental challenges such as climate change and pollution by recycling and reusing waste. Through waste valorization, biomass is highly significant in the circular economy regarding energy provision and input resource applications for other processes. Increasing global demand for crops, limited nutrient resources, and high production costs of fertilizers have led to the expansion of scientific research in wet biomass valorization to achieve nutrient recovery. In recent years, hydrothermal carbonization (HTC) as a thermochemical process of wet biomass treatment has been attracting the attention of researchers. This process has many advantages, including simplicity, relatively low-temperature conditions, and the capability to process wet feedstocks. The two main products of the HTC process are hydrochar and hydrolysate. Hydrochar is a carbon-rich solid with widespread usage as a fuel source, adsorbent, and soil conditioner. As a liquid effluent of the process, the hydrolysate is a good source of nutrients that could replace the current fertilizers. In recent years, depending on the input feed, the recovery of several nutrients, such as phosphorus, nitrogen, and potassium from hydrolysate, has received significant attention. In the present study, state-of-the-art on the nutrient recovery of different biomasses using HTC, the influence of governing factors on the fate of nutrients, and the current challenges in using process water as a fertilizer alternative have been reviewed.

Keywords: Circular economy, Hydrothermal carbonization, Nutrient recovery, Hydrolysate

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