Types of plant feedstock determine biochar's role in anaerobic digestion

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Biochar had been shown previously to promote methane (CH\textsubscript{4}) yield from anaerobic digestion (AD) by promoting direct interspecies electron transfer (DIET). Due to the diverse physicochemical properties, biochar derived from different materials might have discrepant effects on AD. As for materials of plant origin (MOPO) are the main raw materials for biochar production, understanding the effects of physicochemical properties of biochar derived from different MOPO on AD performance of glucose. Biochar pyrolyzed from rice straw (RSC), corn stalk (CSC), bamboo (BC), pine (PC), oak (OC) and apple wood (AWC) were used in this experiment.

Results showed that compared to control treatment without biochar addition (CK), the addition of biochar RSC, BC, PC, OC and AWC significantly improved cumulative CH\textsubscript{4} production by 27.01%, 10.16%, 19.66%, 49.41% and 52.78%, while CSC had no apparent effect on CH\textsubscript{4} production. Closer detection of key fermentation parameters showed that the addition of biochar resulted in significant improvement of chemical oxygen demand (COD) removal efficiencies comparing with CK. Furthermore, biochar addition increased the conversion rate from COD to CH\textsubscript{4}, except for CSC which reduced the conversion rate by 2.32%. Biochar may promote methane yield during AD via improving the COD removal efficiency and the conversion rate from COD to CH\textsubscript{4}.

Correlation analysis between biochar physiochemical properties and biomethanizaiton performance showed that specific surface area and electron-donating capacity (EDC) both have significant influence on maximum CH\textsubscript{4} production rate (p<0.05). Biochar with higher specific surface area and EDC may be much easier for the attachment of microorganisms and might be the main reason for the better AD performance. This study provided a potential solution for biochar selection and optimization in AD.

![Figure 1. Correlation analysis between biochar physiochemical properties and biomethanizaiton performance.](image-url)