HIGH-RATE ANAEROBIC DIGESTION USING CARBON SUPPORT FOR BIOFILM IMMOBILIZATION

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ABSTRACT

The performance of a three-phase up-flow integrated high-rate anaerobic digestion reactor system utilizing corn cob biochar as biofilm support was characterized at 10 liter total scale on synthetic and food processing derived wastewater at defined hydraulic retention times. Both feeds possessed equivalent feed COD of approximately 16 g L^{-1}. Performance was evaluated in terms of COD, TN, TP reduction, as well as methane production rates. Soluble COD reductions of approximately 85% with a methane production rate of 0.89 m^3 m^{-3} d^{-1} were achieved for digestion of the synthetic wastewater at a HRT of 7.3 days and an organic loading rate of 2.2 kg COD m^{-3} d^{-1}. Soluble COD reductions of approximately 60% were achieved on food processing derived wastewater for an HRT of 3.0 days and an organic loading rate of 4.93 kg COD m^{-3} d^{-1} and a methane production rate of 1.48 m^3 m^{-3} d^{-1}. Combined, these results confirmed that high rate anaerobic digestion can be achieved through use of biochar filled column reactors connected in series and fronted by an initial hydrolysis reactor that buffers the system from disturbances in pH and temperature as well as non-sterile wastewater feed that is infused with natural bacterial flora.