Optimization of Acid-enzyme Hydrolysis Conditions of Horse Manure

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Abstract

Horse manure is a very abundant biomass resource in China, containing 21% organic matter, 0.4-0.5% nitrogen, 0.2-0.3% phosphorus, and 0.35-0.45% potassium. Using horse manure hydrolysate as a substrate for biological hydrogen production is very promising, but one of the bottlenecks limiting this technology is the low content of reducing sugars in horse manure hydrolysate. Optimizing the hydrolysis process conditions is an effective way to solve this problem. Acid enzymatic hydrolysis has significant advantages in the hydrolysis process of horse manure. On this basis, the process conditions for acid enzyme hydrolysis of horse manure were optimized in this experiment. Sulfuric acid concentration, hydrolysis temperature, enzymatic pH, enzymatic temperature and enzyme dosage (cellulase and hemicellulose) were selected as parameters for optimization, and the optimal hydrolysis conditions were obtained. The optimal hydrolysis conditions are: sulfuric acid concentration of 9.0%, hydrolysis temperature of 105 ℃, enzymatic hydrolysis pH of 6.0, enzymatic temperature of 105 ℃, enzyme dosage (cellulase 27 g/L, hemicellulose 27 g/L) of 54 g/L. Under these conditions, the hydrolysis rate of horse manure is 59.76 ± 1.65%, and the reducing sugar content in the hydrolysis solution is 65.21 ± 0.16g/L. The reducing sugar obtained from the hydrolysis of horse manure serves as a carbon source for hydrogen production by photosynthetic bacteria, which not only reduces the burden on the environment caused by excessive return of horse manure to the field, but also reduces the cost of hydrogen production through photosynthetic bacteria. This to some extent alleviates energy pressure and drives the animal husbandry economy, resulting in sustainable development of the industry.

Keywords

Horse Manure, Resource Utilization of Horse Manure, Optimization of Conditions