

NaOH处理玉米秸秆厌氧生物气化试验研究

Anaerobic biogasification of NaOH-treated corn stalk

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中文摘要:

提出通过NaOH化学处理以改善玉米秸秆的可生物消化性能、提高玉米秸秆厌氧消化产气量的方法。NaOH添加量为玉米秸秆干物质的8%。对未处理和经NaOH处理的玉米秸秆进行了厌氧消化对比试验研究, 厌氧消化负荷率为35, 50, 65和80 g/L。分析并比较了两者在不同负荷率下的日产气量、累积产气量、单位TS和VS产气量等。结果显示, 与未处理玉米秸相比, NaOH处理过的玉米秸的干物质消化率和产气量明显提高, 在35, 50, 65, 80 g/L负荷率下, 产气量分别提高了13.1%, 39.8%, 48.3%和47.8%, 单位TS、VS的产气率分别提高了13.1%~48.3%、23%~61.3%; 两种玉米秸分别在35和65 g/L负荷率下获得了最高单位TS产气量。NaOH化学处理使玉米秸细胞壁结构和化学成分发生了明显的变化, 分别有53.2%、46.9%和66.6%的木质素、纤维素和半纤维素被分解, 其中1/2~2/3被转化成了易被厌氧菌利用的可溶性物质, 这是产气量提高的主要原因之一。研究结果对提高玉米秸的产气效率、实现大规模应用具有重要指导意义。

英文摘要:

NaOH pretreatment was employed in order to improve anaerobic biodegradability and biogas yield of corn stalk. Corn stalk was first treated for 30 days at ambient temperature by sodium hydroxide (NaOH), NaOH amount added was 8% of dry matter of corn stalk. The untreated and NaOH-treated corn stalks were then anaerobically digested at mesophilic temperature (35°C) in batch reactors. For each corn stalk, four loading rates of 35, 50, 65 and 80 g/L were used. The results showed that NaOH pretreatment could significantly improve the biodegradability of corn stalk and increase biogas yield. The total biogas yield of NaOH-treated corn stalk was increased by 13.1%, 39.8%, 48.3%, and 47.8% over the untreated one for the loading rates of 35, 50, 65 and 80 g/L, respectively. The loading rates of 35 and 65 g/L achieved the highest biogas yield per gram of TS (total solid) loaded, for untreated and NaOH-treated corn stalk respectively. The contents and dry matter of main compositions of the corn stalk were changed significantly through NaOH pretreatment, approximate 1/2~2/3 of lignin, cellulose, and hemicellulose decomposed were converted into readily biodegradable soluble compounds. The biogas yield per gram of TS and VS (volatile solid) loaded for NaOH-treated stalk were increased by 13.1%~48.3% and 23.0%~61.3%, respectively, as compared with the untreated one. The average biogas yield per gram of VS reduced was the same for both untreated and NaOH-treated corn stalk, but not for the average biogas yield per gram of TS reduced. The results provided useful information for large-scale anaerobic digestion of corn stalk for production of renewable bioenergy and reduction of pollution associated with corn stalk.

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