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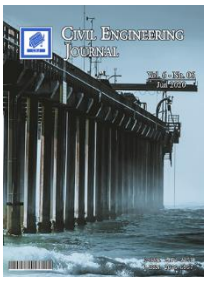

Wheat Straw Optimization via its Efficient Pretreatment for Improved Biogas Production

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Abstract

The complex indigenous configuration of non-bio-labile wheat straw necessitates its pretreatment to optimize the breakdown of its structural components for its ultimate conversion into biogas by means of anaerobic digestion. In this research work, wheat straw was pretreated with potassium hydroxide (KOH) to facilitate its improved biodegradability. The pretreatment of wheat straw was also obvious in terms of its crystallinity resulting in the improved amorphous regions compared to the control wheat straw. The results showed that pretreated wheat straw digestion transpired into comparatively higher removal of TS (86%), VS (89%) and total lignin, cellulose and hemicellulose (22%) than that obtained with control wheat straw. Maximum biogas production accrued was 1550 mLN per day with optimized dosing of KOH compared to 967 mLN per day obtained with control wheat straw, implying that the cumulative biogas production was improved by 45% using pretreated wheat straw than that using control wheat straw. These results suggested that pretreated wheat straw digestion led to a significant improvement in the biogas yield.

Keywords: Wheat Straw; Pretreatment; Hydrolysis; Lignocellulose; Anaerobic Digestion; Biogas.

1. Introduction

Harnessing biogas energy could be one of the most important options to undertake to realize one of the goals of clean energy as outlined under the banner of united nation's sustainable development goals [1]. Wheat straw is a by-product of wheat cropping process that is left behind after the wheat is mechanically separated from inside the straw. Wheat straw is one of the potential low-cost lignocellulosic biomass used as a key substrate in bio-refineries and for biogas production [2]. However, there is a technical hitch in the effective utilization of wheat straw as a feedstock for the purpose of making it a potential source of clean energy. The internal structural configuration of wheat straw is such that the innate constituents of wheat straw such as Lignin, Hemicellulose and Cellulose (LHC) are intertwined in a way that makes their overlapping presence in wheat straw as intricate.

The level of recalcitrance of the LHC needs to be compromised so as to overcome the limitations that are expected per se during the course of enzymatic and microbial degradation of wheat straw [3]**.** To address this complexity, wheat straw pretreatment is required beforehand to make the LHC compliant to an extent so that it results in its optimum biodegradability during the course of its digestion. Different techniques have already been adopted for the pretreatment of lignocellulosic biomass to improve upon the production of biogas [4]. Compared to physical and

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