Structural Analysis for Developing Organic Waste Biorefinery Model through Integrated Sustainable Approach

T. Qureshi[1], M. Farooq[1,*], A. Nizami[2], F. Riaz[3], U. Ali[1], M.H. Siddiqi[4]

[1]Department of Mechanical Engineering, University of Engineering and Technology, Lahore, Pakistan
[2]Sustainable Development Study Centre, Government College University, Lahore, Pakistan
[3]College of Engineering, Abu Dhabi University, Abu Dhabi, UAE
[4]School of Energy and Power Engineering, Xian Jiaotong University, Xian, China
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Corresponding author: engrfarooq137@gmail.com

Introduction

The Sustainable Development Goals (SDGs) of the United Nations aim to transform society to meet present and future challenges. Despite their distinctive essence, many fields have not yet seen the practical execution of these goals. The primary objectives of SDGs have been reducing the effects of climate change (SDG 13), providing sustainable waste management (SDG 11), and producing sustainable energy (SDG 7) (Cancino et al., 2018). The two main factors influencing technology's development are the depletion of fossil resources and the deterioration of our earth's environment (Hameed et al., 2019). Many developing or growing economies still rely on agriculture, thus when crops are produced on a large scale, a by-product known as biomass/biowaste is produced as a source of value-added products (Lee et al., 2022). The environment is in danger from unregulated open waste dumping sites, which makes it necessary to divert this trash for alternative energy production like waste-to-energy (WtE) (Vassilev et al., 2010). According to the circular economy concept, nations should utilize waste materials to support the principles of sustainable growth (Moya et al., 2017) . Conventional fuels negatively impact globally through greenhouse gases (GHGs) and climate change Biomass is a by-product of agricultural activities, and its use for energy production is growing significantly worldwide (Moya et al., 2017) . However, using biomass commercially will resolve issues like efficient burning, energy security, and environmental degradation Many nations are currently investigating various methods to get energy from biomass (Ning et al., 2019). This research aims to develop a biorefinery model for organic waste to achieve several prominent SDGs. X-ray diffraction (XRD technique will be used for the structural analysis.In the current work,Surface morphology and texture will be examined.

Materials & Mehtods

In Figure 1, the process of producing treated biomass is depicted. The first step involves shredding raw biomass, which is then sieved to form a sample. To remove impurities and dust particles, the biomass sample is washed using distilled water. The washed sample is subsequently demineralized for treatment purposes, followed by neutralization. To study the impact of changes in demineralized time on the biomass sample, the aforementioned procedure will be repeated multiple times.

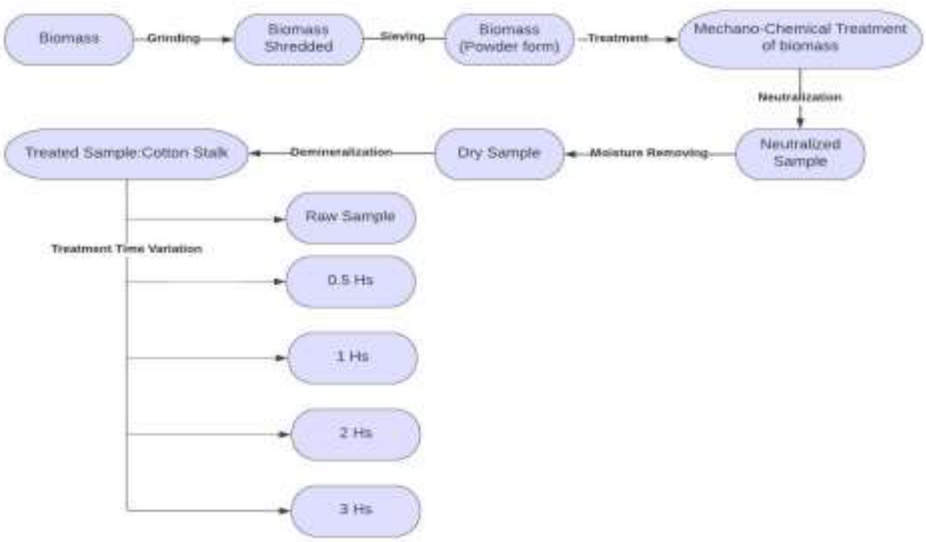

Figure 1: Experimental Methodology for Structural characterization of treated biomass samples

Results & Discussion

In Figure 2, multiple graphs of cotton stalk are presented based on changes in treatment time. A 0.4 molar concentrated solution of hydrochloric acid was used for leaching. It was observed that all biomass samples exhibited sharp peaks, with the major intensified peaks detected in the range of 20 to 30 degrees. Sample 3hS exhibited the highest crystallinity behavior, whereas raw showed the lowest. Notably, the degree of crystallinity is influenced by factors such as wax, cellulose, and intermolecular bonding.

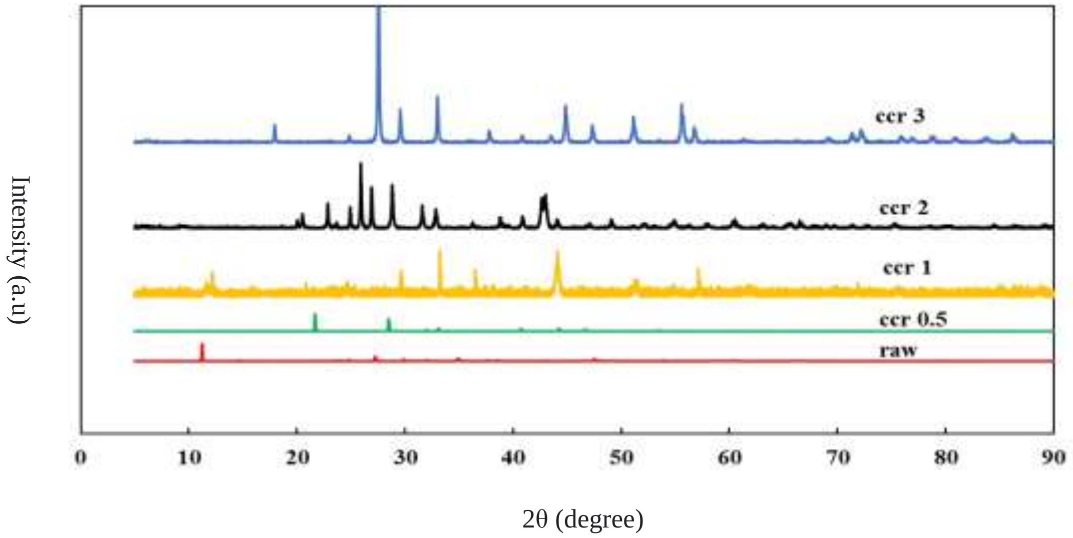

Figure 2: XRD curves of multiple treated biomass samples

Conclusion

Based on the current work, it can be concluded that treating biomass not only enhances its energy efficiency, but also makes it more environmentally friendly. The study found that a higher concentration of treatment resulted in a more noticeable crystalline nature of the sample. Additionally, the acidic treatment had a significant impact on reducing the ash content in biomass.

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