Abstract

This project addresses the global challenge of municipal solid waste (MSW) management, focusing on Palestine, and explores sustainable solutions through biochar production. Biochar, produced via pyrolysis of organic waste, presents an eco-friendly alternative to conventional waste disposal methods. The project aims to alleviate environmental impacts associated with MSW, offering a dual benefit of waste reduction and sustainable resource utilization.

Key objectives include production and characterizing biochar from cooked rice and pyrolysis conditions, evaluating its physical and chemical properties, and exploring its applications in environmental remediation. Experimental methodologies involve conducting pyrolysis under controlled conditions, and analyzing biochar properties such as pH, surface area, water holding capacity, and ash content.

In this project, rice was exclusively used to produce biochar, with no prior studies available. The biochar samples showed varying physical and chemical properties depending on the pyrolysis conditions. For instance, a sample treated for 3 hours at 400°C had a surface area of 307.40 m^2, while a sample treated for 2 hours at 450°C had 285.45 m^2, compared to activated carbon with 1,317.45 m^2. Biochar pH ranged from 5.46 to 7.36, while activated biochar had a pH of 9.72. The highest water holding capacity (WHC) was 180% for biochar treated for 1 hour at 450°C, dropping to 80% after 2 hours, versus 160% for activated carbon. Ash did not appear at high temperatures, and no combustion occurred, highlighting the potential for further investigation. Adsorption efficiency using methylene blue dye varied with pyrolysis conditions, favoring the Freundlich isotherm for heterogeneous surfaces and the Langmuir isotherm for homogeneous ones. Surface area increased with chemical activation using Phosphoric acid (H_3PO_4) to 346.06 m^2 and to 807.47 m^2 with physical activation at 750°C for one hour.

After studying the physical and chemical properties of all the samples, the sample treated at 450°C for 2 hours was selected.