Abstract No: MP-02

Evaluating the nutritional compositions of king coconut husk waste (KCHW) biochar and ash: as feasible soil conditioners for coconut plantations

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King Coconut Water exports have swiftly surged, making it a prominent sector in Sri Lanka's exports. However, this rapid growth has led to increased husk waste generation, prompting the search for eco-friendly disposal solutions. This study aimed to comprehensively assess the nutritional composition of King Coconut Husk Waste (KCHW) ash and biochar produced at varying temperatures. Employing a muffle furnace, biochar and ash from the husk were produced. Biochar was generated at temperatures of 300 °C, 400 °C, and 500 °C for 1-hour period, while ash was produced at temperatures of 400 °C, 500 °C, and 600 °C for 4 hours, as chosen pyrolysis conditions. The research outcomes underscore the significant influence of pyrolysis temperature on the chemical characteristics of both biochar and ash. Even though higher conversion efficacy was achieved at 300 °C for biochar (58.87 %) and at 400 °C for ash (9.73 %). The partially burnt feedstock was observed under 300 °C during biochar production. Notably, biochar produced at 300 °C exhibited the highest levels of total nitrogen (1.99%) and available phosphorus (0.50 %). At 400 °C, biochar showcased elevated levels of available nitrogen (0.08 %) and total magnesium (0.41 %). Biochar derived at 500 °C displayed the most pronounced content of total phosphorus (0.47 %), potassium (3.33 %), calcium (1.16 %), along with the highest available potassium (2.93 %), calcium (0.38 %), and magnesium (0.24%) levels. Ash produced at 500 °C exhibited the highest proportions of total potassium, calcium, and magnesium (16.16 %, 3.11%, and 1.78 %, respectively), alongside elevated levels of available potassium (12.40 %) and magnesium (1.87 %). Similarly, ash generated at 600 °C demonstrated the highest percentages of total (2.47 %) and available (2.27 %) phosphorus. Noteworthy is the finding that 400 °C yielded the highest levels of total nitrogen (2.27 %), available nitrogen (0.07 %), and magnesium (0.45 %). Furthermore, biochar produced at 300 °C manifested the highest fixed carbon and moisture content, while ash generated at 400 °C exhibited the highest fixed carbon content. Trace nutrient concentrations were most pronounced in the ash. The maximum electrical conductivity (EC) values were recorded at 600 °C (17.12 µS/cm) for ash and at 500 °C (2.31 µS/cm) for biochar. In conclusion, based on the investigation, it has been found that biochar and ash produced at 500°C have a higher nutrient content when compared to other temperature conditions. This highlights the potential use of King Coconut Husk Waste-derived biochar and ash as nutrient-enriched soil conditioners, with enrichment in nitrogen, phosphorus, potassium, and magnesium.

Keywords: King Coconut Husk, Pyrolysis temperature, Waste disposal, Sustainability, Ecofriendly solutions