Valorization of Invasive Weed Biomass and Waste Plastic Mulch through Co-Pyrolysis into Biochar

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The prevailing priority to stimulate the transition towards a circular economy expanded the tempo of the search for alternatives in the forms of biofuels, biomaterials, bio-based adsorbents, and other value-added components. Thereby, resource recovery techniques such as thermochemical conversions can present more sustainable solutions to waste management than conventional dumping and burning practices. Agricultural wastes are produced in massive quantities worldwide and comprise a range of feedstocks, making them potentially valuable inputs to support resource circularity. This study focused on the resource recovery through co-pyrolysis of two major waste types from the agricultural industry: weed biomass (WB) and waste plastic mulch (WPM). Six invasive WB species, Wal Suriyakantha (*Tithonia diversifolia*), Ipil-ipil (*Leucaena leucocephala*), Baloliya (*Lantana camara*), Katakalu bovitiya (*Clidemia hirta*), Podisinchomaran (*Eupatorium odoratum*), and Wedelia (*Sphagneticola trilobata*) were co-pyrolyzed with WPM at 550°C, in six different WB:WPM mass ratios of 100:0, 99.75:0.25, 97.5:2.5, 95:5, 92.5:7.5, and 90:10, respectively. The physical, chemical, and surface morphological characteristics of the produced biochar were analyzed to evaluate its suitability as soil amendments or adsorbents. The results showed that increasing the plastic ratio of the mixture decreased the biochar yield by 1-5%, with Katakalu bovitiya having the highest biochar recovery (31%) and Wal suriyakantha having the lowest recovery (28%). Increasing the PM content also increased the volatile matter content by 1–7%. The pH values of all the biochar samples were between 10 and 12, making them more suitable for soil acidity treatment. The FTIR analysis showed that there are prominent surface functional groups like carbonyl in the biochar, and alkene groups may be present due to PM. In conclusion, it can be stated that the co-pyrolysis of invasive weed biomass and waste agricultural plastic mulch is a potential agricultural waste valorization technique.

Keywords: Biochar, Co-pyrolysis, Invasive weed biomass, Waste plastic mulch

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