

Formulation of Slow-Releasing NPK Hybrid Nano-Fertilizer using Eppawala Apatite, Partially Burnt Rice Husk and Dried Banana Peels

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A major source of soil resources that promotes plant growth and production is fertilizer. There is currently a desire for environmentally friendly synthetic materials that minimize nutrient leaching and release plant nutrients under control. Major aim of this research was to propose slow-releasing hybrid nano fertilizer (HNF) by using natural resources chemically modified as a value-added product, that are Eppawala apatite, a rich source of phosphate, partially burnt rice husk (PBRH), and dried banana peels. Apatite were transformed into urea modified hydroxyapatite (HA) nanoparticles using hydrothermal method, and major nitrogen (N) source is urea. These nanoparticles were loaded into the pores of PBRH which is a highly porous material that was prepared by pyrolyzing rice husk, to increase the slow-releasing efficiency of the proposed fertilizer. To increase the amount of potassium (K), dried banana peels were used. Different characteristic techniques were used including powder X-ray diffraction (PXRD), Fourier transform infrared (FTIR), and scanning electron microscopy (SEM). SEM images confirmed the nanoparticles were loaded into the pores of PBRH and the hydrogen bonding interactions of HA nanoparticles clearly defined by the FTIR spectrums while PXRD patterns indicate the formation of crystalline HA. Release behaviors were studied of the fertilizer in soil with a pH value of 6.36 and in deionized water for 20 days and nutrient uptake by plants, pot plant experiments were conducted for 7 days with the control experiment by applying the same amount of dosage. The NPK levels were determined using Kjeldahl method, UV-Visible spectrometry by vanadomolybdate method, and Flame atomic absorption spectroscopy (FAAS). Final fertilizer complex contains NPK levels of 29.68%, 31.20%, and 31.46% respectively while PBRH contains 1.132% of K. A significant increment in NPK levels confirm that the synthesized HNF has the slow release potential for NPK levels compared to the control fertilizer.

Keywords: Eppawala apatite, Rice husk, Slow-release, Nano fertilizer