

## Nitrogen, Phosphorus, Potassium (NPK) Hydroxyapatite Nano-Hybrid Slow Release Fertilizer

**Authors :** Tinomuvonga Manenji Zhou, Eubert Mahofa, Tatenda Crispen Madzokere

**Abstract :** The nanostructured formulation can increase fertilizer efficacy and uptake ratio of the soil nutrients in agriculture production and save fertilizer resources. Controlled release modes have properties of both release rate and release pattern of nutrients, for fertilizers that are soluble in water might be correctly controlled. Nanoparticles can reduce the rate at which fertilizer nutrients are in the soil by leaching. A slow release NPK-hydroxyapatite nano hybrid fertilizer was synthesized using exfoliated bentonite as filler material. A simple, scalable method was used to synthesize the nitrogen-phosphorus hydroxyapatite nano fertilizer, where calcium hydroxide, phosphoric acid, and urea were used as precursor material, followed by the incorporation of potassium through a liquid grinding method. The product obtained was an NPK-hydroxyapatite nano hybrid fertilizer. A quantitative analysis was done to determine the percentage of nitrogen, phosphorus, and potassium in the hybrid fertilizer. AAS was used to determine the percentage of potassium in the fertilizer. An accelerated water test was conducted to compare the nutrient release behavior of nutrients between the synthesized NPK-hydroxyapatite nano hybrid fertilizer and commercial NPK fertilizer. The rate of release of Nitrogen, phosphorus, and potassium was significantly lower in the synthesized NPK hydroxyapatite nano hybrid fertilizer than in the convectional NPK fertilizer. The synthesized fertilizer was characterized using XRD. NPK hydroxyapatite nano hybrid fertilizer encapsulated in exfoliated bentonite thus prepared can be used as an environmentally friendly fertilizer formulation which could be extended to solve one of the major problems faced in the global fertilization of low nitrogen, phosphorus, and potassium use efficiency in agriculture.

**Keywords :** NPK hydroxyapatite nano hybrid fertilizer, bentonite, encapsulation, low release

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