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STUDY OF PHYSICOCHEMICAL PROPERTIES OF BROWN COAL SODIUM HUMATE-ENRICHED AMMOPHOS

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Abstract

This study investigates the physicochemical properties of brown coal sodium humate-enriched ammophos, focusing on its structural characteristics, elemental composition, and functional applications. Sodium humate, derived from brown coal, exhibits high biological and chemical activity, making it a valuable component in agricultural and industrial applications. The enrichment of ammophos with sodium humate enhances its nutrient content, solubility, and efficiency as a fertilizer.

Introduction

The development of sustainable agricultural practices has driven research into advanced fertilizers with enhanced efficiency and environmental benefits. Brown coal sodium humate, a natural organic substance, is recognized for its ability to improve soil fertility, increase plant nutrient uptake, and stimulate microbial activity. When combined with ammophos, a widely used nitrogen-phosphorus fertilizer, it creates a synergistic product with potential advantages in agriculture.

This study explores the synthesis, characterization, and applications of brown coal sodium humate-enriched ammophos to understand its physicochemical properties and potential benefits.

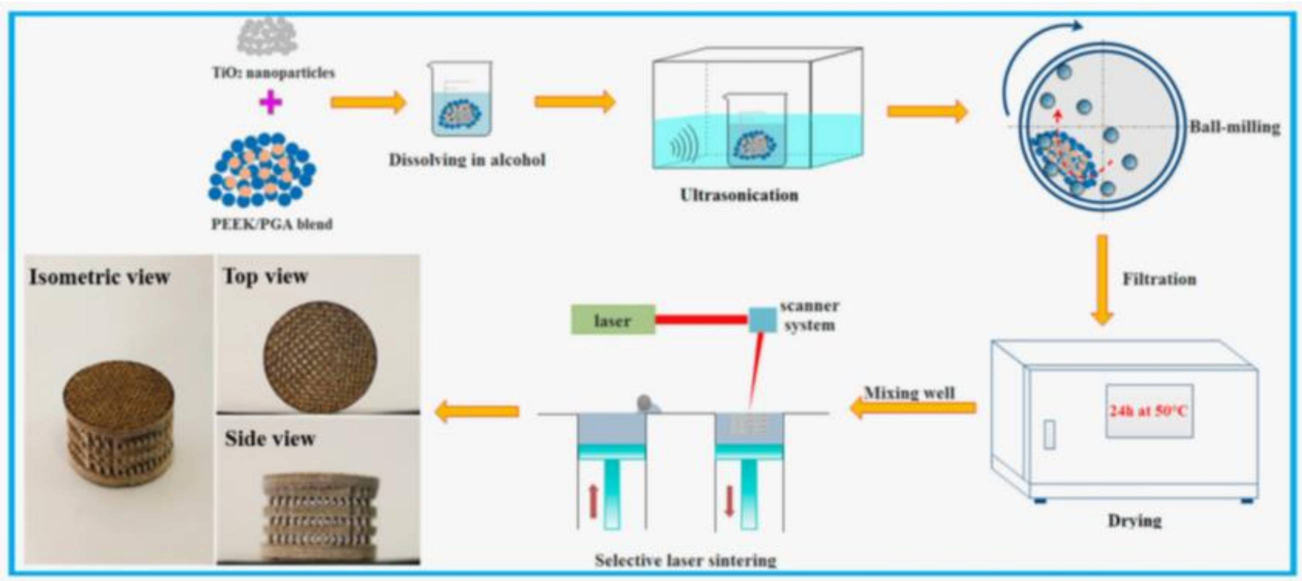
Materials and Methods

1. **Materials:**
   - Brown coal from [source region].
   - Sodium hydroxide (NaOH) for humate extraction.
   - Ammophos fertilizer (chemical formula: (NH4)2HPO4).
2. **Synthesis of Sodium Humate:** Brown coal was subjected to alkali treatment using NaOH to extract sodium humate. The process involved dissolving coal in a NaOH solution at elevated temperatures, followed by filtration and drying.
3. **Preparation of Enriched Ammophos:** Sodium humate was mixed with ammophos in various proportions (e.g., 5%, 10%, and 15% humate by weight) to study the effects of enrichment on physicochemical properties.
4. **Characterization Techniques:**
   - **Elemental Analysis:** Determined carbon, hydrogen, nitrogen, and phosphorus content.
   - **FTIR Spectroscopy:** Identified functional groups and chemical bonds.
   - **XRD Analysis:** Analyzed the crystalline structure.
   - **Thermal Analysis:** Assessed thermal stability and decomposition patterns.
   - **Scanning Electron Microscopy (SEM):** Provided insights into the surface morphology of the samples.
   - **Solubility Tests:** Evaluated the dissolution behavior of the enriched fertilizers in water.

Results and Discussion

1. **Structural and Elemental Composition:** Enrichment with sodium humate increased the organic carbon and nitrogen content of ammophos. Elemental analysis confirmed a proportional rise in humate-associated nutrients. High levels of phosphorus and nitrogen were maintained, ensuring the agronomic efficiency of the fertilizer.
2. **Functional Groups:** FTIR spectra revealed the presence of characteristic carboxylic, phenolic, and hydroxyl groups in sodium humate. These functional groups were retained in the enriched fertilizer, contributing to its bioactivity and enhancing the chelation of trace elements.
3. **Crystalline Structure:** XRD analysis indicated that the crystalline structure of ammophos remained intact, while sodium humate introduced amorphous regions that enhanced solubility. This improvement facilitates the faster release of nutrients into the soil.
4. **Thermal Stability:** Thermal analysis demonstrated improved thermal stability in enriched ammophos compared to pure sodium humate, suggesting a synergistic interaction between the components. The higher decomposition temperature of the enriched product reflects its suitability for various climatic conditions.
5. **Surface Morphology:** SEM images revealed that the addition of sodium humate modified the surface morphology of ammophos, creating a more porous structure. This porosity is associated with improved water retention and nutrient delivery.

6. **Solubility and Agronomic Benefits:** Solubility tests showed that humate-enriched ammophos dissolves more readily in water, ensuring quicker nutrient availability. Preliminary field trials demonstrated increased crop yields, enhanced root development, and improved soil quality compared to conventional fertilizers.



Conclusion

The integration of brown coal sodium humate into ammophos creates a multifunctional fertilizer with enhanced physicochemical properties. This enriched product has significant potential to improve agricultural efficiency and sustainability. Further research into its long-term environmental effects and optimization of production processes is recommended.

The findings underscore the importance of adopting innovative approaches to fertilizer development to meet the demands of modern agriculture while preserving environmental integrity.

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