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Development of Smart Nitric Oxide Release Controling System using Hydroxyapatite-Humic Acid Complex and its Agricultural Application

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Agricultural application of the existing chemical fertilizers has been shown low nutrient use efficiency and resulted in environmental eutrophication. To maximize the efficiency of a fertilizer for crop nutrients, an increasing number of studies for the development of smart fertilizers releasing nutrients have been proceeded. In this context, the research of fertilizer for crop nutrition based on nano-technology has been suggested as the advanced platform to overcome the limitation of chemical fertilizer used in the normal farming practice. Nitric Oxide (NO) has been reported to regulate diverse pivotal biological processes in plants including development, growth, biotic and abiotic stress responses. In particular, NO, as a signaling molecule, plays a key role in plant defense mechanisms against biotic stress and abiotic stress. Furthermore, recent findings regarding NO in post-harvest have been reported that fruits exogenously applied NO can increase the shelf life and preserve their qualities during the ripening of fruits in post-harvest. Using the binding principle of the carboxyl group, the Hydroxyapatite-Humic Acid complex allows to combine with NO, which makes NO release slower and co-released Phosphate and Humic substances. This complex was analyzed with TEM (Transmission and Scanning Electron Microscopy), FT-IR spectra (Fourier Transform Infrared Spectroscopy) and TGA analysis. In this analysis, we confirmed NO was bound to the particle surface of Hydroxyapatite-Humic Acid. The amount of NO emission on NO-Hydroxyapatite-Humic Acid complex was measured by Nitric Oxide Analyser (NOA280i, SIEVERS) and we confirmed a prolonged NO gas emission in comparison to Control (only GSNO). This study is the first step towards enhancing Smart Fertilizer not only to assist plant growth but also to help storage after harvesting in combination with Hydroxyapatite-Humic Acid and NO, which is conducting various studies in plant. The new type of smart complex fertilizer based on nanotechnology is eco-friendly and is considered to have a good effect due to its high availability in agricultural industry.

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