ENCAPSULATION OF NANOPARTICLES IN LAYERED MATERIALS TO BE USED IN AGRICULTURAL APPLICATIONS

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DECLARATION

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ABSTRACT

Layered materials, which consist of stacks of layers, where the thickness of those layers occur, in the nanometer scale with interlayer charge balancing ions are interesting due to their potential applications in catalysis, biomedical applications, environmental remediation and controlled/ slow release applications in agriculture. Montmorillonite (MMT) is one of the smectite type clay composed of tetrahedral sheets of silica sandwiched between octahedral sheets aluminaand it can be used as a stable host matrix for storage, and delivery of encapsulated plant nutrients, which are released in a given medium for extended periods in a sustainable manner. In an attempt to address the unsolved problems in fertilizer use in agriculture which is the loss of nitrogen due to leaching and evaporations as gaseous matter, a controlled release fertilizer nanocomposite formulation based on montmorillonite clay was developed. The resulting nanocomposite was prepared by the encapsulation of urea modified hydroxylapatite nanopartiles into montmorollinite clay. The resulting nanocomposites were characterized using a number of solid state characterization techniques such as Powder X-ray Diffraction (PXRD), Fourier Transform Infrared spectroscopy (FTIR) and Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM) and Thermogravimetric Analysis. The release behavior of the nutrients in the fertilizer compositions were studied in acidic soils (pH- 4.2 and pH -5.2) and in neutral sandy soil for over 60 days. The release bahaviour was compared with a commercial NPK fertilizer composition, which is currently used in tea industry. A sustained release of nitrogen was observed for the two acidic soils with the new fertilizer composition.

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ABBREVIATION

AFM	Atomic Force Microscope
ATR	Attenuated Total Reflectance
CEC	Cations Exchange Capacity
EDX	Energy Dispersive X-ray Analysis
FTIR	Fourier Transform Infra Red Spectroscopy
HA	Hyroxyapatite
LDH	Layered Double Hydroxide
MMT	Montmorillonite
Modi. NanoHA	Modified Nanohydroxyapatite
Np	Power Number
NPK	Nitrogen,Phosphorus,Potasium
O	Octahedral
PXRD	Powder X-ray Diffraction
Re	Renolds Number
SEM	Scanning Electron Microscopy
T	Tetrahedral
TGA	Thermo Gravimetric Analysis