

Nanomodified vermiculite NMV – a new material for recycling ammonium nitrogen

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Vermiculites ((Mg,Fe,Al)₃(Al,Si)₄O₁₀(OH)₂ [U+F_{0D7}] 4H₂O) are naturally occurring minerals from hydromica group with a high cation exchange capacity and large surface area. Since vermiculite is a hydrated mineral, its structure can be changed with heat. In this study vermiculite samples were heated in an oven until the interlayer distance of them diminished from 14 Å to 11.7 Å. This method for improving vermiculites intake of ammonium ions by heating, is an invention made at the University of Turku. Nanomodified vermiculite (NMV) is able to absorb up to 4.7 wt% of ammonium.

NMV can be used as an efficient filter and immobilizer of ammonium in different environments. NMV has been efficiently tested on waste water from a biogas plant, human urine, combustion experiments, industrial chimneys, excrements from farms etc. Ammonium doped vermiculite (ADV) is further developed for fertilizer use.

Performed experiments have testified the usability of ADV as a fertilizer. At first step the NMV was processed with the reject water from a biogas plant, where it absorbed NH₄⁺ into the lattice. At second, the ADV was used as nutrient source for garden plants. Geraniums and begonias were used as test plants of the work. Plant growth rate was evaluated based on plant weight. Results showed that significant increase of the growth of geraniums and of begonias were observed when comparing to those cultivations where plants have got normal fertilization. Moreover, ADV has been tested as a fertilizer in greenhouse experiments with spruces and pines. After five months, the weight of the plants that had grown in a substrate containing ADV was 10 times the weight of plants growing in the reference substrate.