



Sustainable practices for fertilizer use through controlled release techniques

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Controlled release fertilizers are efficient tools that increase the sustainability of agricultural practices. However, the biodegradability of the matrices and the determination of the release into soil still require some investigation. This work describes the preparation of potassium-containing microspheres based on chitosan- montmorillonite clay as fertilizer double coated. The release profile in water (ion conductivity measurement) and soil (ion movement performed with time-domain reflectometry (TDR) technique) were evaluated. The potassium-containing microspheres were placed in a 7.5-L container filled with soil (Typic dystrophic LVd). The container was prepared with a water drainage system consisting of a thin layer of gravel at the bottom, which was followed by a geotextile fabric to prevent the loss of soil. The container was filled with soil (9 kg) in layers of 0.05 m to simulate the original bulk density of 1.30 g.cm⁻³. Each container received 4 g of microspheres placed at a single spot. They were placed at a depth of 10 cm. The fertilizer release was monitored using three electromagnetic probes for TDR that consisted of three continuous metal rods of 20 cm, which were in contact with the material and can be used to estimate the moisture and electrical conductivity. One probe was installed at the center of the container, which meant the rod was in contact with the microspheres in the soil. The other two probes were installed 5 cm from the central probe, and they were only in contact with the soil. Therefore, the purpose of these probes was to monitor the lateral displacement of the fertilizer from the microspheres in the soil. The release in water is fast than in soil, since the total amount of fertilizer in water was delivery during only one week and in soil during 60 days the fertilizer still continue drifting. The composite based on chitosan biopolymer as controlled release material is an efficient method to monitor the fertilizer consumption.