

Use of surfactant-modified zeolite to carry and slowly release sulfate

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ABSTRACT

Use of water soluble fertilizers could result in increased loss of plant nutrient during irrigation and cause non-point source groundwater contamination. In this study the feasibility of using surfactant-modified zeolite (SMZ) as fertilizer additives to control sulfate release was tested in batch and column leaching experiments. The zeolite was able to carry as much as 5, 15, and 25 mmol/kg of sulfate when modified to 100%, 150% and 200% of its external cation exchange capacity (ECEC). Batch tests showed an almost instantaneous and partially reversible sulfate release. Leached with 50 pore volumes (PVs) of water, 70% and 85% of the loaded sulfate was still remained on SMZ modified to 150% and 200% ECEC, respectively. The initial sulfate concentration in leachate was reduced by a factor of three when sulfate loaded SMZ was used compared to mixtures of soluble sulfate and zeolite of the same loading in column leaching experiments. Mass balance showed a 31% recovery after the columns were flushed with 60 PVs of water, similar to the observation in batch tests. The results indicated that SMZ could be a good carrier for sulfate. Thus, leaching of sulfate can be greatly reduced and slow release of sulfate can be achieved if SMZ is used as fertilizer additives.

Keywords: Slow release fertilizer; Sulfate; Surfactant; Zeolite

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