

Struvite Crystallization from Nutrient Rich Wastewater

Thesis submitted by

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DEDICATION

Dedicated to

My Mother

ABSTRACT

Discharge of untreated nutrient-rich wastewater is a problematic issue, which may cause root burning and eutrophication of receiving water. It is also a problematic issue due to the formation of crystalline deposits in waste water systems. The recovery of nutrients using a crystallization technique may provide a value added product. The recovered product is struvite, which is chemically known as magnesium ammonium phosphate hexahydrate. The key focus of this research is the modeling and simulation of struvite growth, which incorporates solution chemistry and thermodynamics, kinetics of growth and process description of the recovery system. This research also focuses on the strategy of struvite crystallization in a fed batch system, to avoid spontaneous precipitation. A fully integrated control strategy in pilot scale is developed in this research. This control strategy is based on feedback control, maintaining constant supersaturation throughout the crystallization. The development and commissioning of experiments includes investigation of suitable seeds, automatic temperature control, operating zone of crystallization and correct design of the pilot scale reactor. Experimental investigation showed a precise stability of the controlled supersaturation. Moreover, size independent growth is indicated in this investigation. An ensemble of experimental data is combined with a dynamic model to carry out parameter estimation of struvite growth kinetic parameters using gPROMS.

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