CESARE'22
3rd Coordinating Engineering for Sustainability And Resilience
May 6th – May 9th, 2022, Irbid, Jordan
ISSN:2788-6204

PREDICTING INFLUENCE OF PROCESS PARAMETERS THROUGH MODELING STRUVITE PRECIPITATION USING VMINTEQ

Sarah S. Sinno[1*], Kazi P. Fattah[2]

[1]American University of Sharjah
American University of Sharjah, Sharjah, United Arab Emirates
g00088543@aus.edu

[2]American University of Sharjah
American University of Sharjah, Sharjah, United Arab Emirates
kfattah@aus.edu

ABSTRACT

Phosphorus (P) and nitrogen (N) have a major role in the world food supply as they are essential nutrients for plants and crops growth. Phosphorus is a non-renewable, non-rechargeable, and finite resource available only in mineable P-rocks. The rapid increase in population and consequently the increase in demand for fertilizers is putting a strain on the phosphorus production that is expected to hit a critical point in this century. On the other hand, population growth is increasing the production of nutrients rich wastewater, causing pollution in soil and waterbodies, and limiting the availability of clean water. Thus, the removal and recovery of nutrients from wastewater is now a necessity rather than just an option. A sustainable approach for nutrients recovery is the precipitation of struvite ($MgNH_4PO_4 \cdot 6H_2O$). The crystallization of struvite is affected by various factors such as: pH, molar ratios between nutrients, presence of competing ions, organic loads, and solid content. This study investigates the impact of different parameters on the formation of struvite through process modeling using VMINTEQ. The variables investigated are pH, Mg/P and Ca/Mg molar ratios. The struvite formation was predicted for a pH ranging between 7 and 11, Mg/P molar ratio between 0 and 2.5, and Ca/Mg molar ratio between 0 and 2.5. Results showed that the optimum conditions for struvite crystallization is at pH 9 when Mg/P molar ratio is unity, and that the presence of Ca hinders the formation of struvite even with a Ca/Mg molar ratio as low as 0.2. The results of the model help predict the struvite formation in future studies and help in the choice of wastewater pretreatment when dealing with high Ca concentration wastewaters.