

Removal of Phosphorous and Nitrogen from Wastewater of Uva Wellassa University by utilizing Bittern Solution

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Fluidized bed reactors (FBRs) are one of the best methods used for phosphorous recovery as Struvite crystallization from municipal wastewater streams. This study aims to remove and recover of phosphorous (P) and nitrogen (N) from wastewater generated at Uva Wellassa University through struvite precipitation in air agitated fluidized bed reactor by utilizing bittern solution. Bittern solution is a by-product of salt manufacturing process used as a low-cost source for Mg source in this study. Operating conditions i.e., pH range, aeration rate, constant bittern solution inflow rate and hydraulic retention time (HRT) were tested for obtaining optimal conditions for both batch mode and continuous flow mode air agitated FBR setup. According to the batch mode experimental results, the maximum recovery efficiency of P ($\text{PO}_4^{3-}\text{-P}$) and N ($\text{NH}_4^+\text{-N}$) were achieved 98.29% and 19.82% respectively through 3.0 L/min aeration at 180 minute HRT. Considering the operational parameters of the batch mode air agitated FBR setup, aeration rate increment (from 1.0 L/min to 3.0 L/min) did not show any significant effect on P ($\text{PO}_4^{3-}\text{-P}$) removal efficiency. On the other hand, for continuous flow mode experiment, the P and N maximum removal efficiency were reached 80.62% and 5.19% respectively through 65.0 mL/min wastewater inflow rate at 60 minute HRT. While optimizing the HRT for continuous flow mode air agitated FBR setup, the HRT is proportional to the wastewater inflow rate. Hence, the optimal operational parameters of experiments were obtained as 9.0 - 9.5 pH range, 1:1 molar ratio of $\text{PO}_4^{3-}\text{:Mg}^{2+}$, 120 to 180 minute HRT and 1.0 to 3.0 L/min aeration for batch mode air agitated FBR setup. According to the experimental results batch mode is more suitable than continuous flow mode for removing P from municipal wastewater for achieving higher efficiency. Therefore, the findings of this research would be applicable in designing and operating pilot scale air agitated FBR for struvite crystallization from wastewater.

Keywords: Air agitated Fluidized bed reactor; Phosphorous removal; Struvite precipitation; Aeration; Hydraulic retention time; Batch mode