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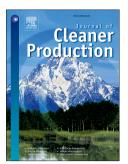
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Recovery of phosphate and ammonia nitrogen from the anaerobic digestion supernatant of activated sludge by chemical precipitation

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6 Abstract: This paper presents a study of the method used in recovering P_T (the total 7 orthophosphate) from the anaerobic digestion supernatant of sludge via chemical precipitation. 8 The P_T recovery efficiencies of three metal salts (AlCl₃, CaCl₂ and MgCl₂) at different pHs were 9 investigated. The results indicated that the pH of the solution exerts a significant effect on the P_T 10 recovery by chemical precipitation. The preference order of the three metal salts for the phosphate 11 recovery is $MgCl_2 > CaCl_2 > AlCl_3$ at the optimal pH range. Moreover, the phosphate precipitate 12 of MgCl₂ has a better settleability compared with those of AlCl₃ and CaCl₂. The alkalinity of the 13 supernatant exerts a significantly negative effect on the phosphate precipitation of CaCl₂ and 14 MgCl₂, especially on that of CaCl₂. When the alkalinity increased from 0 mg/L to 1968 mg/L, the 15 P_T recovery efficiency of CaCl₂ decreased from 94% to 85.4%. To overcome this problem, the 16 CO₂ degasification technique was used in the chemical precipitation. The effect of the alkalinity 17 was then found to be almost completely eliminated at an airflow rate of 8 L/min and a stripping 18 time of over 60 min. The results of the experiments of air stripping combined with struvite 19 precipitation using low-cost MgO showed that it is possible to recover approximately 100% of P_T 20 and 50% of the Total Ammonia Nitrogen (TAN) from the supernatant. An economic evaluation 21 revealed that the P_T recovery cost of the combined process was \$ 0.38 per kg P_T, which was far 22 lower than that of extracting P from phosphate rock.

23 Keywords: Phosphate recovery, anaerobic digestion, alkalinity, chemical precipitation.

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