NITROGEN RECOVERY FROM AGROINDUSTRIAL WASTEWATER BY STRUVITE PRECIPITATION IN A STRATEGY TO OVERCOME METHANE PRODUCTION INHIBITION BY AMMONIUM NITROGEN

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Animal manure and slurries produced by the animal breeding sector are still an environmental risk because their high nitrogen content hinders biological treatment processes. In addition, sludge from small wastewater treatment plants (WWTP) has few disposal options if a life cycle approach is considered. In this regard, the recent trend in wastewater processes is to move forward resources recovery options, moving from a linear to a circular economy approach. Therefore, this study aims to optimise anaerobic co-digestion of cattle manure and WWTP sludge, by removing the excess of ammonium nitrogen through struvite (magnesium ammonium phosphate), prior to the biomethanation process, thus allowing the simultaneous recovery of energy and valuable N-P fertilizer.

Struvite precipitation experiments were carried out using a mixture of cattle manure from a dairy farm and waste sludge from a domestic WWTP (1/1). The batch reactors were operated at 35ºC, using an orbital shaking incubator. A solution of $MgCl_2$ 0,05 M was used as magnesium source. The pH was maintained between 7 and 8,5. Process monitoring included COD, ammonium nitrogen and phosphorus analysis.

Cattle manure and WWTP sludge had a very unbalanced content of total organic carbon and nitrogen. Volatile solids content was 18,3±0,2 g L^{-1} and 14,3±0,1 g L^{-1} , respectively. At the tested conditions, ammonium nitrogen and phosphorus were precipitated with a maximum observed efficiency of 58% and 92%, respectively.

Struvite pre-treatment of animal organic wastes and sludge with a high nitrogen content is a feasible option in integrated biogas production facilities, if a magnesium source is added. Low-cost technologies for struvite crystallisation have a high potential in rural areas, not only for minimise nitrogen inhibition of biomethanation and energy recovery processes, but also for in-situ fertilizer production.

Keywords: Struvite, nutrient recovery, circular economy