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Effect of slurry acidification on particle size and separation efficiency

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Acidification of slurry is a treatment initially proposed to reduce ammonia (NH_3) emissions (Research Brief N. 2 ReUseWaste News) but recent studies showed that it also modifies slurry characteristics. Solid-liquid separation is a technique applied at farms to improve management and reuse of slurry. We hypothesized in this study that acidification before separation could improve separation efficiency by changes in slurry characteristics, such as the particle size.

We acidified dairy and pig slurries to pH 5.5 by addition of concentrated sulfuric acid or aluminum sulfate (alum). Slurries were separated by centrifugation in a laboratory scale centrifuge. The same slurries were sieved into five particle size fractions: >1000 µm, 500 - 1000 µm, 250 - 500 µm, 100 - 250 µm and <100 µm (Fig. 1). The fractions obtained from both separations were analyzed for dry matter and nutrients (N, P, and K) content.
Our results showed that acidification of slurries affects slurry composition, particle size, nutrient distribution between particles and separation efficiency. The slurries showed different results depending on the additive used and the type of slurry considered. Soluble phosphorus increased notably in both slurries when sulfuric acid was used, however no changes were observed with alum.

The proportion of solid fractions was notably increased when acidification was applied before centrifugation and such increase was higher when alum was used. As a consequence, the dry matter separation efficiency was also increased. We observed a notable increase in P separation efficiency when alum was used, reaching an almost complete removal (90%) to the solid fraction in dairy slurry (Fig. 2a). This increase may be related with P distribution between particles thus, the P proportion in the range between 100 and 1000 µm notably increased when alum was used (Fig. 2b).

Fig. 1 Laboratory centrifuge and five sieves used on the separations

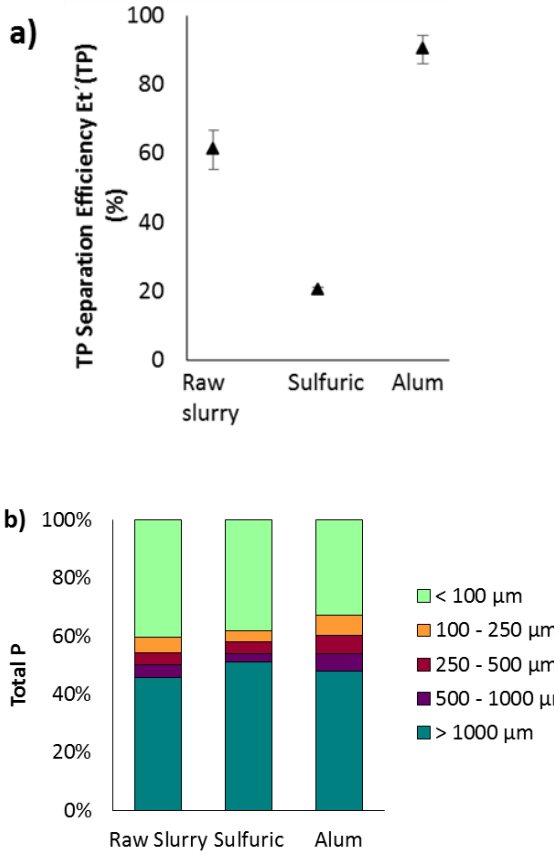

Fig. 2 Total phosphorous (TP) separation efficiency expressed by the Reduced Separation Index (a), and P distribution in 5 particle sizes (b) of raw dairy slurry and acidified dairy slurry with sulfuric acid and alum

The selection of an optimal treatment combination is affected by the end use of the fractions obtained where these fractions will be applied. If the priorities are to increase the amount of solid fractions, dry matter and P content in the solid fractions, the use of alum before centrifugation would be the most suitable option. At the same time, the liquid fractions would be suitable for fertigation in soils where there is no need for P supply.

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