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ORIGINAL PROCEDURES OF CONCENTRATION OF ORGANIC SEDIMENTS WITH REDUCTION OF TOTAL NITROGEN IN WWTP

Alexandru Visnevschi, Petru Spataru, Oxana Spinu, Igor Povar

State University of Moldova, Institute of Chemistry, MD-2028 3 str. Academiei, Chisinau, ipovar@yahoo.ca, Republic of Moldova

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Introduction

Until now, a series of methods for treating/dehydrating waste from wastewater treatment have been proposed, based on the following procedures for separating solids from water**: *a.*** Using geo-textile container filtration systems; ***b.*** Concentration by treating residual sludge with a mixture of flocculants produced as a result of the activity of *Proteus mirabilis* bacteria and with a coagulant/flocculant containing polyvalent metal salts; ***c.*** A complex of methods that combine the processing of extracellular polymeric substances from waste through oxidation, degradation, thermophilic decomposition, and flocculation, electro-osmotic dehydration. The disadvantages of these methods consist in the fact that special containers, coagulation/flocculation agents, geotextile, and extensive dehydration sites are required for dehydration, as well as installations for separating water from the flocculated solid and other technological equipment (filtration systems, centrifugation, separation, etc.) are needed. Typically, all the procedures listed require large amounts of energy.

The importance of investigating flotation processes *not initiated* by aeration in this study is understandable, as organic sediment particles are usually lighter than water and stay suspended due to their hydration. The procedures employed for separating solids from intercellular waters in waste originated from wastewater treatment relying on the flotation process and triggered by gas micro-bubbles formed in solid-hydrated flocs, which depend on the biochemical reactions influenced by the concentrations of components present in the analyzed sludge.

Materials and methods

The experiments were conducted both in laboratory conditions and by applying a pilot installation. Measurements were taken of the moisture content of organic solids and of the indices of ammonia nitrogen, nitrite, nitrate, and the chemical oxygen demand of the separation water.

Results and conclusions

This study has developed and investigated three procedures for concentrating organic sediments while reducing the nitrogen content in the separation waters of the wastewater treatment plant (WWTP). The first experimented procedure involved

mixing two types of residues, activated sludge (AS) and primary sediment (PS), in various proportions: 15/85; 20/80; 30/70; 40/60; 50/50; and 60/40%, respectively, at constant temperatures of 40 and 45°C, maintained under meso-thermophilic conditions for 1, 4, 16, and 18 hours. As a result of the mixing process, flotation separation occurs due to the formation of microbubbles embedded in the solid granules formed concurrently.

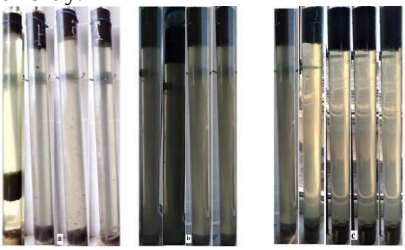

Figure 1. Flotation separation involving: a) aged activated sludge (AS), b) combining AS with PS, c) utilizing chemical preparation CP.

The maximum concentration efficiency in the flotation (approximately by 10 times) was achieved for the 20/80 proportion with the acceptable indices for the separation water (14.30 mg/L NH_4^+, 15.50 mg/L NO_2^-, 21.33 mg/L NO_3^-, 48.0 mgO/L CCO_{Cr}). The second procedure involves applying of a conventional preparation called *CP* (chemical preparation, consisting a liquid mixture of $Ca(NO_3)_2$ and $NaNO_2$) in the residual sediment, which is used to reduce odor, and flotation separation occurred at room temperature (20-22°C). The volume of organic solids following this procedure decreased by over 10 times with better quality indices for the separation water (6.0 mg/L NH_4^+, 7.5 mg/L NO_2^-, 13.0 mg/L NO_3^-, 46.0 mgO/L CCO_{Cr}). An analogous concentration efficiency occurs within the third procedure, which involves the flotation process with an addition of the aged activated sludge (lysate), kept for approximately 60 days by sedimentation. The flotation process of organic solids occurs at temperatures below 30°C. The quality of the separation water obtained in this procedure with lysed activated sludge is at the limit of allowable levels for discharging treated water into the outfall. The developed methods could be applied in WWTP technologies. At the same time, the elaborated solid separation methods, especially the method involving the use of CP preparation and aged activated sludge, have priority for application during summer temperatures, thus saving both energy and the consumption of flocculants and coagulants.

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