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Improvement of the treatment of salted liquid waste by integrated electrodialysis upstream biological treatment

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Abstract

As far as the reduction of the environmental impact of production processes is concerned, the management of liquid wastes of high salinity remains a key point. In this paper, the possibility to use electrodialysis for the improvement of the management of such problematic liquid wastes is investigated. The ED experiments are carried out to investigate the influence of the operating parameters on the ED performances, i.e. on the variation of the organic loss factor versus the demineralisation factor. It is demonstrated that the demineralisation can be accompanied by a change in the mineral composition, i.e. an increase of the sulphate to chloride ratio. A concentration limit is pointed out. Then, the influence of the salt composition on the biological degradation is investigated.

Keywords: Salt liquid wastes; Demineralisation; Electrodialysis; Biological degradation

1. Introduction

With respect to the environmental processes impact, the management of salt effluents, produced by chemical, pharmaceutical, food, textile industries, has a crucial importance. It is known that such liquid wastes, which contain variable concentrations of organics and minerals compounds, are very difficult to treat. Indeed, high salt concentrations in wastewater reduce the performance of biological treatment processes. For instance, micro-organisms inhibition during the oxidation stage or problem in the flocculation stage are favoured by the presence of mineral [1]. In this work, a combined process, including electrodialysis before the biological step, is

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investigated. The experimental study is carried out with synthetic wastes, containing acetic acid and different mineral salts. The performances of the ED step are first studied. Then, the influence of the salt composition on the biological degradation is investigated.

2. Results and discussion

The performances of the electrodialysis process, i.e. the demineralisation factor and the organic matter yield, are first studied [2]. Indeed, the purpose is to extract the mineral compounds of the effluent in order to reach a concentration compatible with the biological step. On the other hand, since the organic matter has to be treated, it is necessary to minimise the loss during the ED step.

For neutral compounds, like acetic acid in the present case, the mass transfer is only due to diffusion while for charged species, i.e. salt, the transfer results from the combination of diffusion and migration. In this latter case, migration is generally predominant over diffusion. As a result, the link between the salt concentration and the organic matter yield is controlled by the contributions of these transfer phenomena. The influence of the process parameters, like the current and the effluent composition for instance, is investigated.

An example of result, providing the organic matter loss factor versus the demineralisation factor, is shown in Fig. 1. One can observe that the organic matter loss, fixed by the diffusion of acetic acid through the membranes, depends on the salt nature [3]. Diffusion is more important with sodium sulphate than with sodium chloride.

On the other hand, the influence of the salt content on the biological degradation of the organic matter was studied. Indeed, whilst different works were published on this subject, the salt concentration limit, above which the performances of the oxidation are hindered, was not properly identified [4].

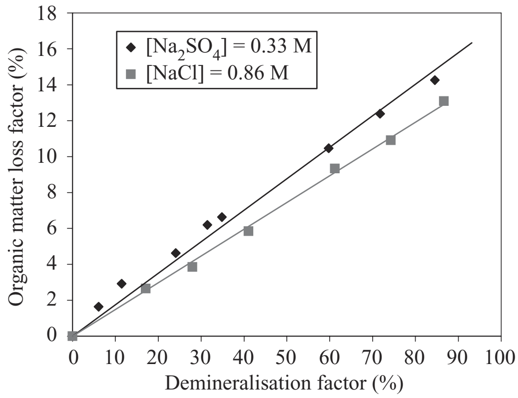

Fig. 1. OM loss factor versus demineralisation factor, $[CH_3COOH] = 1.3$ M, $[NaCl] = 0.86$ M, $[Na_2SO_4] = 0.33$ M.

Experiments were thus carried out to study the organic matter degradation in presence of salt through biodegradability tests.

Fig. 2 shows the micro-organisms growth factor versus salt concentration, for two different effluents, containing acetic acid and sodium chloride or sodium sulphate.

One can remark that for each effluent, the micro-organisms growth remains constant for salt concentration lower than about 0.25 $eq.L^{-1}$. For higher concentrations, it starts to decrease. This decrease is also more pronounced with NaCl than with Na_2SO_4.

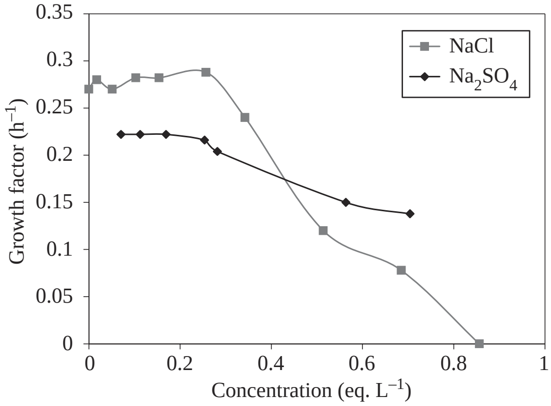

Fig. 2. Micro-organism growth factor versus salt concentration.

3. Conclusions

Experiments were carried out with synthetic wastes containing acetic acid and various salt contents in order to study the two steps of the process considered for the treatment of salted liquid wastes.

The operating curves, i.e. the relationship between the organic matter loss and the demineralisation factor, were determined for different operating parameters and various waste salt content, considering the transfer phenomena involved in ED.

It was also demonstrated that the presence of salt influences the biological degradation. A salt concentration limit, about 0.25 $eq.L^{-1}$, was pointed out for the case investigated.

The performances of the combined process should be now further investigated.

References

[1] F.J. Ludzack and D.K. Noran, Tolerance of high salinities by conventional wastewater treatment process, J. Wat. Pollut. Control Fed., 37 (1965) 1404–1416.

[2] T.V. Elisseeva, V.A. Shaposhnik, and I.G. Luschik, Demineralization and separation of amino acids by electrodialysis with ion-exchange membranes, Desalination, 149 (2002) 405.

[3] E. Singlande and H. Roux-de Balmann, Etude de l'électrodilayse en vue de l'amélioration du traitement biologique des effluents salins, Récents Progrès en génie des Procédés, 92 (2005).

[4] F. Kargi and A.R. Dincer, Effect of salt concentration on biological treatment of saline wastewater by fed-batch operation, Enzyme Microb. Technol., 19 (1996) 529.