EFFECT OF HYDROGEN PEROXYDE ON SOLUBILISATION AND BIODEGRADATION OF ACTIVATED SLUDGE

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Introduction. In Europe, major ways of disposing excess sludge from wastewater treatment plants are subject to more and more legal and social constraints. Therefore, reducing Excess Sludge Production (ESP) instead of merely treating it appears to be a very appealing solution to this social and economic issue, because the problem would be treated at its roots.

Wastewater excess sludge is composed of organic and inorganic matter coming both from the cell growth and from the accumulation of particulate inert matter.

Several methods can be used as combined treatments in order to reduce the quantity of final sludge produced, e.g. mechanical, electrical, thermal, thermo -chemical, biological and oxidative processes. For oxidative processes, among the available oxidants hydrogen peroxide appears to be an effective reactive for degrading many pollutants and decomposes simply into water and oxygen. Moreover it is stable and easy to handle. Murillo *et al*. (2003) found that solubilisation of sludge into a biodegradable organic carbon form occurs thanks to an hydrogen peroxide treatment.

Hence, the objectives of this study are : 1)To confirm, through continuous experiments, the potential effect of hydrogen peroxide on ESP reduction, 2)To quantify by performing mass balances the effect of hydrogen peroxide both on the organic fraction of the sludge and on the mineral fraction, and 3) To determine the consequence of the combined treatment on the reliability and the efficiency of treatment of a settled wastewater.

Materials and methods Two lab scale (26 L) Activated Sludge Plants (ASP) run in parallel were continuously fed with a primarily settled wastewater from Toulouse network. On one ASP, two liters of mixed liquor were periodically pumped towards a 2 L reactor, heated at 95°C. Then, the addition of an hydrogen peroxide dose was performed. After a defined reaction time, the whole treated sludge was pumped back towards the ASP. Mass balances on COD, SS, VSS, TKN, P, were performed to evaluate the efficiency of the combined treatment in comparison with the control line.

Results and discussion. A continuous run associating discontinuous sludge oxidation by H_2O_2 and biological oxidation in the ASP was conducted for 3 months. Sludge oxidation were performed over a rather long time (up to 2 hours) and the specific H_2O_2 dosage was 0,12 g H_2O_2/g. Following results were obtained :

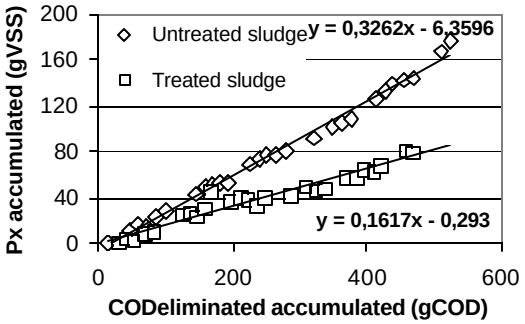

Figure 1.Variation of sludge production with COD elimination

- An observed sludge production yield of 0.3 g VSS . g $COD_{removed}^{-1}$ was measured on the control line (see figure 1).
- For the applied H_2O_2 dosage, a 50 % reduction of the organic ESP was observed (figure 1).
- Similar ESP reduction was observed on the SS showing that the sludge mineral fraction was also solubilised at the same rate than the organic fraction.
- Settling characteristics were improved in comparison to that observed on the control line.
- Nitrogen and phosphorus compounds are also solubilised during oxidation. However nitrogen removal efficiency was not affected by the combined treatment.

Conclusion. The combined treatment H_2O_2 – ASP can be effective to reduce the ESP. However, the energy required to heat the mixed liquor at 95°C is high. More research is needed to improve the effectiveness of hydrogen peroxide on sludge biological treatability.

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