Toetab TÜ ja TTÜ doktorikool
"Funktsionaalsed materjalid ja tehnoloogiad" (FMTDK)

ESF projekt 1.2.0401.09-0079

OZONATION WITHIN AN ACTIVATED SLUDGE SYSTEM USING SMALL OZONE DOSES

O. Järvik, I. Kamenev

Department of Chemical Engineering, Tallinn University of Technology, Estonia

e-mail: oliver.jarvik@ttu.ee

Industrial wastewaters are often characterized by high total organic carbon content, low biodegradability, high toxicity and colour – these properties may cause great problems in biochemical purification process.

The aim of the present study was to compare the performance of the integrated and conventional aerobic bio-oxidation (ABO) processes. In integrated process ozone was dosed directly into ABO process. The performance of the processes was characterized by measuring and comparing changes in effluent water quality.

Additionally, adenosine-5'-triphosphate (ATP) concentration and external oxygen uptake rate (OUR_{ex}) measurements were carried out with the aim to evaluate the effect of ozone on viability of micro-organisms in activated sludge (AS) suspended in distilled water (with necessary nutrients) and in wastewater. Experiments were carried out in batch reactors by comparing values of ATP concentration and OUR of ozonated samples to initial values.

Present study showed that small ozone doses introduced directly into bioreactor improved the COD removal efficiency of ABO of phenolic wastewater (Figure 1). Also, the pollutants (resorcinols) removal rate was improved in integrated process: the concentration of resorcinols was reduced approximately two times faster compared to ABO process. This finding shows that short-termed ozonation or small ozone doses actually increase biomass activity and viability of micro-organisms is not affected. At higher ozone doses the performance of the process will deteriorate. This is caused by the reduced concentration of viable micro-organisms, as well as increased solubilization of micro-organisms. The optimal ozone dose depends on wastewater and activated sludge composition and should be experimentally determined.

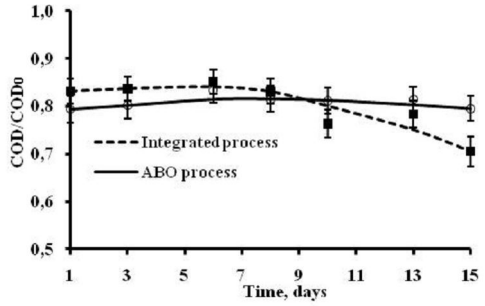

Figure 1. Evolution of COD removal efficiencies in integrated and ABO processes

The experiments of AS ozonation in batch reactors showed that ATP and OUR measurements are valuable and enable to detect changes in viability (Figure 2).

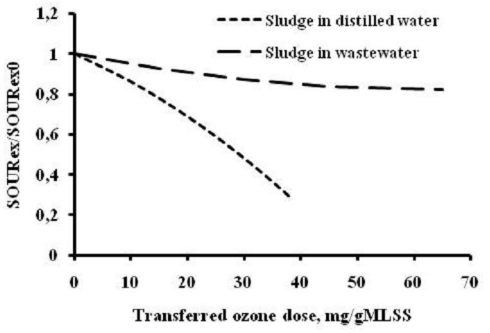

Figure 2. Changes in viability (expressed as relative $SOUR_{ex}$) caused by ozonation