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Research area:  
General aims/Environmental technology/Water

Keywords:  
Ozone, fresh water consumption, reuse, simulation

Subject:  
Reducing fresh water consumption by recirculating biologically treated and ozonised waters

Initial situation / Problem area:

The importance of ozone treatment for biologically treated waste waters is going to rise in the future. Because of their high quality, biologically treated waters should be reused for production. The ozonation of biologically treated paper mill effluents requires a low-load biological treatment stage downstream of the ozone stage. The possibility of using just an ozone stage here when recirculating the ozonised water into the existing biological stage has not been investigated so far.

Ozone treatment can considerably reduce the COD values of process waters in paper mills. Up to now this effect has been measured as a sum parameter only. No experience exists as to which of the COD fractions are influenced in which way by the ozone. The COD distribution among different molecular weight fractions will be investigated as a prerequisite for reliable simulations of the ozone stage, and to be able to determine the influence of the ozone stage on the biological degradability of different water constituents. The simulation tool will make it easier to dimension an ozone stage.

Objectives/ Research results:

The project aims at reducing the fresh water consumption of paper recycling mills by means of a new extension model based on the recirculation of biologically treated and ozonised effluents. Moreover, the behaviour of the refractory COD recirculated into the biological stage is to be investigated in detail. The knowledge gained will be used to calculate (simulate) the potential accumulation of refractory COD components in the production circuit.

Laboratory trials with activated sludge plant and ozone plant were carried out using water from mills A and B. The recirculation of the ozonised water does not cause any deterioration in COD degradation, irrespective of the ozone amount introduced and the water volume being recirculated. In the activated sludge plant the COD was reduced by 80 % (mill A) or 50 - 68 % (mill B), respectively, using ozone it was reduced by 22 - 34 % (mills A and B). The Zahn-Wellens test confirmed the results of the continuous trials. The degradation took 1.3 – 1.7 days using water from mill A, which is very fast. The degradation using water from mill B clearly proceeded more slowly, it took 5.2 - 10.8 days. The reproducibility of the COD-measurements in the molecular weight fractions is unsatisfactory. The evaluation showed a tendency toward increased elimination of the large fractions above 20,000 D in the activated sludge plant.

Application/ Economic benefits:

Up to now, installing an ozone stage for further treatment in an existing single-stage biological effluent treatment plant has meant that an extra biofilter had to be installed as well. The costs of this concept (operating material and depreciation) amounted to 1650 €/d. When the waste water volume is halved by recirculating ozone-treated effluents, the load levels of the individual treatment stages will rise, but the COD loads eliminated will hardly be changed. If the COD load to be eliminated by biofilters can be removed by the existing waste water treatment plant, 165000 € could be saved annually. If advanced effluent treatment is necessary, the new enlargement concept will greatly enhance the efficiency of small and medium-sized paper mills.

Project period:  
01.09.2003 – 31.08.2005

Remarks:

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