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Research area: General Aims
Environmental Technology / Water

Key words:
Slime formation, biofilms, nitrate

Subject:
Possibilities and limitations of nitrate salts for controlling slime formation in paper water systems

Background / Problem area

About 75 % of all Bavarian paper manufacturers are small and medium enterprises. Compared to the average German paper mill, the Bavarian paper industry is famous for its high recovered paper utilisation rate whilst consuming comparably low amounts of fresh water (low specific effluent discharge). Consequently, slime formation is one of the most serious microbial problems in papermaking, and has increased dramatically in recent years. This is caused by the growing utilisation rates of recovered papers containing large amounts of contaminants and micro-organisms and the increasing closure of water circuits. This in turn leads to a faster accumulation of organic substances in the process water, to increased electrolyte and calcium concentrations, and to higher process temperatures. State-of-the-art slime control concepts are based on the targeted use of biocides. The EU Biocide Directive (98/8/EG) implemented on 14th May 2000, however, demands an approval procedure for all biocide products. Even existing agents and products must pass an evaluation process relating to their environmental compatibility and performance in order to be able to be sold commercially. This is expected to incur extra costs of about 5m € per agent/product and approval procedure. As a result, about 50 - 65 % of the biocide products currently being used will disappear from the market. There is an urgent need for further research into slime formation and its impact, and for novel solutions in the area of slime control.

Objective / Research results

The project aims at replacing some biocides, well known for slime control in the paper manufacturing process, by environmentally sound nitrate salts. Based on the findings gathered, the unsatisfactory know-how relating to slime control by biocide substitutes should be expanded, i.e.:

- environmental compatibility (environmentally sound nitrate salts)
- occupational safety (biocide substitutes; less sulphide formation)
- process relief (load reduction in water circuits; less corrosion potential)

Results:

- A procedure was developed to “create” slime by controlling hydraulic retention times, pH, temperature, oxygen, nutrient levels etc. in a biofilm reactor
- The biocide introduced in reference trials worked well. The growth of slime was reduced by about 50 %.
- The dosing of $Al(NO_3)_3$ tends to result in positive effects in the splash water area as well as in the submerse area when dosing 20 mg NO_3/l. When dosing 10 mg NO_3/l the single values were widely dispersed. The dosage of larger $Al(NO_3)_3$-amounts had a negative effect, often even more biofilm was accrued than during those tests without any dosage.
- The dosing of $NaNO_3$ only showed a marginal positive effect in the splash water area when dosing 20 mg NO_3/l and hardly any effects in the submerse area. When dosing 100 mg NO_3/l or more, in the submerse area considerably more biofilm was grown than without any dosage. Additionally more water has been bound to the microorganisms. At all trials dosing $NaNO_3$, the single values were widely dispersed, so the results must be considered as a tendency.

Application / Economic benefits

About 80% of the fresh water introduced into Bavarian paper mills originates from surface water. Consequently, increased organic carbon loads and microbiology are monitored. As a result, slime formation will be promoted, causing severe problems in terms of decreased process stability and product quality. The results of this project would lower the number of complaints received on the grounds of inadequate product quality.
At the same time, great efforts are being undertaken to increase paper machine speed whilst reducing grammage and increasing the fraction of fillers. Guaranteeing competitiveness, this development presumes increased process stability which is based on improved slime formation control.

Project period: 1st August 2004 – 31st July 2006

Remarks

The BAY 04/02 research project is being sponsored by the Bavarian Ministry of Economic Affairs, Infrastructure, Transport, and Technology.