

Optimisation of biological treatment plant in the Pulp and Paper Industry

Problem

Sludge quality fluctuations and filament growth resulted in sludge drain and high pollution levels, including TOC (Total Organic Carbon).

Solution

Continuous, on-line monitoring of the biological treatment plant load and nutrient levels in the effluent enables better plant control. The resulting high-quality sludge improves plant efficiency and effluent quality.

Benefits

Smurfit Kappa Piteå can increase the production of kraftliner without exceeding discharge standards.

Background

Smurfit Kappa Piteå is the largest kraftliner mill in Sweden with an annual production of about 800,000 tonnes of kraftliner in different designs, bleached and unbleached pulp with recycled fiber of different levels depending on the paper quality. Smurfit Kappa Piteå has two liner machines that produce the different paper qualities.

They intended to improve the management/regulation of the biological treatment plant so it could handle the resulting load variations in the best way. The goal was to get a stable operation of the biological treatment plant with a uniform sludge quality and discharge levels well below the stipulated regulatory requirements.



Smurfit Kappa Piteå Paper Mill

Problem

Smurfit Kappa Piteå had for some time experienced fluctuations in sludge quality in the biological treatment, and therefore the function of the biological treatment plant was not reliable. Smurfit Kappa Piteå had trouble meeting discharge requirements as TOC levels added load on the biological treatment plant. They investigated the cause of the problem and implemented a number of improvements, one of which was to improve the control of the nutrient dosing in the biological treatment plant.

Previously, Smurfit Kappa Piteå used the flow into the biological treatment plant and laboratory values of TOC to control a number of nutrients dosed. Underdosing of nutrients results in filament growth and scum, overdosing results in increased chemical costs and denitrification, which in turn can lead to filament buildup and floating sludge problems.

The intention was to supplement existing metering of nutrients by measuring TOC on the incoming water stream to the biological treatment and so to monitor the load continuously. They previously used production speed of the paper machines as a decisive parameter relating to the nutrient dosing. High demands are made on the TOC Analysers' accuracy, accessibility, and user-related supervision.

CASE STUDY: OPTIMISATION OF NUTRIENT DOSING

Solution

Smurfit Kappa Piteå had previously mounted instruments from Hach® for phosphate (Phosphax sigma) ammonium (Amtax sc) and nitrate (Nitratex plus) combined with filtration equipment for pretreatment of samples (Filtrax). The analytics instrumentation fleet was extended to include a TOC analyser (BioTector B7000). This provides a complete analytics suited to efficiently control nutrient dosing.

The water to be analysed places high demands on the pretreatment and analysis equipment to be used. The quality of water to be analysed places high demands on both the pre-treatment and analysis equipment due to residual fiber fragments, filler particles and chemical residues.

Previous tests with high-temperature technology TOC analysers proved unsatisfactory as hose blockages and crystallization in the furnace resulted in breakdowns and low uptime.

Uptime considerations have been overcome with the new two-stage oxidation technology from Hach. This provides complete oxidation of the sample, measurement accuracy and the uptime performance needed and already demonstrated by the other Hach analysers installed on site. Smurfit Kappa Piteå are fully confident in the online data provided and that consistently correlates with laboratory cross-checks.

Mounting



TOC analyser BioTector B7000 has a unique double oxidation method giving a total digestion of the sample, and it can handle particle sizes up to 2 mm.



The phosphoric analyser Phosphax sigma is capable of measuring both phosphate and total phosphorus. The ammonia analyser Amtax sc is seen here with a Plexiglas door for indoor mounting.

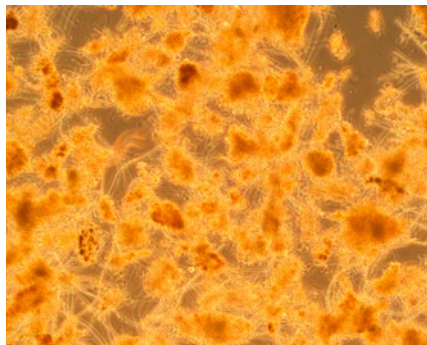


Pictured top left is the Nitrate analyser Nitratax plus mounted in a flow-through fitting and below that you can see the Filtrax unit and the boxes where the filter is mounted.

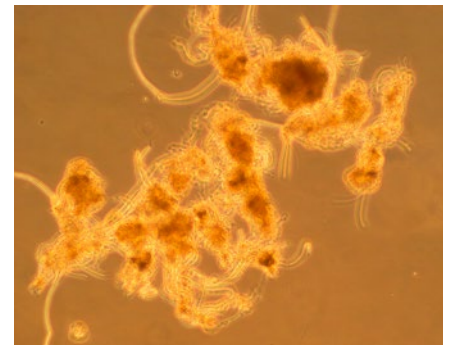
Benefits

Smurfit Kappa Piteå has, by ensuring a continuous accurate and reliable analysis of TOC and nutrients, been able to control its biological treatment so that it is now capable of handling the wide variations in incoming water quality.

The previous problems of potentially exceeding discharge consents, and higher than necessary chemical usage due to sludge quality issues and over-dosing have been stopped and the biological treatment plant performance improved.



Microscope image of initial sludge quality showing extensive filament growth. This in turn negatively impacts biological treatment performance and may lead to discharge issues.



Microscope image following plant analytics upgrade showing fewer filaments and greater, dense flock formation

Summary

After the changes made by the installation commissioning and implementation of the new BioTector B7000 online analytic system, Smurfit Kappa Piteå is now able to meet discharge requirements. The site is now well equipped to cope with future increases in production without compromising on internal requirements for environmental sustainable production of the highest quality kraftliner.