

Real-time TOC Tightens Effluent Control at Greencore

A food manufacturing facility in Selby, UK, has installed a new continuous TOC (Total Organic Carbon) monitor which has dramatically improved the site's capability to refine and improve the plant's wastewater treatment process. As a result the plant is better able to quickly respond to changes in the influent.

“*To achieve continuous, function in harsh process environments the BioTector from HACH LANGE uses a patented advanced oxidation process to offer aggressive breakdown of organics without thermal dependence.*”

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Greencore Foods is a significant player in the food processing industry and the group's Grocery division manufactures bottled recipe products (including cooking sauces, pickles, dips and soft drinks, producing 200 million jars per annum across 800 product lines). Operating from a site at Selby near York, it produces a wide range of both branded and retailer branded products across key market sectors.

The facility has received considerable investment in the last 10 years and now boasts some of the most modern, hygienic and efficient production facilities in the UK, achieving the prestigious AIB accreditation and being placed in the 'superior' category.

The Selby site is operated on a continuous improvement basis with its own dedicated wastewater treatment plant to monitor and control effluent quality and minimise costly discharge fees. Effluent from the food manufacturing industry contains an array of inorganic salts and organic components which enter the waste stream in part from the intense wash down of processing tanks and lines during clean in place procedures for product changeover. Overload of organics on the effluent treatment plant adversely affects the efficiency of the treatment process. If the waste is not treated to the required standard, then the site will be unable to achieve the river discharge parameters that have been set by the Environment Agency of England and Wales.

The effluent treatment plant at the Selby facility is managed by a specialist team from Veolia Water Industrial Outsourcing Ltd. Raw feed water entering the facility, is analysed for TOC to control the strength of the feed transferred to the site effluent treatment plant.

As Greencore Environment Manager David Murtagh explains "In the past samples were manually collected from the site drains pit and transported to the laboratory at a second location. Given the geographical distance between sites this led to significant waste, both in terms of time and resources. We had a small team in the laboratory who performed a number of analyses on the delivered samples, which was quite labour intensive and delayed results. Even state of the art laboratory techniques still took too long for pragmatic purposes, preventing prompt feedback on the process. Overall, this was not 21st century and provided no direct information to control the effluent plant or provide an early warning of process issues. An alternative needed to be sought.

"A further key driver was the impending tightening of the consent to discharge to river by the Environment Agency. We needed more frequent, more detailed, prompt, accurate and reliable influent TOC data to help manage the effluent treatment plant more efficiently and provide feedback on the process which is the source of the TOC. We were wary of on-line TOC instruments due to poor experiences in the past; while they worked well on cleaner, particulate-free effluent samples, the high solids, fats, oils and greases, and variable TOC loads coming from raw influent was a major issue for delicate fine capillary tubing and valves, which typically caused instrument seizure."



Historical issues

Traditional methods for analysis of TOC/COD/BOD were developed as laboratory systems based on UV exposure, wet chemistry or more aggressive digestion by catalysed combustion. While these provide an excellent basis for spot sampling within the laboratory where sample pre-treatment (e.g. by filtering) is controllable, the systems do not often translate well in a real process environment.

Raw effluent presents a series of challenges. With UV based systems, high salt loads can cause scaling of the UV light column creating problems or organic recovery. In high temperature combustion systems, salt loads as low as 0.5% can deteriorate the lifetime of the catalyst, demanding excessive maintenance by replacement of the column. Sample volume is commonly restricted to less than 10µl and sample pre-filtering is necessary to avoid particulate blockage of tubing and multi-port valves such that particle size is restricted to <200µm. In a process environment, clogging of tubes with crystallised salts and particulates can demand instrument re-calibration every 2-3 days.

New Monitoring Technology

To achieve continuous function in harsh process environments the BioTector from HACH LANGE uses a patented advanced oxidation

process to offer aggressive breakdown of organics without thermal dependence. This is achieved by exposing high pH reagents to ozone. Highly corrosive unstable hydroxyl radicals are generated by a Two Stage Advanced Oxidation. The hydroxyl radicals convert organic carbon into oxalate and carbonate intermediates.

Acidification in the presence of a catalyst converts the intermediates into CO₂ which is measured. This enables the system to handle very large sample volumes without the need for syringe controlled dilution mechanisms (an additional route for blockage in traditional techniques). The reactor and all sample lines back to the inlet are cleaned after each analysis using the spent acid left after the reaction. Salt loads as high as 30% are tolerated since the acid maintains the salt in solution and calcium loads of up to 12% are tolerated without dilution. Unlike contemporary systems, the BioTector has no furnace and with no ceramic components where salt can easily crystallise and cause blockage, easy maintenance is facilitated.

Unaffected by fats (internal tubing is protected by back wash), greases, salts and particulates up to 2mm diameter, a representative sample is achieved without pre-filtering allowing in excess of 80,000 continuous measurements per year. Maintenance requirements are minimal (6 monthly service is recommended with no calibration demands between service). The overall result is a 99+% uptime for the end user.

Summary

As Veolia's Continuous Improvement Manager Marcus Hardiker explains "All previous concerns regarding the use of an on-line TOC meter were addressed with practical solutions. The instrument takes samples from the raw effluent that is fed to the site's treatment plant. However, we needed the sample to be as representative as possible and therefore no in-line filters were installed in the sample line. The sampling arrangement was very carefully engineered by



the specialist team in order to deal with the site's unique type of effluent containing high sand and silt content.

"The signals from the BioTector unit have been integrated into both Veolia Water's effluent plant control system and Greencore's own data acquisition system. Veolia use the analysis to control the strength of feed transferred to the site effluent treatment plant. Any loads that exceed a pre-determined level are diverted to the site calamity tank. This control has enabled the performance of the effluent treatment plant to be greatly improved.

"The signals from the TOC meter are also transmitted to Greencore's production areas, and the on-line data is visible for



process personnel who can now see the effect that their activities are having on the effluent loads being discharged to the site treatment plant. Greencore has also linked the on-line results provided by the BioTector to an alarm system so that production personnel know when the TOC levels have increased - thus enabling them to react much quicker and thereby identify and address any issues as they arise."

With tailored solutions to match client needs, BioTector is simple to use and can reduce operational costs, avoid downtime and provide greater insight into processes for true real time control.