

MEDIUM

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TYPES OF WATER

OIL-IN-WATER / WATER EFFLUENT / INDUSTRIAL  
WASTE WATER / PROCESS WATER

PARAMETERS

TOC / TC / OIW

INSTRUMENTATION/PROCESS AUTOMATION

CHEMICAL

PHARMACY

FOOD /

BEVERAGE

OIL /

GAS

WATER /

WASTEWATER

DESIGN

OPERATION

MAINTENANCE

# How to Be In Control Of TOC

Online analysis of vegetable oils and animal fats in waste water



View of an oil and fat separator. The influent water is warm and contains a high load of mainly oils and fats.

layer of fat builds up in process pipes or/and sewer systems, restricting the waste water flow.

Should an incident arise where some of the costly raw oil products are spilled, an organic shock load would be caused, leading to severe problems in the waste water treatment installation. To prevent this, a reliable online oil-in-water analyser is needed. It continuously measures and reports the organic load of the discharged waste water. By monitoring the operation of the oil production process operators can take prompt action, therefore preventing the loss of products and breakthroughs in the oil-and-water separation systems, whilst protecting the biology in the aerobic and/or anaerobic waste water treatment tank.

## Case Study

A big industrial production facility develops biodegradable chemicals from renewable raw materials, such as vegetable oils and animal fats. It produces base oleochem products such as fatty acids, fatty alcohols and glycerine, as well as oleochemical specialties such as esters, dimers, isostearic acid, ketones, conjugated fatty acid and technical oils. Among other waste water treatment techniques, the plant uses two oil and fat separators that operate in a parallel configuration. The influent water is warm and contains a high load of mainly oils and fats. ODS Sampling and Analytical Systems was asked to design a complete online oil-in-water analyser system.

Most online oil-in-water analysis methods are based on indirect measurements. They are only suitable for certain types of oil (fluor-

The continuous online analysis of oils and fats in waste water is known to be one of the most toughest applications. Many oil-in-water analysers have trouble handling this highly contaminated oily and fatty waste water. Not so for the QuickTOC (Total Organic Carbon) analyser from LAR.

PIET BROERTJES

● Oils and fats are extracted from raw materials, like seeds, seeds leaves and animal fats, by the way of mechanical treatment, drying and heating, extraction with use of a solvent and steam, concluding with separation via evaporation. During these processes quite a bit of the dissolved and emulsified oils can leak into the warm process water and finally end up in the sewer system.

Basically oil and water are immiscible. Oil can be present as free oil, as an oil sheen and as mixed droplets, but at an increased temperature, and in turbulent conditions, it can be dissolved or get emulsified. When some process solvents also leak into the waste water, oils become even more soluble or/and emulsified. As the water temperature slowly drops, the unctuous emulsified oil starts to separate, thickens, hardens and solidifies. Oils become fats. The typical solidification range depends on the type of oil, e.g. palm oil 41 to 31 °C. As a consequence, a

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## PROCESS PLUS

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rescence) or respond to oil droplets (light scattering). A TOC analyser, however, uses a direct measurement method. It determines the organic carbon content of all organic species in the water, regardless of their origin, composition, phase or consistency. It is actually a hydrocarbon counter and therefore, the TOC analysis method can be considered as an oil-in-water method as well.

Most types of TOC analysers have an upper range limitation of 2,000 mg C/litre. To achieve higher ranges, the sample must be diluted with demineralised water. Because oil and water do not mix, sample dilution techniques cannot be used, as the resulting analysis would be too poor.

#### Problem: Memory Effect

Most analysers have problems with a phenomena called memory. Basically, this memory effect is caused by the absorption and adsorption of the organic compounds from the sample by the wetted parts of the analyser. These memory effects result in a reduced response time, a slow recovery after measuring a high peak and cross contamina-



QuickTOC analyser 2-stream

tion for multi-stream applications. Techniques to lessen these memory effects are to reduce the surface area of wetted parts, a rinsing technique to clean wetted surfaces and an outstanding oxidation technique, e.g. thermal oxidation.

The QuickTOC manufactured by LAR Process Analysers does not have problems with the issues mentioned above. It proves to be most suitable for oil, fat and grease applications and in numerous oil-in-water applications it is successfully in operation. There is no sample pretreatment or dilution technique needed; samples are directly injected into the reactor and only three components come into contact with the sample: the sample tube, a quarts glass overflow vessel and a rugged injection needle. It offers a full oxidation up to 50,000 mg C/litre, irrespective of what type of oil is injected and regardless of the organic content of the sample. The applied 1200 °C thermal oxidation technique is superior to any other oxidation technique. The special design eliminates the need for components that are often subject to maintenance, e.g. pinch valves, rotating multi-port valves, pumps and more. Furthermore, LAR is able to deliver a 2-stream oil-in-water analyser system in order to monitor the influent and effluent waste water loads simultaneously and thus determine the efficiency of the WWTPs operation.