Submerged aerated filtration (SAF) and activated sludge plant (ASP) processes have been widely used for the treatment of raw or settled sewage or industrial effluent. The processes are invariably used to reduce the carbonaceous or the combined carbonaceous and ammonia load of the effluent; and more recently to some extent the phosphate and nitrate load.

SAF and ASP concepts
The concept of the SAF plant is to encourage growth of micro-organisms onto a media that has a high surface area within an aerated tank. However, many medias have:
- Poor biomass (biofilm rich in micro-organisms) to surface area ratio on which micro-organisms can adhere, and
- Poor oxygen supply to the biofilm.

While a submerged aerated filtration plant relies solely on the micro-organisms adhered to the media (sessile), an activated sludge plant relies on freely suspended micro-organisms (mixed liquor suspended solids (MLSS) or activated sludge). Within an ASP, a greater amount of biomass is available to carry out the required treatment. However, with increasing human populations, limiting land access, decreasing budgets and ever tightening discharge consents it is becoming ever more challenging for water companies to treat the effluent.

The IFAS concept
Integrated Fixed-Film Activated Sludge (IFAS) process takes the benefits of both the SAF and ASP and combines them into one treatment plant with ever more biomass to treat stronger effluents, without the need to build additional tanks.

Hydrok process solution
Hydrok, a leading UK water and wastewater engineering company, supplies IFAS technology to address the challenges faced by water companies in treating effluent. Hydrok uses the Biotextil Cleartec® polypropylene curtain media for sessile biomass growth, which has a greater biomass to surface area ratio than conventional medias; and because of its flexible nature, it has a greater guarantee to
supply oxygen to the biomass and eliminate blockages. The curtain material can be applied as either a SAF or IFAS treatment solution for new plant installations or retrofit within existing plants.

Hydrok constructs bespoke stainless steel cages to contain the Biotextil Cleartec® curtains. The cages are also designed to be lifted to allow inspection work on the curtains without interfering with the process treatment. Due to the bespoke nature of the cages, the curtain material can be positioned directly over the diffusers of the biological treatment tank.

The curtains allow horizontal effluent flow to pass between them. The effluent flow combined with the vertical rising air bubbles from the diffusers allows continued rather than periodic shock sloughing (shedding) of excess biomass. Sloughing of the biomass continually promotes aerobic conditions within the biofilm, essential for the process treatment.

Benefits
The benefits of the flexible curtain material are summarised as:

- Enhances aerobic conditions within the biomass, essential for optimum process treatment.
- No blockages within the media, therefore greater oxygen supply to the biological active surface; and no shock loads to the final settlement tanks (FSTs).
- Promotes excellent biomass settling properties, typically SSVIs of 40 to 70.
- Allows the opportunity to operate the treatment plant at lower O2 concentrations.
- No additional scour or mixing required, therefore lower operational costs.
- Low transportation volume.
- Minimal hydraulic head loss.
- No treatment loss during maintenance, as the media can be lifted for inspection during process treatment.

Installations
At Armthorpe, Doncaster the growing population and tightening consent required that the existing treatment plant would have to be modified. The existing process consisted of a surface aerated activated sludge plant (ASP).

The conventional approach to solve the problem was to purchase additional surrounding land and construct 11 (No.) new ASP pockets, an inter-stage pumping station and a new final settlement tank. Such a solution was not only expensive but also would have involved a significant carbon footprint to install, as well as to operate for its continued life expectancy.

Hydrok's solution was to replace the existing mechanical surface aerators and replace with Biotextil Cleartec® curtains within bespoke stainless steel cages, combined with Hydrok's fixed bed diffuser aeration system (FBDA). Within Hydrok's FBDA system, Hydrok offers very shallow depth fine bubble polyurethane Aquaconsult AEROSTRIP® diffusers that offer greater oxygen transfer efficiencies and longer operational life expectancy than traditional EDPM diffusers.

The client Water Company carried out Hydrok's proposal, which resulted in land as well as additional treatment plant savings, as the IFAS process and FBDA system was installed within the existing tanks. The solution also gave more than 50% carbon footprint saving for both the installation and continued operation life expectancy. In addition, solids settlement and effluent quality improved beyond the target levels for the site.

This paper was prepared by Lewis O’Brien, Technical Manager at Hydrok UK Ltd.
Tel: 01726 861900  E: sales@hydrok.co.uk  W: www.hydrok.co.uk
WASTEWATER TREATMENT PROCESSES:

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www.hydrok.co.uk
01726 861900  sales@hydrok.co.uk