

HSAF

a truly versatile multifunctional process

by
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Delivering high quality effluent on large schemes is no longer the challenge it used to be, there are numerous well proven process options that can be employed, such as BAFF, Membrane or even carefully designed and controlled ASPs. However, as consents tighten CAPEX and OPEX, including manpower to operate and maintain the plant, rise dramatically. With tighter consents applying to yet smaller schemes, a need has been generated for small scale or ‘packaged’ process plant to deliver high levels of performance, for example down to 1 or 2 mg/l of ammonia.



HSAF Solids Filter built for Yorkshire Water for a P removal project

Courtesy of FLI Brightwater

Whilst the cost and complexity of operation to achieve tight consents on large works is taken for granted, budgetary constraints and manning levels are such that ‘throwing money’ at the problem to install complex high tech solutions is not a viable option for smaller schemes.

FLI Brightwater recognised this trend to tighter consents on ever smaller schemes several years ago and, as part of its on going research and development programme set about meeting the challenges posed by its clients to deliver a reliable process that doesn’t break the bank in terms of OPEX and CAPEX.

Having a history of developing and successfully bringing to market a range of high tech processes capable of delivering whatever consent levels our customers need and having the in-house knowledge and production expertise with regard to plastic media based processes, it is here that the journey started to develop a rugged and reliable process to meet the changing needs of our customers.

Development stage

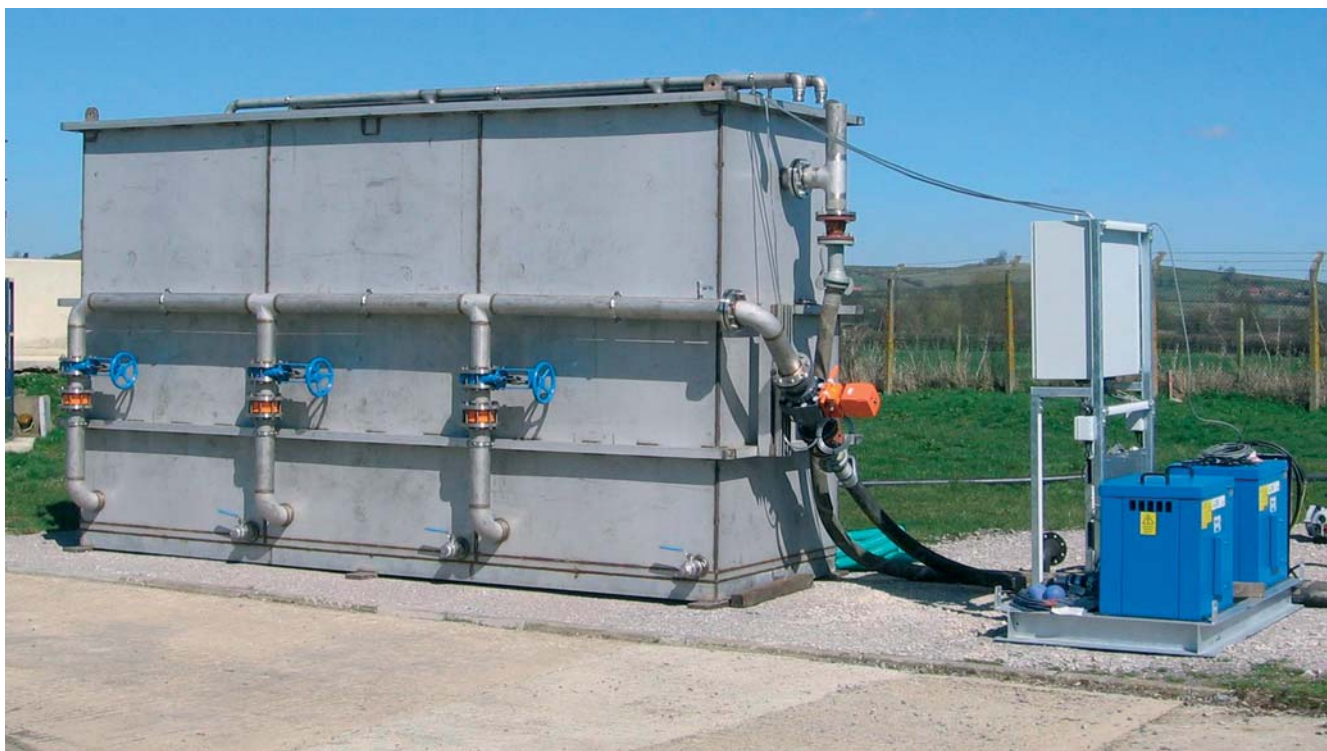
During the early stages of this development exercise it became apparent, from customer feed back, that the consent tightening process was subtly changing and whilst many works were having

dramatically tighter consents imposed with respect to ammonia, often the suspended solids consent would remain unchanged. It was this subtle change in approach to consent tightening that lead to the exploration of the potential to make a step change in the development of Submerged Aerated Filter (SAF) technology.

Various forms of SAF plant have been around for some years now, used mostly on very small schemes and to meet relatively basic consent requirements.

As a generic process most SAF plant is fairly simple, the package versions using a prefabricated tank of steel or GRP construction filled with a media – often corrugated plastic sheets, glued together and fixed in place with a diffuser system below the media and a simple inlet/outlet system.

However although conventional SAF plant is simple, it is not without its problems, media blockage is common, diffusers need to be removed for maintenance and operational/maintenance costs including power costs are fairly high. Whilst treatment to higher standards is possible with conventional SAF plant, loading rates are low due to the need to utilise media that has a high voidage, hence low specific media area, to minimise the risk of blockage.



HSAF Number One: The first full size HSAF unit at a Thames Water site

Courtesy of FLI Brightwater

In order that a more rugged/reliable process could be offered whilst achieving better levels of treatment in a low footprint low power process, FLI Brightwater set about developing a SAF that had all of the above issues designed out and yet remained simple to install and operate and at a competitive overall cost of ownership.

It is from these relatively simple requirements and customer needs that a new generation of SAF was born – called HSAF®

Following extensive small scale trials on a local sewage works, HSAF Number One, the first full size unit was delivered to site early 2006. The plant was used as a demonstration plant to show the performance capabilities in both carbonaceous and nitrification treatment modes on a Thames Water site.

Features & Benefits

The key features and benefits of the process that was subsequently developed and named HSAF are summarised below.

- HSAF uses a buoyant open random packed media, engineered from post consumer waste recycled plastic and carefully quality controlled to have the right size, shape surface characteristics and density.



Buoyant open random packed media

Courtesy of FLI Brightwater

- The media has a considerably higher specific surface area – in excess of $700\text{m}^2/\text{m}^3$ – than any other SAF, leading to much greater processing capacity per m^3 of media and hence much smaller foot print.
- HSAF operates with such a high specific media area and yet is not susceptible to media blocking, this being due to a cleaning sequence that is engineered into the process, during which the media is fluidised and expanded to ensure all accumulated solids and excess biomass are removed.
- The ability to operate with a very high specific media area without blocking enables much higher loading rates to be adopted. The photo to the right shows an HSAF on industrial scheme that is delivering ammonia removal rates of $0.7\text{kg}/\text{m}^3$, which is approximately 10 times the rate that a fixed corrugated media can achieve.
- Aeration is via a sparge type system using stainless steel tubular aeration arrays that are rugged and can be withdrawn through the floating media in the unlikely event that the aeration system needs to be removed – there is no need to remove the media or to drain down the tank to undertake this removal. As the process air is injected into the system within the media bed and due to the constricted air path through the media, HSAF operates with an oxygen transfer efficiency of up to $10\%/m$, resulting in power savings of up to 65% when compared to other SAF plant.
- With air grids that can be adjusted for level from the top of the tank and without having to drain down or even stop flows, installation for temporary treatment applications is swift and easy, using either existing hardstanding or layer of compacted MOT Type 1 hardcore.
- The unique scour cleaning feature of HSAF means that SAF media blockages are a thing of the past.

HSAF – a truly versatile, multifunctional process

HSAF has been developed to be a truly multifunctional process that can be utilised for BOD removal, ammonia removal, with applications in use down to $1\text{ mg}/l$ final effluent ammonia on a



HSAF Solids Filter built for Anglian Water as part of a P removal project

Courtesy of FLI Brightwater



Large Scale HSAF delivering consent compliance at 1 mg ammonia/l on a 95%ile basis, whilst using only one third of the power of alternative SAF technology, built for United Utilities

Courtesy of FLI Brightwater

95%ile spot sampling basis, for total N removal, in de-nitrification mode and if the process air is switched off, for solids removal down to less than 10 mg/l suspended solids, either to meet a suspended solids consent or for particulate removal as part of a P removal solution.

Solids filter unit as a bespoke solution used as part of a P removal scheme for capture of particulate P and iron – two different schemes pictured.

HSAF is available in M range, that is mobile, transportable units for fast response projects whether temporary or permanent, with capacities up to 20 l/s for the M10, or as bespoke solutions, which can be customised to client needs, and has to date been supplied for populations up to 31,000.

The M range multifunctional HSAF units have proved extremely popular with numerous clients as quick response units for compliance

issues, where units are hired out to ensure that consent compliance is maintained.

To date HSAF has been supplied to Anglian Water, Northumbrian Water, Scottish Water, Thames Water, United Utilities, Yorkshire Water and Dwr Cymru Welsh Water as well as several non-municipal clients.

The performance achieved from the HSAF is such that, when on hire for maintenance of consent compliance, the units are often purchased to become part of the permanent works. With well over 100 reference applications to date and several more installations in the pipeline we feel that the performance and capability of HSAF should be judged by the success it has achieved in such a short space of time.

Note: The Editor & Publishers thank Melvyn Rose, Business Development Director with FLI Brightwater, for preparing the above article for publication.■



HIRE UNITS ALSO AVAILABLE FOR TEMPORARY TREATMENT

BRIGHTWATER HSAF TECHNOLOGY

Submerged Aerated Filters are an established technology for treating wastewaters. The unique HSAF™ design, using B-Max floating media, offers a low footprint, low power process, without the sludge blockage problems inherent in many other SAF designs.

- Single units suitable for flows up to 20l/s
- Suitable for C, N or denitrification duty
- Can also be used in un-aerated mode for Solids Filtration duties
- Proven on P removal applications
- Bespoke designs for large scale applications



HSAF Solids Filter built for Yorkshire Water for a P removal project

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