KEE INSIGHT
THE SOLUTION TO WATER POLLUTION NEWSLETTER
ISSUE 4

THIS ISSUE

Just some of the features in this issue – and more … ❑

FOR MORE INFORMATION
visit our web site
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EXPANSION IS KEE TO MEETING DEMAND

As our business continues to grow and develop at a pace, so too does our commitment to provide quality engineered and cost effective solutions to our customers. In order to facilitate the extra demand from a number of business activities, we have recently invested in two further production units. These units will offer a further 6000 ft² of external concreted storage facilities and are based alongside the existing office and production facilities in College Road North, Aston Clinton. ❖

Revitalise Oxidation Ditches with Aire-O_2 Triton Aerator and Mixer

Independent mixing tests on a 75Hp Triton aerator showed velocities out to 60 feet and down to the lagoon's 24 foot depth.

AERATION INDUSTRIES INTERNATIONAL INC has patented a new Triton Aerator/Mixer called the Aire-O_2 Triton Aerator/Mixer. This new technology overcomes the previous limitations of oxidation ditch technology and can be used to revitalise existing oxidation ditches and technology.

Oxidation ditch technology is one of the oldest ways of treating wastewater. Whilst it enables wastewater to be treated to a high standard including nitrification and even denitrification, it does however have significant limitations.

The process requires aerated and mixed liquor to continuously move through the aeration ditch. Brush rotors and disc rotors aerate and mix the liquor, but because they can only maintain the necessary fluid velocity of 0.3 - 0.4 m/s in a shallow depth of no more than 2m, the footprint area of the oxidation ditch is extremely large.

The Aire-O_2 Triton Aerator and Mixer Aeration is an energy efficient, dual mode (aeration and mixing) process aeration that is capable of nitrification and denitrification all in one unit. With two propellers and a regenerative blower, it is able to operate either as an anoxic mixer with the blower turned off, or a very efficient aerator/mixer with the blower turned on.

With its two mixing propellers, the Triton is able to achieve significant velocities in depths of up to 7m. This means the oxidation ditch basin can now be built up to 7m deep, therefore significantly reducing the footprint area.

The Aire-0_2 Triton Aerator/Mixer's primary and secondary propellers inject air into a high velocity stream of bubbles (defined by the Environmental Protection Agency as "fine bubble") below the surface of the water and provide flow linkage mixing in multiple unit arrangements.

The Triton can also be used to revitalise existing oxidation ditch systems with failing brushes or disc rotors. If the rotors have totally failed, the Triton can replace them.

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WWT WATER & WASTE TREATMENT

ARTICLE EXTRACT

Suru Nathwani, managing dirtector of KEE Process, comments on a practical approach to industrial wastewater disposal and treatment.

CUTTING POLLUTION

KEE launch of a NEW Microfloat system

The NEW KEE Microfloat system

KEE HAS INTRODUCED IMPROVEMENTS TO effluent treatment technology in a bid to minimise environmental pollution from wastewater.

Many industrial processes, particularily food processing, generate a large volume of effluent that is discharged into the sewer. The raw wastewater has high biological oxygen demand (BOD) and high chemical oxygen demand (COD). To reduce environmental pollution, companies often pre-treat the wastewater before it is discharged into the sewer.

Until now, a system known as dissolved air flotation (DAF) has been used to do this. The DAF system uses a high-pressure pump and venturi system to dissolve air into the wastewater. The solution of air and water is stabilised in a pressure vessel under high-pressure.

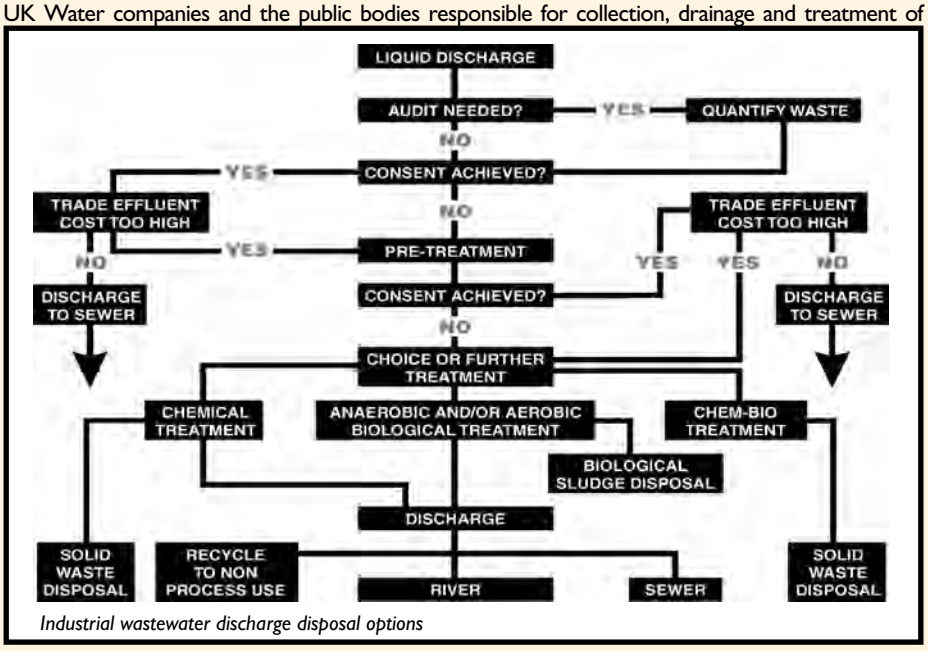
A stream from the pressure vessel is discharged into a separating vessel where the air comes out of the solution and is released as a fine bubble spray. These bubbles reduce the pollutants by floating them to the surface where they are removed.

The new KEE Microfloat system achieves the same result without the need to use a high pressure pump and venturi. Instead, it incorporates a patented system from Aeration Industries, which uses a low-power motor. A specially designed propeller disc on the aerator's shaft produces extremely fine bubbles and transfers these 10-50µm air bubbles into the water through special ejectors. ❖

Essential disposal solutions

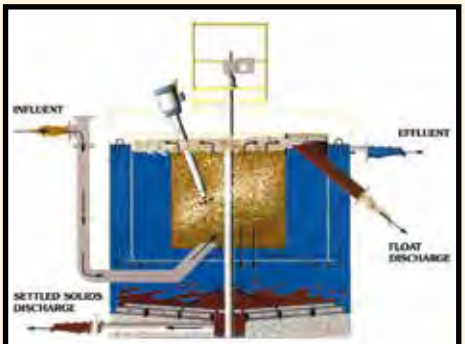
THERE ARE MANY INDUSTRIES that use large amounts of water, including brewing, wine making, soft drinks manufacture, food preparation, production and packaging (baking, ready convenience meals, abattoir, meat, poultry and vegetable), dairy (milk processing, cream, cheese and yoghurt production), commercial laundries, pharmaceutical, petrochemical and many others. This results in large quantities of heavily polluted wastewater for disposal.

UK Water companies and the public bodies responsible for collection, drainage and treatment of wastewater have strict controls on the quantity and the quality of industrial and trade wastewater being discharged into public sewers. Legislation supports them in this. Direct discharge to a watercourse is even stricter and is normally monitored by the Environmental Agencies (EA) in the UK.



Industrial wastewater discharge disposal options

Penalties for transgression can include prosecution, fines, financial loss and can, in some cases, prohibit operations. It is advisable to carry out an evaluation of the processes involved in the core business of an organisation to identify sources of wastewater. An audit would help reduce waste/wastewater and disposal costs, quantify flow rates, solids and organic loads and characterise the wastewater to provide the necessary data for analysing the available disposal options and optimise the design of any on-site treatment plant.



Interior working of the Microfloat dispersal air flotation system.

It is useful to be subjective when carrying out an audit to ensure that good housekeeping practices are identified to reduce unnecessary waste which would add to the costs of disposing wastewater generated on-site. Process audits should be aimed at identifying the waste, excess use of water and energy. Simple actions, such as installations of energy-saving devices or taps and hose controls and careful disposal of solid waste, can produce both financial and environmental benefits. Also it would help to reduce the size of an on-site treatment plant if one was planned and this would result in capital cost-savings.

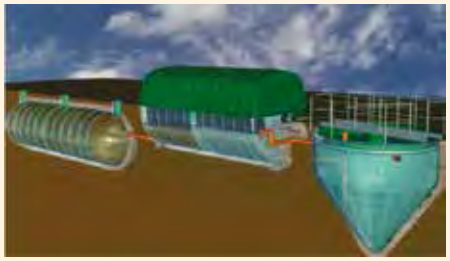
An audit would lead to evaluation of volumetric and organic mass loads for design purposes and would aid in characterising the nature of the waste, to optimise the design for on-site treatment plants. Public sewers are convenient for disposal if nearby.

Quantity, strength and characteristics of the wastewater need to be considered and consented by the EA or the water company. If approval is granted and the wastewater meets the criteria set, then sewer disposal would be an obvious choice, but this comes at a cost. High chemical oxygen demand (COD) and suspended solids would lead to high costs in discharging to sewer and reducing these parameters could make significant savings.

Partial or full on-site treatment would bring about cost savings to sewer discharge but needs justifying through quantification. With the food processing, beverage and dairy industry, hygiene is of paramount importance. On-site wastewater treatment may be perceived by management as presenting problems although the risks are small.

It is vital that the operatives normally involved in the process part of the industry, do not need to visit the WwTW and the risks to main operation therefore are contained and the operation of the WwTW becomes one of non-core features. This can be achieved by having the plant operation undertaken by the maintenance department of the industry or independent operators such as KEE Process which would provide a turnkey solution for designing, supplying, installing and operating a plant for a client. Where the decision to treat on-site has been made, the appropriate choice of plant has to be determined.

Effluent screenings from vegetable processing plant



A modular RBC system

Compact, single piece KEE NuDisc® RBC

The decanter & access manway of an SBR at a fruit juice factory

Large RBCs providing full on-site biological treatment

Whether partial treatment or full treatment is installed is usually a matter of economics. A capital outlay is necessary and this must have an acceptable payback period. The treatment options available are physical, physical/chemical, biological or a combination of all or any of these. On-site treatment could involve simple physical treatment to remove materials such as gross solids, fat, oil and grease (FOG) and can include pH correction.

The equipment may include manual or mechanical screens, grease separators or the newly introduced dispersed air flotation, which is simple, economical, efficient and effective. A component of COD associated with these materials would also be removed by the physical treatment. With dispersed air flotation up to 30% BOD, 50% COD, 60% TSS and over 90% FOG can be removed physically without the use of chemicals. Better performance can be achieved by using coagulant, flocculants and poly-electrolytes. In most cases, partial treatment using dispersed air flotation would achieve the reduction in pollution loads necessary to substantially reduce the cost of discharge of effluent to public sewer.

The ownership costs (capital expenditure, servicing, maintenance and operation costs) associated with dispersed air flotation are usually low. The benefits of cost savings in effluent disposal are high and the financial justification of proving on-site partial treatment are justified against the ownership costs.

Given these benefits it may be sufficient not to invest in further on-site treatment for the effluent to be discharged into public sewer. However, it may still be necessary or even desirable for the wastewater to be treated further for direct discharge to a watercourse or re-used for non-process operations within the industry. In such a case, full on-site treatment would often justify the capital and operations cost. Cost analysis must also take into account the valuable space required for location of the treatment plant on the core business site. For disposal to watercourse, consent from the EA will be necessary. The full treatment options could include anaerobic fixed film technology. This is particularly suitable for high strength wastewater requiring initial partial treatment prior to sewer disposal or further aerobic treatment to produce effluent suitable for direct discharge to a watercourse. The aerobic process could include:

- suspended growth activated sludge process options through extended aeration, sequencing batch reactor (SBR) or even oxidation ditch.
- fixed film process through rotating biological contactors (RBC), submerged aerated filter (SAF).

The most suitable process selection would depend on many factors such as:

- initial mechanical/electrical capital plant cost.
- installation cost.
- operating cost including on-site attendance/ labour costs, energy costs, consumables and plant operation complexities. Disposal costs of physically separated pollutants e.g. FOG, TSS and sludge in case of full biological treatment plant.
- servicing, spares and maintenance cost.
- space and land requirements for location of the on-site treatment plant.

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KEE AWARDED PRESTIGIOUS CONTRACT

KEE SERVICES LTD have been awarded a three year contract to provide complete management and operation for the wastewater treatment plant at the De Vere Slaley Hall Hotel.

As part of the selection criteria, the ability of KEE Services to provide a tailored and flexible management and operation solution to De Vere was paramount. In addition, as part of the KEE Group, the ability to provide a 'One Stop Shop' to De Vere was also critical.

The American WwTP based on extended aeration activated sludge process with initial screening and screenings dewatering and final effluent filtration, is designed to treat a maximum of 180m³ from the various hotel's conference, leisure and golf functions.

As part of the management and operation role, KEE Services will provide all the routine site related duties including the service and maintenance responsibilities together with the management and supervision of the regular tankering operations.

A brief summary of the key responsibilities are outlined below;

- Complete responsibility for Management and Operation
- Emergency 'Call Out'
- Weekly routine planned preventative maintenance visits
- Total management of all desludge operations
- Weekly sampling of effluent
- Monitoring of critical plant performance indicators
- Regular reporting on plant operation characteristics

In addition to providing the management and operation role for De Vere, KEE Group will also provide in-house process design capabilities in order to optimise the operation of WwTP by identifying improvements to the existing plants. ❖

SHORT - TERM HIRE FOR SHORT - TERM SOLUTIONS

Did you know that KEE supplies a range of equipment for short-term hire?

So, should you require treatment systems, biological reactors, surface mounted Aire-O_2 Aspirating Aerators and Triton Aerators to take over the treatment whilst refurbishments or upgrades are carried out on your existing equipment, we can supply them at a very competitive rate.

Installing an Aire-O_2 Aspirator or Triton Aerators for a short time to assist in mixing and aerating, will also give your Oxidation systems or Activated Sludge Aeration Plants a performance boost.

To find out more about our short-term hire scheme, **call KEE now on 0800 389 0457.**

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All these factors should be taken into account and a discounted cash flow calculated on a 10, 15 or a 20-year replacement cycle. This should be weighed against the cost of disposal to sewer or partial treatment followed by disposal to sewer. When evaluating the disposal costs to public sewer, it is necessary to liaise with the authorities or provider of the central WwTW to establish initial capital cost contribution expected and the potential annual costs associated with sewer discharge over the next 10, 15 or 20 years.

Armed with this financial data, the overall cost of various disposal options should be evaluated and the final disposal option chosen justified on a payback period or the net discounted cash flow, or the simple approach of evaluating the cost of disposing a unit volume (say 1 m^3) of effluent.

With so many factors to consider, such as type of treatment, if any, the process selection for partial or full on-site treatment and cost analysis to justify the most appropriate option for disposal of the effluent, it may be beneficial to use the services of a professional.

An experienced independent consultant with a wide knowledge of industrial wastewater treatment processes would be the obvious choice. Some Companies do offer a wide spectrum of process options and have the necessary experience to offer turnkey solutions using the most optimised process. Such companies may have a bias towards their own technology and process if they have a limited range of process options to offer. All this should be balanced against their ability to provide project management, process design, site civil work, mechanical or electrical erection commissioning and more importantly on-site operation with process warranties. ❖

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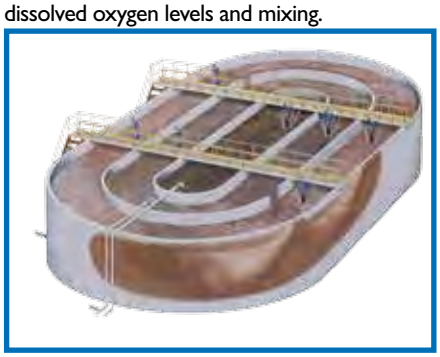
Alternatively, if the rotors are still in good working order, but the plant is failing to meet treatment objectives due to lack of dissolved oxygen and/or mixing of the oxidation ditch aerators, Triton can be used in conjunction with the rotors to improve dissolved oxygen levels and mixing.



CASE STUDY

The Oxidation Ditch Wastewater Treatment Plant at Franklin in the USA, was failing to meet the consent of 15mg/l BOD and 23 mg/l TSS. Because the rotors required daily lubrication, maintaining them was a time consuming and costly exercise.

So when the rotors fractured and failed four years ago, the decision was made to upgrade the plant by replacing the brush rotors with the Aire-O_2 Triton Aerator/Mixer.

Franklin's plant has two oxidation ditch systems operating in parallel, each of which treat 4536 m^3/day, with influent BOD of 185 mg/l and TSS of 90 mg/l.

During the upgrade each ditch was fitted with 4 No. Triton each rated 18.6 kW. This represents a maximum of just over 2 kWh of electrical energy per kg of BOD or 0.4 kWh/m^3 flow.

The final effluent quality from the refurbished oxidation ditch is testimony to the excellence of the Aire-O_2 Triton. The result of the upgrade was final effluent with BOD of between 2 and 3 mg/l and TSS well below 15 mg/l. Independent velocity measurements at extremities are well above the minimum 0.3 m/sec therefore guaranteeing that no deposit would develop in the basin. At the same time, maintenance requirements have been substantially reduced to a simple lubrication task once every six months. ❖

Questions frequently asked about KEE capabilities

Operation Related Queries

Q. What causes Wastewater Plant Odours?

A. Probable causes
- a) The plant has reached its capacity of sludge storage and is due for sludge removal.
- b) Air blower or RBC stopped.
- c) Excessive grease or chlorine in plant and the aerobic reactor of the plant (SAF, BAF, RBC, AST).
- d) Toxic or inhibitory substances in incoming wastewater (chemicals, medications, photographic processing waste, excessive bleaches, commercial laundry waste in large proportions, catering establishment dish washer waste in large proportion etc.).
- e) Higher than design incoming BOD_5.
- f) Overloading of the initial stage or whole of the aerobic reactor.

Q. What are the probable causes of high BOD, Ammoniacal Nitrogen and/or Suspended Solids in the effluent?

A. Probable causes
- a) Any of the above causes of odour problems.
- b) Excessively high level and long duration of peak flow rates.
- c) Insufficient biological treatment capacity and plant overloading.
- d) Wastewater temperature below design temperature.
- e) Improper and inadequate final clarifier design.
- f) Partial nitrification occurring in the biological stage generating difficult to settle pin floc in the final clarifier.

Q. What is the reason for excessive and/or unhealthy looking bio-mass on the SAF or BAF or RBC media or in the Activated Sludge plant?

A. Probable causes
- a) Excessive grease in plant and the aerobic reactor of the plant (SAF, BAF, RBC and AST).
- b) Higher than design flow or influent BOD_5 loads.
- c) Excessively septic influent wastewater.
- d) Overall and/or first stage loading of SAF, BAF or RBC too high.
- e) Discharge of high strength industrial wastewater not allowed for in design.

Q. What could be the reason for loss of Activated Sludge or Biomass from SAF or BAF or RBC media?

A. Probable causes
- a) Toxic or inhibitory substances in the influent wastewater.
- b) pH of wastewater outside the normal operating range.

Q. What could be the cause of white/buff coloured biomass on SAF or BAF or RBC media?

A. Probable causes
- a) Severely septic influent wastewater.
- b) High H2S (Hydrogen Sulphide) concentration in influent wastewater.

Note: Hydrogen sulphide has a smell similar to that of rotten eggs.
- c) Overloaded biological stage or first stage.

Q. What factors require special consideration in Design and Selection of wastewater treatment plant?

A. Factors requiring special consideration
- a) Surface water
- b) Wastewater temperature
- c) Fat, Oil and Grease (FOG) content of the wastewater
- d) Inhibition of biological treatment of wastewater due to inhibitory substances in the wastewater
- e) Applications where high quality effluents are required.

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