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# PumpAction..... ISSUE 44 SEPTEMBER 07

## FEATURE

### Blivet versus Rotating Biological Contactor

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The Kelair-Blivet™ is a stand-alone packaged sewage treatment plant comprising primary settlement, aerobic zone, final settlement (humus tank) and sludge storage. The plant is designed to accept raw (unsettled) sewage and produce a high quality final effluent without the need for ancillary tankage or equipment. The system may be buried up to lid level, significantly reducing the visual impact on the environment.



#### DESIGN PARAMETERS

| Parameter        | Influent | Effluent    |
|------------------|----------|-------------|
| BOD              | 250 mg/l | 20/10* mg/l |
| Suspended Solids | 250 mg/l | 30/15* mg/l |

\*10/15 effluent standard is applicable when the Blivet is fitted with Saran filter. Please note that other final effluent standards can be achieved. The Blivet is a modular, completely self-contained unit, which lends itself to future expansion or relocation. The Blivet consists of the following four components.

#### PRIMARY SETTLEMENT

Raw sewage enters the Blivet and hits a full-width baffle which intercepts any plastic bags and floatables. The rest of the raw sewage is directed downwards into the primary settlement tank. Primary settlement is enhanced by upwards flow through parallel or lamella plates. The inclusion of parallel plates results in a much smaller primary settlement tank as well as 25% removal of BOD. This increase in efficiency over a standard open tank allows a corresponding reduction in the size of the aerobic section. The end result is that the Kelair-Blivet is a very compact all-in-one packaged plant; probably the smallest available worldwide.

After flowing upwards through the parallel plates, the sewage flows over a notched weir and enters the first section of the Aerobic Treatment Unit, the Kelair-BMS Aerotor. This patented Aerotor process is where the most significant improvements and differences occur in comparison to standard Rotating Biological Contactor (RBC) systems.

#### BIOLOGICAL TREATMENT (AEROTOR)

A common misconception is that the Aerotor is in fact a rotating biological contactor (RBC). An Aerotor can-

not be defined as an RBC. The Aerotor is a unique combination of two tried and tested methods of aerobic biological treatment systems: RBC-style fixed film reaction; and activated sludge. The key points of difference between an Aerotor and a Blivet are:

- An RBC turns much more slowly than a Blivet. If the RBC is overloaded, an overgrowth of biomass can accumulate. The Biozone's speed of rotation (approximately 6 rpm) is such that the biomass keeps stripping off leaving a healthy layer that can not get too thick and anaerobic. The constant stripping of biomass avoids a problem seen in conventional RBCs, where the biomass bridges across the discs, effectively reducing the RBC surface area by preventing the sewage from getting between the individual discs.
- An RBC generally has open discs. The Biozone is an enclosed rotor. Encasing the biomass inside a rotor facilitates forcing the sewage through a set path inside the Biozone, ensuring that the influent is exposed to as much of the biomass as possible.
- An RBC only has passive aeration, from oxygen being entrained in the biomass as the RBC turns. The Biozone is designed to actively aerate the sewage, by sucking in air through a series of holes located along the perimeter of each Biozone and mixing it thoroughly with the influent.
- The flow path for sewage passing through the RBC is much more inconsistent than through a Blivet Aerotor. Influent could flow through the tank of an RBC and never come in contact with the discs or the biomass. In the Blivet, the influent is directed to each Biozone - and through the passageways inside

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## (Feature cont.)

- to get to the next stage, so it must make contact with the biomass for a considerable period.

The Biozones are all a standard diameter of Ø1500mm, to allow Blivets to be shipped to overseas markets in a standard container. Therefore, Biozone size increases by length only.

The rotating motion of the rotor, which in mechanical terms is a pump, provides a nett head gain of 375mm. This head gain provides the following advantages:

- Automatic recirculation of any proportion of treated effluent under gravity back to the primary settlement tank. Recirculation helps keep the primary settlement tank from going septic (anaerobic). One of the major causes of odour in STPs is septicity in the primary settlement tank.
- Gravity recirculation increases at times of increased flow, thereby providing a buffer against irregular surges.

The rate of recirculation can be adjusted by the use of adjustable weirs in the final compartment splitter box to suit periods of peak loads and surge conditions. For example an amenity facility can have minimal usage during weekdays and maximum usage at weekends. Going on total recycle during the week will allow the biomass to be maintained at the level required during peak periods.

### FINAL SETTLEMENT

The final settlement tank, commonly known as the Humus tank, is a discrete compartment separate from untreated or partially treated liquor. The design is similar to the primary settlement tank in that the treated liquor flows upwards through parallel plates. The normal design effluent quality is 20mg/l BOD5, 30 mg/l suspended solids. A membrane (Saran) filter or equivalent may be fitted just below top-water level, to further improve the effluent quality to 10 mg/l BOD5, 15 mg/l suspended solids.

The filter is a static design, ie; not powered and set in frames that are easily removable for cleaning. Settled humus is automatically removed to the primary settlement tank via a timed submersible pump (0.48kW, 2-4 min/hour maximum loading).

### SLUDGE STORAGE

Sludge storage is provided in the base of the units. Depending on the load applied, there is approximately

12 weeks capacity provided. Normally, desludging is carried out by suction tanker.

### RUNNING COST COMPARISON

The Kelair Pumps-BMS Blivet packaged sewage treatment plant requires an operator attendance of fifteen minutes per week for a visual inspection and one hour per month for greasing of the bearings, bringing the total labour requirement to two hours per month. Based on a labour rate of \$60.00 per hour this equates to \$840.00 per year. This labour requirement is constant, even when the plant experiences fluctuating loads.

Extended aeration plants require, under normal conditions, approximately fifteen minutes per day operator attendance for equipment checks and two hours per weekend for testing of effluent pH levels, oxygen level and solids settlement. Based on a labour rate of \$60.00 per hour, this equates to \$5915.00 per year. This labour requirement can increase substantially when the plant experiences periods of fluctuating or intermittent loading (a fact of life for most treatment plant).

The electrical requirements of the two plants are typically 10 kW hrs for the Blivet per day and 55 kW hrs per day for the extended aeration plant. Based on an electricity cost of \$0.10 per kW/hr, this equates to \$365.00 for the Blivet and \$2007.50 for the extended aeration plant. If we sum up the running costs per year for both types of the treatment plant, the figures come to:

| Expense                | Blivet Plant | Extended Aeration Plant |
|------------------------|--------------|-------------------------|
| Labour costs per year  | \$840.00     | \$5915.00               |
| Power costs per year   | \$365.00     | \$2007.00               |
| Total per year         | \$1200.00    | \$7922.00               |
| Total cost for 5 years | \$6025.00    | \$39612.00              |

From the above it becomes quite clear that the initial outlay for a treatment plant can be only one cost of the overall operation, especially when one considers that the design life of the Blivet treatment plant is twenty years.