

# Solutions to solvent extraction

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As separation and filtration technologies continue to be studied and improved, compliance with the South African National Water Act 1998 (Act No 36 of 1998) – with reference to prevention and remedying effects of pollution and control of emergency incidents – becomes easier. The Act prescribes the discharge limit to any natural water source to below 2, 5 mg oil/ litre. In order to comply with these regulations, oily-water separation systems must be able to process all three phases of oil in contaminated water. This article deals with hydrocyclone technology in contamination management.

## Hydrocyclone technology: a water management solution

In general hydrocyclone separation, the water/oil effluent enters the cyclone and begins to spin under a centrifugal force which is in the order of 800 to 1 000 times the force of gravity. This force causes the two immiscible liquids (oil and water) to separate.

As the inventors and pioneers of industrial hydrocyclone oily water systems, Ultraspin is the world's largest

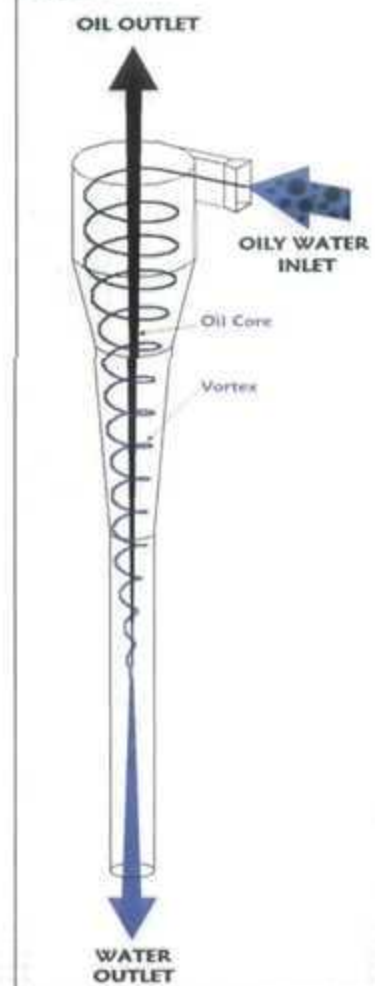
supplier of industrial hydrocyclone oily water treatment systems. The Ultraspin Separator pumps water tangentially into the large diameter end of the separator, which initiates a spinning vortex. This spinning vortex is accelerated as it moves down the tapered separation tube where the heavier (water) phase is forced outward toward the cyclone wall, and the lighter (oil) phase migrates toward the centre core. The separated oil is removed via a hole in the separator end face, and the treated water is discharged out the other end of the tube.

With no moving parts, the process is low maintenance, simple and effective with separation occurring during the 2-3 seconds it takes for the water/oil mix to pass through the cyclone. Effluent can then be recycled for continuous treatment.

## Phases of oil contamination

It is important to note, however, that there are three phases of oil in contaminated water: the free phase, the emulsified phase and the dissolved phase, and each has a specific impact on the

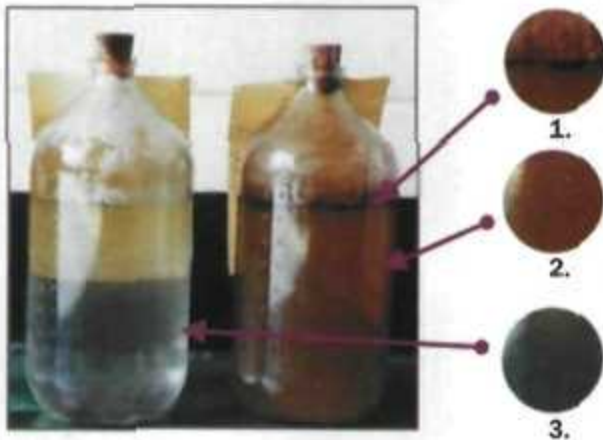
Figure 1



quality of that water. To clean the water, a precise strategy for each phase is required.

The free phase refers to free-floating oil or oil droplets greater than 150 micron, and the oil in this phase can be separated by gravity. The next phase is emulsified oil, and this includes oil droplets between 2 and 150 micron in size, which subsequently requires a separating process that is more powerful than the force of gravity. Finally, the dissolved phase refers to oil droplets that are less than 2 micron, where the oil is physically dissolved in the water. Dissolved oil cannot be treated by conventional gravity and plate pack type systems. (See image below.)

Figure 2: Three types of oil removed



### 1. Free Oil

Free floating oil OR  
Oil droplets greater than 150 micron  
Free oil can separate by gravity

### 2. Emulsified

Oil droplets less than 150 micron AND  
Oil droplets greater than 2 micron  
Emulsified oil must be treated with  
more powerful separator

### 3. Dissolved

Oil droplets less than 2 micron OR  
Physically dissolved in the water  
Dissolved oil will NOT be treated by  
conventional gravity, plate pack type  
systems

Hydrocyclone technology enables the separation of oil from water at any flow rate, from the smaller system that operates at 3.5 m<sup>3</sup>/hour up to and above 1 000 m<sup>3</sup>/hour with specially designed larger systems.

Where traditional oily water separator systems use plate pack mechanisms, which can only guarantee the removal of oil droplets that are greater than 160 micron in size, hydrocyclone technology can achieve a 95% success rate with oil droplets less than 15 micron in size.

### Gravity settling tanks

Simply allowing oil to float to a surface remove separable oil droplets – those that are bigger than 150 micron.

Examples of this technology include API separators, triple interceptors, above ground tanks or collection pits.

The Ultraspin Separator is typically used to remove oil (and suspended solids) from effluent oil waters that collect in a pit or tank. The separated oil and sludge is collected in an oil tank. The treated water is discharged to a sewer or other approved discharge source.

A typical schematic showing this system can be seen in the series of diagrams that follow. Oily water drains from the source into a collection pit, which eventually fills up with oily water. The operator starts manual OS units when the pit is full. The automatic OS units are operated by pneumatic controls that detect pit high and low levels via probes mounted in the pit.

A floating skimmer is used to remove effluent from the pit or tank to the separator. The effluents flow to the pump via a debris strainer on the separator skid. The strainer basket removes large debris and particles. The OS series separators use air powered pumps, which provide the correct pressure to drive the fluid through the separator, which in turn creates the required vortex spin.

The treated water is discharged from the top of the separator. On all models, apart from manual systems, the treated fluid is initially recycled back to the collection pit for a set time, for example, 30 min, after which it is discharged to the sewer (or other approved area).

The separated oil (with some water) is sent to the oil-decant tank. Any excess water is automatically decanted out to be returned to the effluent collection pit for re-treatment.

Figure 3

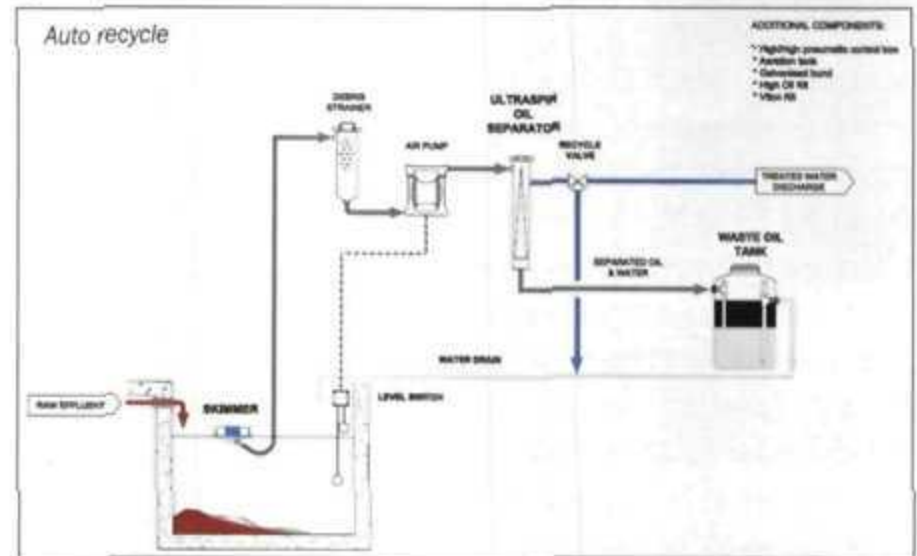


Figure 4

