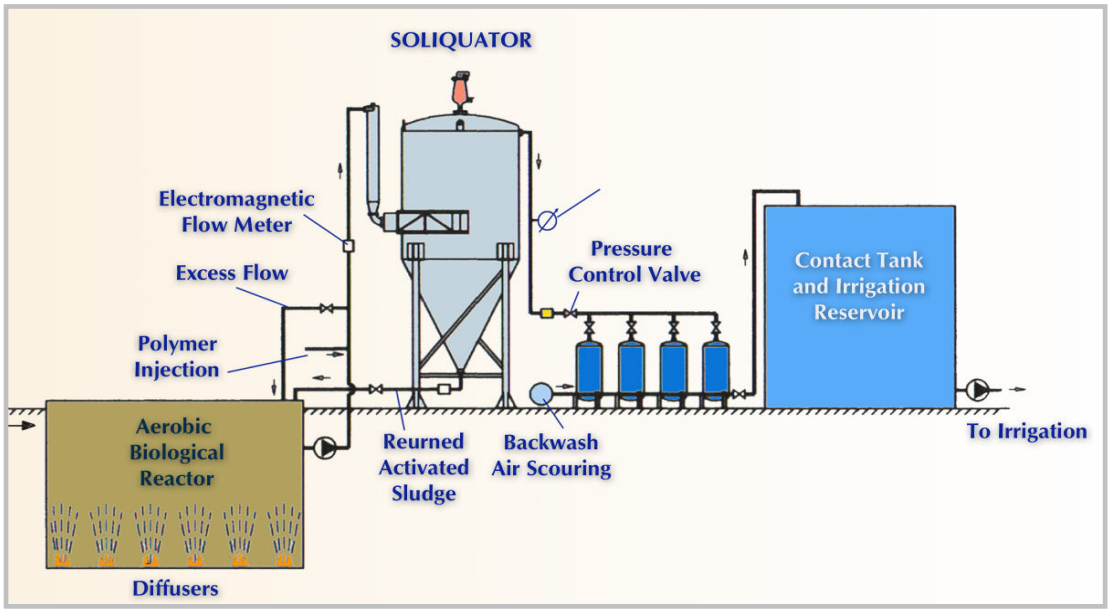
ACSOL®

Industrial Wastewater Treatment Plant



The ACSOL® Treatment Plant is designed to treat the Industrial wastewater and supply safe water for unlimited irrigation.

The ACSOL® Treatment Plant is the result of advanced R&D in ODIS engineering department and it aims to provide an environmentally sound, efficient and cost effective solution.

The ACSOL® Wastewater Treatment Plant is based on standard and customized improved design criteria. Cost-saving technology, simplicity and reliability of performances are its main characteristics.

The ACSOL® **integrates** activated sludge biological treatment with unique solid-liquid separation and clarification *Soliquator*® technology, SEWACLEAR® tertiary filtration and effluent water disinfection for non-limited irrigation.

The ACSOL® Treatment Plant is able to treat wastewater with a variable and broad range of suspended solids, BOD, grease and oil. High technology solutions are utilized in all treatment stages: biological reactor, solid-liquid separation, clarification, deep bed multimedia filtration and disinfection.

The ACSOL® Treatment Plant is fully automatic and all operating modes are controlled and monitored by advanced, PC based, user friendly Hyman Machine Interface system with unique, interactive dialog screens.

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ACSOL®

Industrial Wastewater Treatment Plant

System Description

- **Primary Screening:** takes place in the bar screen strainer
- **Separation of Oil and Grease**
- **Activated Sludge Biological Treatment:** essentially involve a phase in with the water to be purified is brought into contact with a bacterial flock in the presence of oxigen (aeration).
  Air creation system, including air blowers and special diffusers placed on the bottom of aeration tank, causes the air flow into the wastewater to dismantle an organic load.
- **Solid-Liquid Separation and Clarification:** take place in Soliquator® - a proprietary and unique, international patented clarifier. Odis has developed designed and produced this settling unit for high water flowrate and high solid concentrations processing. Advanced process control ensures consistent quality of the treated water filtrate and high solid sludge concentration at the outlet, even under changing conditions of raw wastewater.
- **On-Line liquid polymer grade preparation and injection** by ODIS PP series on-line polymer preparation device - an automatic unit, specially designed to ensure continuous preparation and injection of polymer solution.
- **Returning of Activated Sludge to Aeration Pools:** activated sludge settled in *Soliquator*® is returned back to the aeration pools
- **Multimedia Depth Filtration:** performed by an array of multimedia filters with high depth media bed for final effluent polish at relatively low filtration rate. Effluent water quality less than 1 NTU.
- **Disinfection:** injects hypochlorite to remove all pathogenic microorganisms from the treated water. The disinfecting unit is fully automatic and controlled by residual chlorine controller.
- **Automation and Control:** the system is fully automatic and all operating modes are controlled and monitored by advanced, PC based, user friendly Human Machine Interface system with unique, interactive dialogue screens.

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Main Elements of the System

Wastewater pretreatment

The wastewater will enter the plant through a collecting pipe into a bar screen for rugs, plastics and large-piece separation. The effluent enters then into oil and greases separator.

Aerobic biological treatment

From the oil & grease separator the wastewater enters, by gravity, into the aerobic biological reactor. The reactor is designed as a plug-flow system and is able to support level variations of $^{+}$/- 0.3 m without any damage for the biological process. In this way, the tank is used also as a buffer tank and as a homogenization tank.

The aeration system consists of several air diffusers fed by air blowers under a pressure of 0.6 bar. The diffusers located at the bottom tank as a full floor coverage system, deliver very fine air bubbles that allow a high coefficient of oxygen dissolution in the water.

The air passes through the liquid and generates a very strong mixing effect that assumes the mixing of the wastewater with the activated return sludge coming from the *Soliquator*® array and the homogenization of the mixed liquor in the aeration tank.

In the aeration tank takes place the aerobic biological process in which the bacteria included in the return activated sludge digests the organic matters.

The retention time of the mixed liquor in the aerobic biological reactor is about 30 hours. The mixed liquor travels from the inlet of the tank to the last compartment of the tank which is not aerated in order to create a zone without turbulence from which the mixed liquor is pumped to the *Soliquator*® for solid-liquid separation, effluent clarification and sludge thickening.

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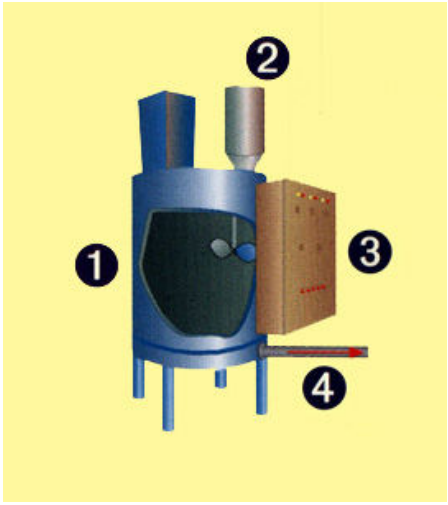
On-Line Chemicals Preparation Device

The polymer is prepared on-line, in the polymer preparation and injection room, located near the control room. The polymer is a liquid grade polymer, which is diluted and mixed in The ODIS PP series On-line Chemicals preparation device.

The PP series On-line Chemicals' preparation device is an automatic unit specially designed to ensure continuous preparation and injection of chemical solution.



The preparation takes place in the process tank (1), where the chemical is dissolved by electromechanical mixer. The grains of chemical are stored in the container on the top of the feeder pipe (2) and dosed to the process tank by special mechanical dosing unit. The prepared solution is fed to the operative tank for injection to the system.

The filtered water is metered on the input.

The injection pump (4) takes the polymer solution from the tank and injects it into the *Soliquator*® feeding line. This injection pump delivers the solution according to the polymer demand in the system, which is controlled by the plant PLC controller (3) and HMI software and the system parameters.

The dosing pump is activated when the *Soliquator*® is in work and stops when it stops.

Level indicators are installed in both tanks to ensure continuous operation.

Soliquator®

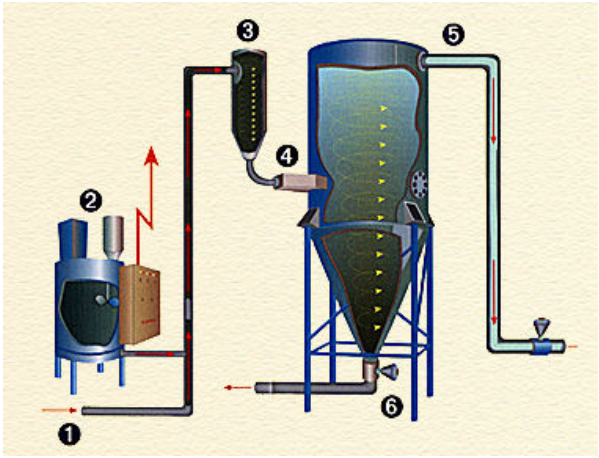
Soliquator® is a proprietary and unique, international patented clarifier, integrating three main functions: flocculation, clarification and settling in the same vessel simultaneously. ODIS has developed designed and produced this unit for high water flow rate and high solid concentration processing.

Advanced process control ensures consistent quality of the treated water filtrate and high solid sludge concentration at the outlet, even under changing conditions of raw wastewater.

Soliquator® is a closed system containing no moving parts.

Operation Principals

Raw wastewater enters the system (1). A polymer preparation and feeding unit (2) injects solution into the inlet pipe. The mixture of water and polymer solution is admitted in a static mixer (3) and fed to the *Soliquator*® through a designated port (4). The *Soliquator*® separates solids from water, collects the sludge at the bottom and discharges the clarified water through an outlet at the top (5) for recycling or for further processing. The concentrated sludge is discharged from the bottom (6) for discharge or further handling.



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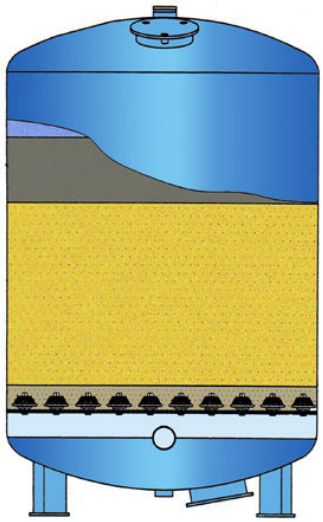
An electro-magnetic flow meter measures the sludge discharge flow, which is regulated by an automatic ball valve, according to the flow calculated by the computer. The flow is steady and proportional to the feeding flow.
The exit pipe conveys the sludge to the aeration tank near the wastewater entering flow or to disposal, according to the program.
From time to time part of the return sludge called aged sludge or excess sludge is evacuated and transported to a discharge field.

Multi Media Filters

The ODIS Multi media filters use combination of media layers as gravel and quartz sand as a bed that captures the suspended matter in the water flowing through.
Multi-media filters (DW series with total media height 1000 mm) use a unique design of a double bottom chamber divided by a welded reinforced steel plate. The upper chamber contains the multi media and the lower chamber is empty and collects the filtered water. The plate is covered by "mushroom" diffusers, which are plastic, slotted conical units. The uniform dispersion of water makes effective use of the whole media volume avoiding the occurrence of channeling or caking. The filter is particularly suitable for back flushing – a process involving reversal of the water flows, causing a turbulent expansion of the media as a fluidized bed. The water flushes out the entrapped debris effectively.



After the back flushing is completed, the filter resumes its normal filtering mode as clean as a new filter. The back flush process is activated automatically by controller or manually according to manufacturer's instructions.

Pressure and Head Loss
Minimum working pressure: 2.5 bar; Maximum working pressure: 8 bar; Check Pressure: 12 bar Head loss after backwash: 0.5 m; Head loss before backwash: 5 m.
The 5 m differential head loss automatically triggers a backwash cycle.

Double-Bottom Chamber

ODIS DW series filters employ a unique design of a double bottom chamber, divided by a welded reinforced steel plate. The upper chamber contains the media; the lower chamber is empty and collects the filtered water.
The plate is covered by "mushroom" filtration nozzles, which are plastic slotted conical units.
The nozzles disperse the water uniformly, effectively

ODIS filtration nozzles model E400-720 Type L

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fluidizing the entire media volume during backwash. ODIS filtration nozzles model E400-720 Type L prevent the occurrence of channeling or caking, thus ensuring long service life and less frequent media replacement.

Chemical Treatment

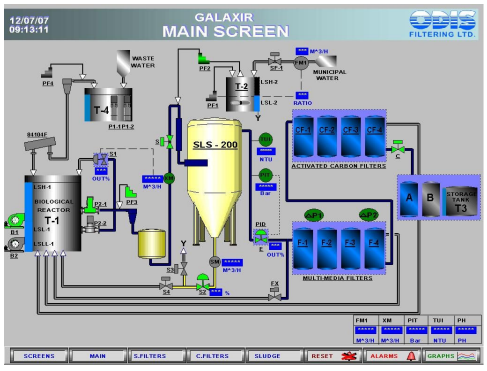
The tertiary water treatment integrates two types of chemical treatment:

- **Coagulant (optional):** Alum (a coagulant) is injected into the raw water in order to destabilize the colloidal matter into flocks.

- **Disinfection (optional):** Chlorine (a disinfectant) is injected at the end of the process in order to kill harmful pathogenic microorganisms and supply disinfected drinking water

Automation and Control

The ACSOL® Wastewater Treatment Plant is fully automatic and all operating modes are controlled and monitored by advanced, PC based user friendly Human Machine Interface (HMI) system with unique, interactive dialogue screens.



The control system includes:

- Control panel with the PLC, breakers for all 220/380 volts motors and associated electronics controls
- Turbidity meter monitor electronic panel with display of the turbidity of the *Soliquator*® effluent
- PC station with equipped with user friendly Human Machine Interface software, with unique, interactive dialogue screens.

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Air Control Quality

The Kenitrol valves positioners must receive dry clean air of control quality. Refrigerated air cooler microfilters and mist separator are installed on the compressed air feeding line to ensure a good air control quality.

Control Process Description

The system process is entirely controlled by the PLC and PC computer.

Before starting the system, the operating parameters must be defined and loaded into the operation screens through the PC. The principal parameters and their allowable limits are fixed on each screen by the operator.
From this point, the system operates completely automatically
Four loops of automation work are presented:

1. Feed Flow and Turbidity

The flow meter activates the positioner valve, which regulates the influent flow between the allowable limits. Influent flow value is sent to the computer. At the same time the turbidity meter checks if the turbidity value is within the allowable preset limits. If not, the feeding flow is corrected according to a special program, in order to maintain the turbidity level at the wanted value.

2. Sludge Extraction

The sludge volume to be evacuated is calculated by the computer according to a formula that takes into account the solids concentrations in the mixed liquor, in the effluent and in the sludge. According to the fixed parameters and the monitored values, the formula calculates the sludge exit flow and the sludge volume to be extracted from each *Soliquator*®.

2 options of sludge extraction control:

a) By batches - The Sludge extraction is performed each time that a calculated volume D of mixed liquor enters the system. Valve S2 opens and extracts from the *Soliquator*® the prefixed value V of sludge which is metered by the flow meter.

b) By percents - The sludge extraction may be extracted at a continuous flow proportional to the feeding flow according to the percentage calculated by the formula.

A single click on the operation screen formula allows handling the sludge evacuation by calculated batches or by percent of the flow-in. In both two options, the sludge evacuation is controlled by flow meter and valve S2.

3. Pressure Control

The pressure gauge measures the pressure inside the *Soliquator*® and adjusts it to the prefixed limits by acting on valve E.

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4. Polymer Injection Control

The flow-meter measures the influent flow and according to the changes adjusts the quantity of polymer to be injected to the *Soliquator*® line.

There is an interaction between the loops, and the program takes this into account and corrects the values according to the operating conditions and prefixed parameter values.

The program also handles the special situations and reacts rapidly in emergency cases.

Automatic Operation of the System

When the basic parameters are inserted into the program registers, they appear on the computer operation screens - the system is ready to operate.

For the start-up run, most of the parameters are estimated values. These values will be adjusted more accurately during the first days of operation by checking results such as:

- Turbidity versus suspended solids in effluent.
- Capacity allowed, compared with turbidity fluctuations.
- Pressure influence on the process.
- Sludge evacuation speed versus sludge concentration, and etc.

Corrections are made to the operating parameters through the computer screens.

Electrical Connection: Three phases; voltage and HZ – as defined by client.

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Connecting Accessories

The ACSOL® Wastewater Treatment Plant elements are connected with manifolds and couplers made stainless steel or plated carbon steel, which are shot blast cleaned, phosphatized and lined with extremely corrosion proof polyester electrostatic spay. The connecting accessories employed by ODIS, produce user-friendly system, which requires minimal maintenance, are easily disassembled / reassembled and are designed for long lasting operating life.

Electrical Equipment

All the electrical and electromechanical equipment including the required switchboards, sub-boards, control and indicating panels, electric motors, starters, cables, etc., are supplied ready for operation.

The electrical and electromechanical equipment incorporated in the ACSOL® Wastewater Treatment Plant is manufactured in accordance with the standards and codes of IEC or VDE and with the other relevant standards and codes.

The electrical equipment is of standard heavy design, suitable for operation under the existing climatic conditions and the duties set out in this specification.

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