Why Choose a DAF for your Wastewater Treatment?

There are many different types of industries manufacturing a diverse range of goods in today's economy. Many of these industries are dependent on processes that produce wet waste as a result of their manufacturing and sanitary practices. Industrial wastewaters can contain significantly high concentrations of Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), as well as Fats, Oils and Grease (FOG). Some industrial waste streams may even contain heavy metals and toxic materials, and a pH that can be out of acceptable range.

Where municipal treatment works have the load capacity to accept the industrial wastewater, the city or town may work out a surcharge agreement with the industrial customer, charging them a fee corresponding to the volume and strength of the wastewater being discharged.

BOD and TSS surcharges are typically charged by weight (Kgs or lbs) when over limit. FOG's and pH, however, are often not accepted from the city and can force a violation or even a shutdown.

Industries can save money on surcharge fees and avoid violations with pre-treatment by installing an H2Flow Dissolved Air Flotation System (DAF). A properly functioning DAF with a suitable chemical program can eliminate 95% or more of FOG, TSS and insoluble BOD. While a DAF system can prevent the pH and FOG violations, it may only reduce the BOD and TSS surcharges to an acceptable level, rather than eliminate them altogether.

BOD is comprised of a soluble portion and an insoluble portion. A DAF, or any primary treatment system, can only remove the insoluble portion of BOD. If further BOD reduction is required, a biological process is necessary. Also, some municipalities require ammonia or Total Nitrogen removal before accepting any wastewater. H2Flow provides a variety of biological systems and can supply to plants discharging to surface water or land, or those who need to remove BOD/NH3/TN down to the provincial/state regulations.

DAF Summary and Benefits

- Excellent for removal of TSS, FOGs and insoluble BOD
- Standard systems include pH adjustment
- Requires a chemical program to maximize efficiency
- Works on the well-established coagulation and flocculation principles
- Micro air bubbles are used to maximize the speed and efficiency of separation
- Moderate capital costs
- Faster than settling
- Smaller footprint than conventional clarifiers
- Easy maintenance

With proper chemistry, a DAF system can remove more than 95% of TSS, FOGs, and insoluble BOD!

H2Flow DAF System Process Description

The H2Flow DAF process starts with wastewater collecting in a lift station or sump pit. From there it is pumped into a screen to remove large solids, protecting all the downstream equipment. The effluent from the screen enters an equalization tank to homogenize the flow; preventing process upsets from reaching the DAF. Wastewater is then pumped through a pipe flocculator, where chemicals are added for coagulation, flocculation and pH control. The wastewater, now separated from most of the FOG and TSS, enters the DAF. With the help of the micro air bubbles, the separated solids (sludge) float to the top and are skimmed off by a raking mechanism. The sludge is pumped to a holding tank where it can be hauled away or dewatered. The effluent from the DAF drains/pumps to the city sewer (or further treatment).

A complete DAF system normally includes the following:

1) Lift station / Pumping / Level control
2) Rotary screen
3) Equalization tank / Mixing / Level control
4) Feed pumps
5) Flowmeter
6) Chemical addition (pH adjustment, coagulation, flocculation)
7) In-line pipe flocculation or mix tanks
8) Dissolved air flotation (DAF) unit
9) Sludge pumping
10) Sludge storage tank / Level control
11) Central PLC control panel to run the complete system
12) Additional treatment steps as needed (sludge dewatering, biological, etc.)

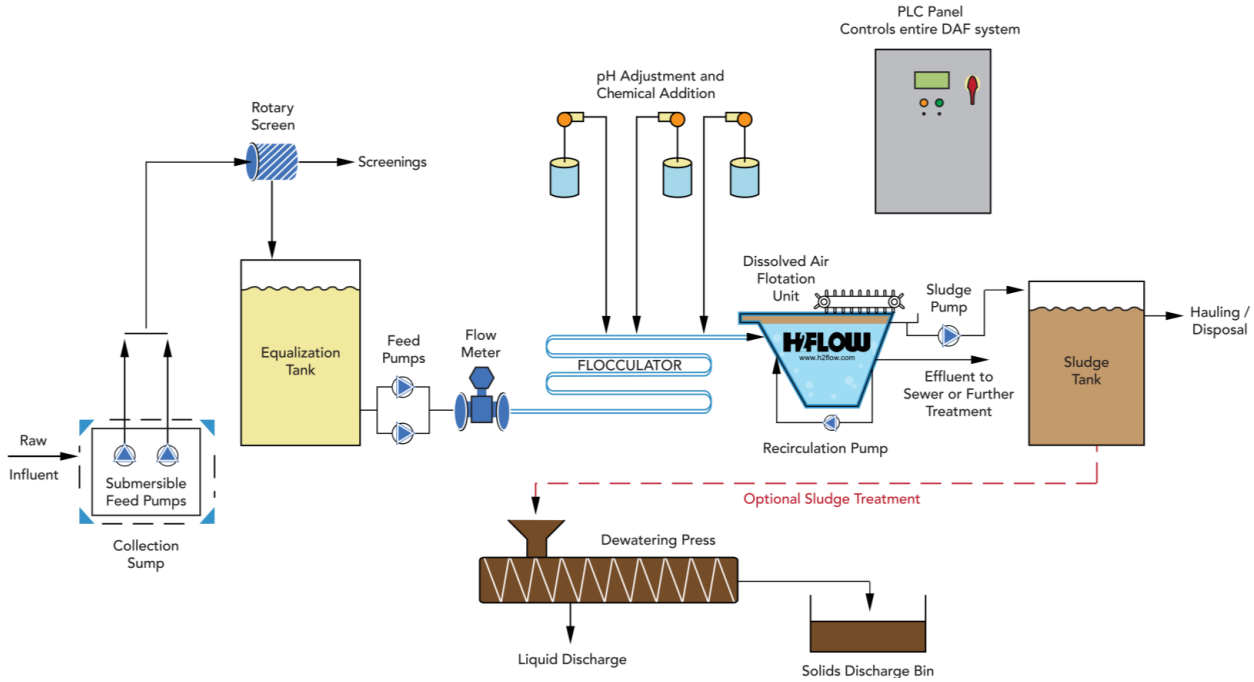


Figure 1: Typical H2Flow DAF process flow diagram

Standard Component Descriptions

1. Lift Station

The lift station collects wastewater from various locations throughout the facility into one pit. The lift station can use submersible or self-priming pumps to discharge the wastewater. H2Flow supplies VFDs and multiple level controls to ensure optimal operation. The wastewater can contain various solids, therefore the wastewater is pumped to a screen. If screening can be done before the pit, that is even better.

2. Rotary Screen

Figure 2: Rotary Drum Screens

A rotary screen is a significant and often overlooked, part of a successful DAF system. The screen prevents unwanted solids (large inorganic debris) from continuing downstream, protecting rotating equipment and pipes from damage or plugging. The DAF is meant to treat insoluble BOD, suspended solids, colloids, and FOGs. It is not designed to remove small pieces of gloves, wood from pallets, hair nets, ear plugs or other items that end up down the drain. A well-designed screen reduces maintenance time and increases the life of the downstream equipment.

3. Equalization Tank and Mixing

Due to process variations and upsets, equalization with sufficient residence time and mixing is the best way to ensure DAF treatment quality is consistent. Equalization needs to be matched to the peak output flow of the plant, ideally to be able to capture the high and low flows and balance them out with a more consistent, homogeneous blend. An equalization tank with 4-8 hours of retention time is common, with as much as 12-24 hours or as little as 2 hours. If adequate equalization is not possible due to space constraints or other factors, the DAF system can include a chemical optimization system to add a real-time water quality correction factor to the chemical dosage.

4. Feed Pumps

From the equalization tank, feed pumps are used to pump the wastewater on towards the DAF unit. The pumps can be centrifugal type mounted outside the tank, or submersible mounted inside the tank. H2Flow can supply variable frequency drives (VFD) to modulate the pumps based on the level in the tank.

5. Flowmeter

The flowmeter indicates how much flow is passing through the system, as well as an accumulated volume. The reading from the flowmeter is sent to the PLC and is used to regulate chemical feed, as well as start/stop equipment.

6-7. Chemical Addition / Pipe Flocculator

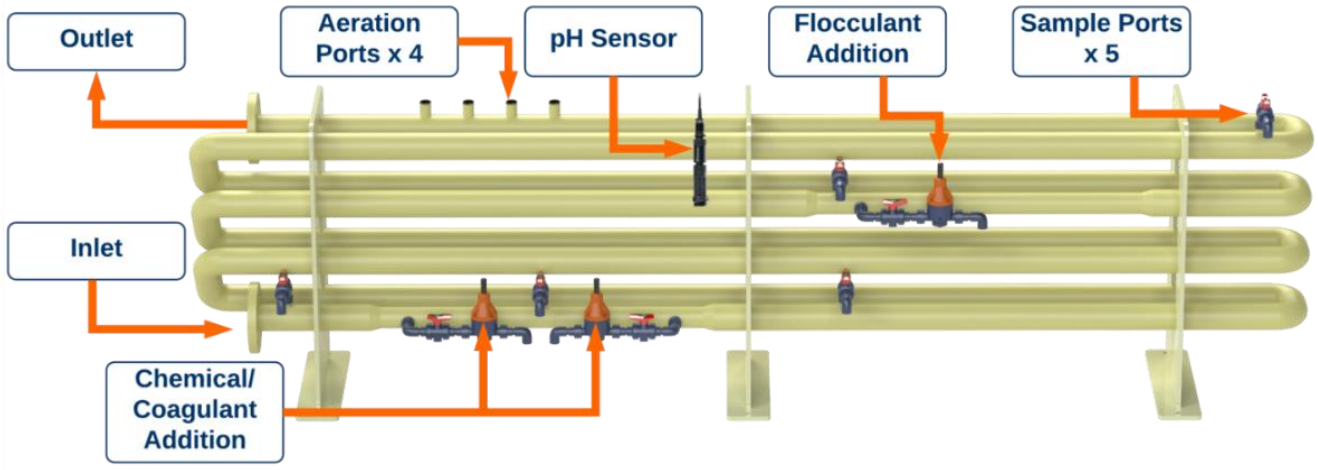


Figure 3: Pipe Flocculator Unit

Unlike conventional tanks and mixers, the pipe flocculator uses kinetic energy from the wastewater flow to mix the chemistry inline. Since sufficient mixing energy is required, each pipe flocculator operates at a specific flow range. Pipe flocculators can reduce chemical usage due to the high mixing efficiency, and increase the ease of chemical optimization due to the short residence time and various sample valves.

The pipe flocculator combines mixing zones, chemical injection ports, sampling ports, pH sensor fittings, aeration ports, and flocculation zones all into one compact unit. The material of construction is HDPE and provides resistance against corrosion and abrasion. It is manufactured using external welds to ensure that the interior surface is completely smooth and does not disturb the fluid velocity profile.

8. Dissolved Air Floatation Unit (DAF)

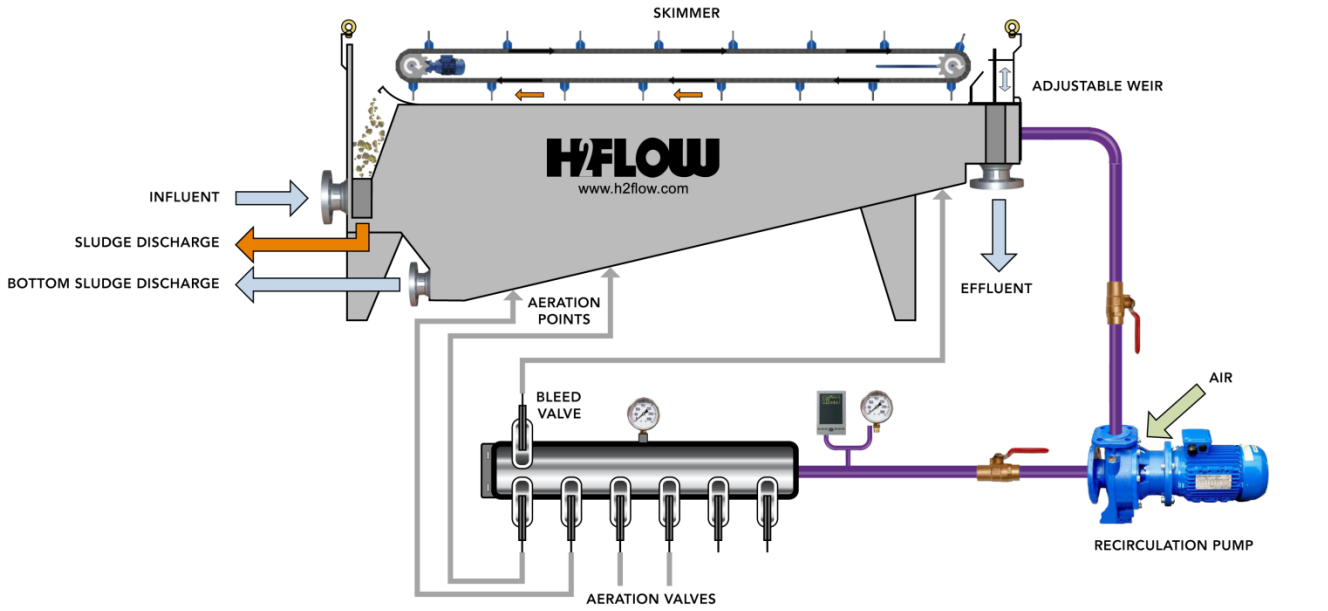


Figure 4: DAF schematic

The DAF is a liquid/solids separation system based on the coagulation and flocculation principle. The DAF primarily consists of a stainless steel vessel, an air delivery system, a sludge skimmer, a recirculation pump, a stainless steel saturation tank, distribution valves, and hoses.

Before the wastewater enters the DAF, it undergoes chemical treatment. The chemical program is different for every plant, but the general rules stay the same. The first step is to add a coagulant chemical. A metal salt like Alum or Ferric is used to destabilize the colloids and suspended solids in the wastewater. Next is a pH adjustment to meet the effluent range and provide efficiency for the coagulant. After that, the coagulant needs residence time to mix and create what is known as ‘pin floc’ or small particles. The pipe flocculator is designed to achieve the mixing in a small footprint.

Lastly, a polymer is added to collect the small pin flocs and create much larger flocs. The polymer is shipped in a dormant state emulsified in oil to extend shelf life. The polymer requires activation before usage. A polymer make-down system is used to achieve this. The activation process involves shearing the polymer and wetting it on all sides while using a two-step high initial mixing energy, then lower speed mixing to complete the process. The activation process creates long chains with many active sites for the pin-floc to attach. The pipe flocculator allows the required residence time for the flocculant to mix and ‘flocculate’ the wastewater. Next, the mixture enters the DAF.

In the DAF, a fraction of the treated effluent is pumped back into the front of the DAF via a recirculation system. Pressurized air is injected into the recycle loop, creating a saturated air/water mixture. The saturated mixture stores in a tank before it evenly distributes into the body of the DAF through various distribution nozzles. When released, the air escapes and forms micro-bubbles in the 30-50µm range, essential for attaching to larger solids and floc. The flocs, now combined with micro-bubbles, have a dramatically increased buoyancy and float rapidly to the surface, creating the sludge layer. Without the

air, the flocs would take a very long time to settle since they are usually neutrally buoyant or just slightly heavier than water.

The sludge layer is removed with a skimmer system and collects in a sludge compartment for discharge. While the floating solids are skimmed off, the clean treated water flows under a weir and out through the effluent compartment. The heavy solids, if present, sink to the bottom of the DAF and are discharged by an automated sediment valve which opens periodically.

9 -10. Sludge Pump / Sludge Holding Tank

The sludge from the DAF is pumped to a DAF sludge holding tank that is sized depending on the amount of sludge produced, and the amount of space available. The tank is fitted with various outlets at different heights to allow for decanting of excess water. The sludge tank has an analog level measurement, a back up high-level float switch, and an overflow pipe. If the sludge tank reaches the high-level, there is an option to sound an alarm and to shut-down the entire WWT plant if necessary.

11. Central PLC Control Panel

Figure 5: H2Flow PLC control panel with HMI

The PLC Control panel houses all of the power supplies, VFDs and motor starters for the DAF system providing a single electrical connection to external power (may not include existing/additional equipment). Allan Bradley PLC is our standard, Schneider and other brands are also available.

The PLC program is customized to a specific site modelled after the H2Flow DAF process control logic. Full automation of the plant is available at the touch of a button. Panels have the option to include remote control, e-mail/SMS notifications, and data-logging. With data being more and more critical, especially for reporting to the municipality, data-logging is quickly becoming a standard among systems. H2Flow provides a web-accessible interface to easily communicate with the PLC requiring no additional software or monthly fees (unless cell service is required).

12. Additional Treatment Steps / Optional Components

12.1 Dewatering Press

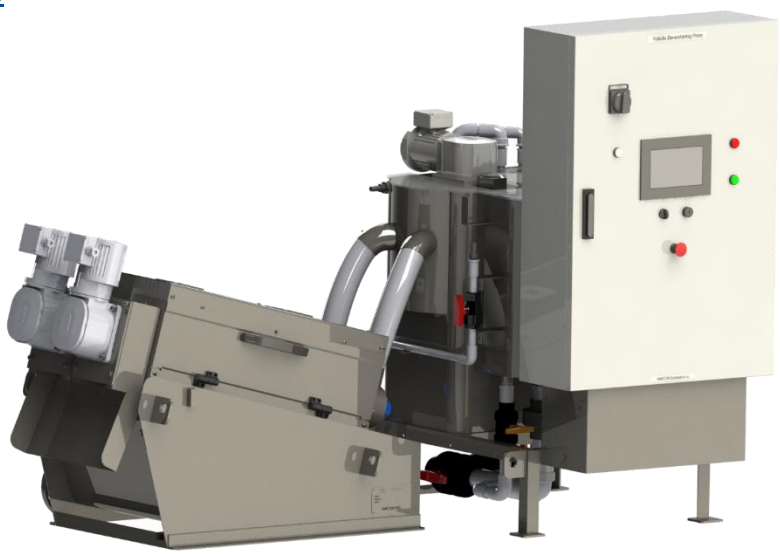


Figure 6: Dewatering Press

Our Standard dewatering press is a screw press design. The dewatering press can reduce sludge volume by 3 to 5 times. It also changes the nature of the sludge from a liquid to a solid. This sludge can transport to a landfill rather than by a vacuum truck.

The sludge removal costs are usually the highest operational costs of a wastewater plant. Adding dewatering can reduce this cost and increase the ROI of the entire plant. Due to the additional capital requirements for dewatering, it may not be possible during the initial phase of the plant, but space allocation for future expansion is highly advisable.

12.2 Chemical Optimization System

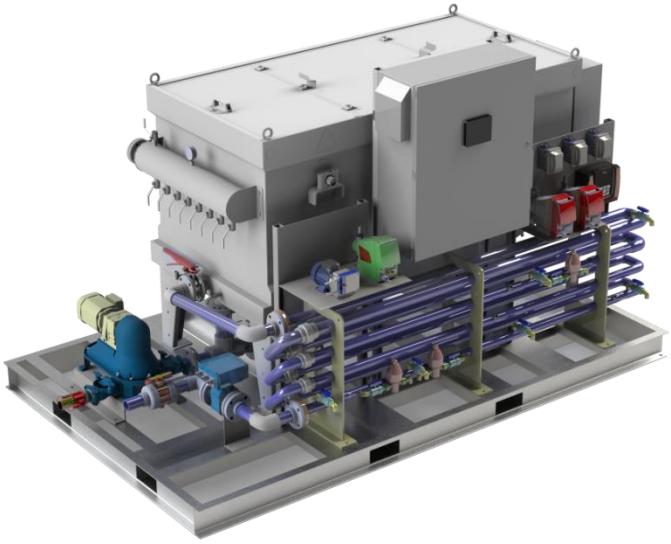
The chemical optimization system includes monitoring sensors for detecting solids and organics in the wastewater. From the data, the system outputs a signal indicating water quality parameters, BOD and TSS, in real-time after an initial calibration.

The output is then used to add a correction factor to the chemical feed rate based on water quality, and not just flow (standard for all our systems). This approach allows for real-time measurement of parameters in the effluent and reduces the chemical dosage during times when the wastewater is relatively clean (i.e. CIP, or sanitation). Chemical optimization improves the efficiency of the treatment process as well as provides cost savings on chemicals while maintaining a high-quality effluent.

12.3 Effluent pH Monitoring and Recycle

Additional pH monitoring ensures that the effluent from the DAF stays within the city regulated pH range. Sometimes during a start-up or after an extended shutdown, the pH of the effluent may be out of range for a short time. This system measures the pH continuously and can divert out-of-range water to the equalization tank or the lift station to be re-treated. The logic includes exceptions for when the tanks are full as to prevent an overflow.

12.4 DAF Pilot Systems



DAF treatment technology is easily piloted on site to confirm treatment results. Piloting is highly recommended for unusual applications to determine the treatability of the water. Results from pilot tests can be utilized to design a full-scale system effectively. H2Flow provides a variety of pilot systems for a range of flows up to 20m^3/hr. Containerized units are popular since they can be installed outdoors, but where space is an issue the 5m^3/hr Delta skid mounted unit can fit into tight spaces. Systems come with interconnecting electrical wiring and a Pilot PLC program pre-installed. Connection to wastewater and utilities is all that is required on site.

H2Flow Equipment Services

H2flow can provide a complete treatment system with all the above components, supplied by a single, experienced and reliable source. H2flow has been supplying DAF systems for over 20 years. H2Flow also provides service packages and offers ongoing support from skilled technicians and engineers for all systems.

ASK H2FLOW FOR MORE INFORMATION OR A QUOTE!