



Aries Dissolved Air Flotation (DAF) System

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Function and Application

Dissolved Air Flotation (DAF) is an extremely effective process used for the separation of suspended solids and oils from water. The introduction of air bubbles to the DAF influent causes suspended particles to float to the top for removal. This technique is especially effective in the pretreatment of process wastewaters containing solids that have a tendency to float. DAF clarification generates sludges with much greater percent solids than does gravity clarification. The Aries DAF has a flocculation section which provides optimal chemical pretreatment for pH control and flocculation. A coagulant, when needed, is fed into the DAF influent pipe. Air bubbles are formed utilizing the recycle pressurization method. This method supersaturates a portion of the clarified effluent, creating an optimally sized bubble for attachment to the suspended solids.

Listed below are a few of the applications in which a DAF system is efficient and cost effective.

Aircraft Maintenance	Fly Ash	Produce Water
Algae Removal	Latex and Rubber Industry	Pulp and Paper Mills
Automotive Industry	Meat Packing	Refinery
Bakery Waste	Mining	Rendering
Ballast Water	Paint Waste	Seafood Processing
Canning	Pet Foods	Slaughter House
Chemical Processing Plants	Pharmaceutical	Tank and Truck Cleaning
Dairy Industry	Potato Processing	Tanning
Fiber Recovery	Poultry Processing	Textiles

Pretreatment of wastewater with a DAF system efficiently lowers total suspended solids (TSS), oils and greases, BOD, and metal concentrations. It often is cost effective to employ a DAF prior to a biological treatment in order to reduce BOD loading.

Aries Equipment Engineers can custom design and manufacture a DAF pretreatment system for your specific application.

Typical Removal Efficiencies

Typical primary chemical/physical treatment with DAF technology reduces pollutants in wastewater significantly. The use of chemical coagulants and flocculants are often necessary to achieve high removal efficiencies.

Pollutant	Removal Efficiencies
TSS (total suspended solids)	70% - 98%
BOD (biochemical oxygen demand)	40% - 60%
O & G (oil and greases)	80% - 95%
Metals	70% - 95%

Process Description

Dissolved Air Flotation System Operation

Air, in the form of fine bubbles, is introduced to the wastewater and adheres to or traps waste particles. This increases the buoyancy of the particle-bubble complex and allows the particle to float with the bubble to the surface of the wastewater. Separation by flotation does not depend as much on the size and relative density of the particle as it does on the surface properties.

Chemical pretreatment using pH control, coagulation, and flocculation can optimize these surface characteristics. pH control is utilized to manipulate the influent to the optimum level for flocculation. Coagulation neutralizes the charge on the individual particles, canceling the existing repulsive forces between them. The coagulant is fed into the influent pipe and the pH control chemicals and flocculant are fed into the flocculation section. Flocculation involves the addition of a long-chain polymer, which causes the particles to connect together and form larger flocs. A variable speed picket fence mixer is utilized in this section to provide optimal mixing conditions.

The recycle pressurization method is responsible for adequate loading of air bubbles into the system. A calculated percent of the clarified effluent is pumped through a special design centrifugal pump with ambient air induced into the pump suction. The higher pressure (~100 psi) allows the water to absorb the air and become supersaturated. The supersaturated recycle stream travels through a pressure regulating valve near the flotation chamber of the DAF system. A pressure drop occurs due to the valve, releasing the air from the water in the form of 30 µm micro bubbles. The free air is now capable of combining with the waste particles thereby adding buoyancy for rapid flotation of the suspended matter.

Once the particles float to the surface of the water, a chain driven flight skimmer is employed to remove the sludge, or “float”. The flights are sufficient in weight to squeeze the sludge as it carries the float over the beach to the discharge trough, aiding in dewatering.

Recycle Pressurization System

The effectiveness of the Aries DAF is largely due to the design of the recycle pressurization system. One open impellor high head capacity centrifugal pump typically recycles a portion of the clarified effluent flow while providing the system pressure necessary for the air dissolving physics. This system works on the principals of Henry’s Law of Partial Pressures.

Compressed air is introduced via an air flow meter into the discharge of the centrifugal pump prior to the air dissolving chamber. The centrifugal pump provides high energy air/water mixing to make the solution of air into the water phase rapid and efficient. Coarse air bubbles separate to the top of the chamber and are bled out of the system. This system achieves greater than 90% air solution efficiency.

This recycled stream flows to the DAF influent distribution header where it is depressurized and the air is released as microbubbles. The air that was dissolved in the recycle pressurization system becomes insoluble when it passes through the diaphragm valve and the pressure drops. This recycle stream mixes with the flocculated waste stream where the fine bubbles attach to the suspended solids causing rapid liquid/solids separation in the DAF the liquid/solids separation (clarification) zone.

The Recycle Pressure Regulating Valve is located prior to the chemically treated wastewater/recycle flow mix point. This regulating valve creates the backpressure necessary for air solution to occur. At the interface of the wastewater and the recycle flow the DAF flow distribution header allows for complete bubble to solids contact. The distribution header is used in conjunction with a baffle to distribute flow into the liquid/solids separation zone while dissipating kinetic energy.

Sludge Removal

The low maintenance sludge flight mechanism utilizes a Polymeric chain system with the head shaft driven by a Browning mechanical speed reducer with roller chain and sprockets. Flights constructed of 304SS with chemical and heat resistant wipers drag the float over the beach and into the sludge sump. The weight of the flight system is sufficient to provide a squeezing effect at the beach as the flight carries the float over the beach to the discharge sump. Dual set point timers in the control panel allow the operator to determine the best setting for specific removal requirements. Control of the float depth via effluent weir plate adjustment is also important for optimizing float concentration. These features allow for maximum thickening of the sludge prior to removal from the DAF system.

An automatic sludge transfer system with a level control device pumps the sludge from the sludge section into sludge holding tanks. The controls operate a solenoid valve on the compressed air supply to the double air diaphragm sludge pump.

Treatability Study Services

To determine the feasibility of an Aries DAF for your process or application, Aries may provide bench scale jar testing to determine removal efficiencies and floatation characteristics. Selection of a cost effective chemical program can also be provided. Our evaluation of your wastewater samples allows Aries to determine several DAF design variables. Upon testing completion you will be sent a lab report outlining the benefits made possible by adding a DAF to your treatment system. Aries pilot scale DAF clarifier is available for on site treatability studies.

Standard Equipment

Flocculation Tank with Variable Speed Drive
Heavy Duty Construction Utilizing Epoxy Coated Carbon Steel
Non-corroding Sludge Flights with Programmable On/Off Cycles
Pressure Recycle System
Automatic Sludge Transfer System
Control Panel with Nema 4 Enclosure and Allen Bradley Components

Equipment Options

pH Control System
Serpentine influent/chemical mixing header
Sludge Screw Auger to Assist Removal of Settled Solids
304SS or 316SS Construction
Chemical Feed Systems
Turbidity Monitoring
Rapid Mix Section
Feed Pumps, Sludge Pumps
Sludge Tanks and Dewatering Presses
Complete System Design and Fabrication Capabilities
Turnkey Installations

**Aries Equipment Systems
DAF-100 Clarification Assembly**

