TECHNICAL NOTES

How DAF Works

How DAF Works

How Dissolved Air Flotation (DAF) Works

Wastewater clarification via Dissolved Air Flotation (DAF) is a highly effective water treatment process used to remove suspended solids, oils, greases (FOG), and other contaminants from industrial and municipal wastewater. Unlike gravity sedimentation (which relies on particles sinking), DAF uses microscopic air bubbles to float contaminants to the water surface where they can be skimmed and removed from the water. https://www.panamenv.com/dissolved-air-flotation-daf/pdaf-plate-dissolved-air-flotation/

DAF is widely applied in industries such as food processing, oil & gas, pulp & paper, chemical manufacturing, and desalination pretreatment. The basic principle DAF works on is buoyancy enhanced by microbubbles.

Pan America Environmental's advanced PD DAF systems include lamella plates and enhanced contact zones for even higher efficiency and smaller footprints.

- Air is dissolved into a portion of the treated water under high pressure (typically 4–6 bar / 60–90 psi) and recycled to the DAF inlet to be mixed with the incoming flocculated materials.
- When this pressurized water is released into the flotation tank at atmospheric pressure, the dissolved air comes out of solution as millions of microscopic bubbles (30–100 microns in diameter).
- These microbubbles attach to suspended particles, flocs, oil droplets, and other contaminants, reducing their overall density so they rise rapidly to the surface.
- The floating layer (called "float," "froth," or "scum") is skimmed off, while clarified water is collected from the bottom.

This process is governed by Henry's Law, which states that the amount of gas dissolved in a liquid is proportional to the pressure of the gas above the liquid.

Step-by-Step Process: A complete DAF system generally follows these stages:

1. Pre-treatment and Chemical Conditioning
   Raw wastewater enters and is often screened to remove large debris. Coagulants (e.g., ferric chloride, aluminum sulfate) and flocculants (polymers) are added in mixing tanks to destabilize colloids and form larger, easier-to-float flocs. pH adjustment may also occur here.
2. Air Saturation (Recycle Stream)
   Approximately 10–30% of the clarified effluent is recycled through a recycle pump into a pressurized saturation vessel (air drum or saturator). Compressed air is introduced, dissolving into the water under pressure.
3. Bubble Formation and Contact
   The air-saturated recycle water is injected into the inlet of the flotation tank through a pressure reduction valve or nozzle. The sudden pressure drop causes the air to precipitate as fine microbubbles ("whitewater"). These bubbles mix with the incoming flocculated wastewater in a contact zone.
4. Flotation and Separation
   Bubbles attach to the flocs and particles. The bubble-particle aggregates rise quickly to the surface, forming a thick float layer. Some heavier solids may settle to the bottom for periodic removal.
5. Sludge (Float) Removal
   Mechanical skimmer continuously or intermittently remove the float layer. The collected sludge is sent for dewatering or further treatment.
6. Clarified Effluent Discharge
   Clean water exits from the launder located at the top effluent end of the DAF tank and proceeds to discharge or further treatment.

DAF Process Flow Diagram showing chemical pretreatment, air saturation tank, contact zone, flotation zone, skimming, and clarified effluent.

6007 S. Railroad Street Burlington, WI 53105 USA 262.716.0105 technical@panamenv.com.
©1991-2026 www.panamenv.com a Pan America Environmental, Inc. brand

Key Components of a DAF System

- Flotation Tank: Rectangular or circular vessel with inlet distribution, contact zone, and separation zone.
- Recycle Pump and Saturator: Pressurizes and saturates a portion of effluent with air.
- Air Compressor: Supplies compressed air to the saturator.
- Chemical Dosing System: Coagulant and flocculant preparation and injection.
- Skimmer Mechanism: Removes floating sludge.
- Bottom sludge hopper or auger: For settled solids.
- Controls: Level sensors, pressure gauges, flow meters, and PLC automation.



Advantages of DAF

- High removal efficiency for oils, greases, and fine suspended solids (often >90–95%).
- Faster separation than sedimentation (smaller footprint).
- Produces drier float sludge (less water content).
- Effective for low-density particles that do not settle well.
- Can handle variable loads with proper chemical conditioning.
  Typical Applications
- Food & beverage wastewater (dairy, meat, poultry, brewing)
- Oil & gas produced water
- Pulp & paper industry
- Chemical and pharmaceutical effluents
- Municipal water treatment (algae removal)
- Pretreatment before biological or membrane processes
  kelvinwatertreatment.com
  Another Process Schematic illustrating the flotation tank, air drum, recycle loop, and skimming system.Factors Affecting Performance
- Proper chemical dosing and flocculation
- Bubble size and quantity (optimized recycle rate and pressure)
- Hydraulic loading rate
- Temperature and pH
- Type and concentration of contaminants
  Pan America Environmental's advanced DAF systems include lamella plates and enhanced contact zones for even higher efficiency and smaller footprints.
  This document provides a comprehensive yet accessible overview of Pan America Environmental PD DAF technology. For site-specific design, performance data, or custom sizing, consult with Pan America Environmental, Inc.

6007 S. Railroad Street Burlington, WI 53105 USA 262.716.0105 technical@panamenv.com.
©1991-2026 www.panamenv.com a Pan America Environmental, Inc. brand