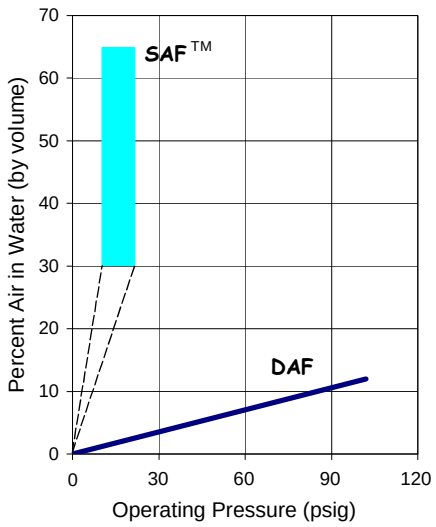
WHY SAF™ REPLACES DAF

SAF™ (Suspended Air Flotation™) by Heron Innovators uses an externally-generated bubble suspension with high air content. Each bubble is covered with a chemically active film which strongly attaches to the flocculated solids in the wastewater, achieving high rate and efficient flotation. DAF (Dissolved Air Flotation) uses high pressure to dissolve a small amount air in water with no chemically active agent, and depends on physical entrapment and a weak surface bond to float the flocculated solids.

SAF™ is re-writing the book on flotation technology, replacing DAF as the method of choice for removal of suspended solids from wastewater.



Here's why:

1. ***SAF™ is smaller than DAF.***
Small equipment footprint is highly desirable, even necessary, in most applications. SAF™ flotation tanks are less than 20% as large as DAF tanks for the same treatment rate. This is because the SAF™ process operates at 10 times the hydraulic *and solids* loading rates of DAF – 10 gpm per square foot hydraulic loading rate *and 10 lb/hr per square foot solids flux*. Two factors account for this:

   a. *The volume fraction of air contained in the SAF™ air suspension is **40%**, 20 times the volume fraction of air in DAF recycle flow.* Therefore, the extra water volume added to the flotation tank in a SAF™ system is only 1 or 2 percent of the wastewater flow rate, compared with 20% to 500% of the flow rate for a DAF. This means that virtually no flotation area is wasted on recycle flow containing only dissolved air and no suspended solids.

   b. *The chemically active film on the SAF™ air bubbles attaches much more strongly to flocculated wastewater particles than plain air bubbles.* Each coated suspended bubble binds electrostatically with polymer molecules of opposite charge on the flocculated solids, forming a much stronger bond than is possible with a plain air bubble. Experience with many wastewaters has shown that an air-to-solids percentage (weight to weight) of **1%** is sufficient for treatment for solids of practically any concentration, compared with a minimum of 2% for a DAF, rising to as much as 15% for applications with suspended solids concentrations 2,000 mg/L and higher. This translates directly into a better and better footprint advantage for SAF™ over DAF for applications with higher and higher solids concentrations.

2. ***SAF™ uses less power than DAF.***
Using a surfactant in the process of generation of the MicroFroth™ microbubble suspension radically reduces the power consumption per unit of air delivered to the flotation tank. One gpm of MicroFroth™ generated at approximately 20 psi contains as much air (by weight) as about 8.5 gpm of DAF recycle flow pressurized to 60 psi. Since power consumption is proportional to both flow rate and pressure, this gives SAF™ a power advantage of 8.5 x (60/20) = 25.5 over DAF. Multiply that by at least 2 again because SAF™ flotation takes half (or less) as much air as DAF, and the power advantage rises to over 50, meaning a SAF™ can be just as effective as a DAF using only 2% of the power for air generation.

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3. ***SAF™ removes more solids than DAF.***
Each SAF™ bubble is a working bubble, with an electrically-charged surfactant film ready to attach and stick to oppositely-charged floc particles. By contrast, DAF bubbles are relatively lazy, initially formed as micron-sized bubbles at the point where pressure in the recycle flow is released, but having a tendency to coalesce and form large bubbles that are ineffective in floating floc particles. This is the reason SAF™ requires less than half the air of DAF for effective suspended solids flotation, and removes many more small size flocs than DAF could ever do. Consistent suspended solids removal percentages greater than 95% are common with SAF™, rare with DAF.

4. ***SAF™ floated solids can be dewatered more easily than DAF solids.***
One of the most remarkable things about SAF™ flotation is the gelatin-like consistency of the floated solids. Typically, DAF floated solids are "sloppy" and require additional high doses of polymer to be dewatered further. In contrast, SAF™ floated solids, with firmly attached air bubbles entrained inside, appear "rubbery" as though high doses of polymer were added. This makes it possible to remove all free-draining water by simple gravity drainage on a slowly-moving plastic chain belt or internally-fed rotating screen. The solids do not readily blind the belt or screen media, and reach their naturally free-drained moisture content in a short period of time. In many cases, the dewatered solids are suitable for immediate disposal, for example as animal feed when mixed with other residual solids from a food processing operation.

5. ***SAF™ operation is more flexible than DAF.***
In virtually all industrial wastewater treatment applications, shutdowns of various durations are inevitable. SAF™ handles these with ease, but DAF always falters. To start a DAF requires over a half hour of constant operator attention and adjustment of machinery. To keep it running wastes power. Whenever a DAF stops, the solids which have floated to the top of the tank soon fall to the bottom and are either re-suspended at the time of the next startup, degrading effluent quality, or are scraped off the bottom and have to be re-treated. **By contrast,** to start a SAF™ takes less than a minute of automatically timed "warmup" for the generator and NO operator attention is required. When a SAF™ stops, the floated solids all stay on top of the tank, ready to be scraped off during the next run period, because the air bubbles are strongly attached inside. This unique characteristic allows the SAF™ to be operated in the same manner as most other industrial wastewater treatment equipment – in batch mode, periodically processing an equalization tank full of accumulated wastewater and able to shut down for extended periods with no detrimental effect on performance.

6. ***SAF™ is more cost-effective than DAF.***
In case after case, SAF™ installations have soundly trounced DAF in cost-effectiveness over the life cycle of the installation, with simple payback periods commonly 2 years or less. Explanation?
   a. *Although SAF™ requires an additional chemical, it is a non-toxic, easily-metered liquid product costing less than $0.03 per thousand gallons treated. The net additional power costs of DAF operation are typically three times this amount.*
   b. *SAF™ capital costs are less than DAF, so much less that a dewatering unit can often be included in a SAF™ system costing less than a no-frills DAF.*
   c. *SAF™ operating costs are lower than DAF, due to its simple, automated operating cycle, less "sludging-up" of the flotation tank and therefore less cleanup time required, and simple, easily-maintained components such as air double-diaphragm pumps and reliable gearmotors. DAF recycle pumps are expensive, specialized for pumping high air content water at high pressures, and costly to rebuild.*

An on-site bench scale demonstration by a **Heron Innovators** Field Engineer will do more than anything to convince you that **SAF™ really does replace DAF.**