DISSOLVED AIR FLOTATION (DAF)

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Goals

- Create lab for senior environmental engineering students to experience DAF
  - Produce synthetic waste water to simulate industry wastewater
  - Produce a working DAF unit for experimentation
- Reduce total suspended solids (TSS) in industry wastewater using DAF
  - Flocculant selection
  - Adjusting flocculant dosages

Background

- Dissolved air flotation (DAF) used in industry to remove suspended solids, oil, and greases in wastewater
- Widely used in industry due to its lower operating cost (chemicals and energy)

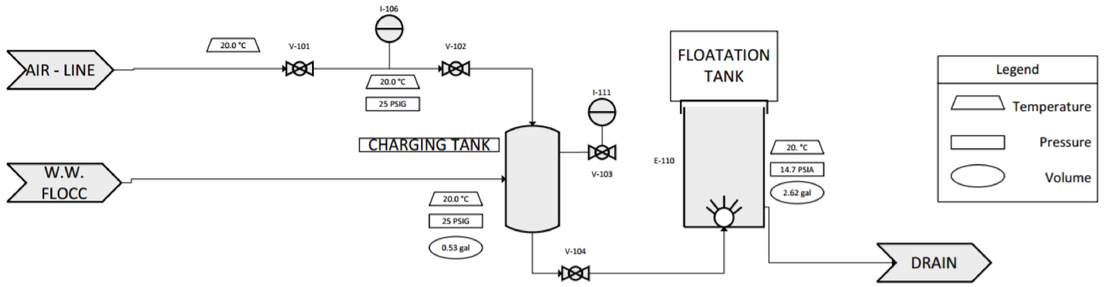
Figure 1: Left: Western Pulp wastewater that has been treated with Praestol A 6291; Right: untreated Western Pulp wastewater

Terminology

- **Total Suspended Solids (TSS):** Solid particulates suspended within waste water
- **Flocculation:** To combine and collect suspended solids into larger, easier to remove particles
- **Flotation:** Introduction of air bubbles to float large flocculated particles to the surface
- **Charging:** Increase of pressure in the system to dissolve air into the waste water
- **Active Area:** Area within the flotation tank that contacts bubbles required for flotation

How does it work?

- Dose wastewater with selected polymeric flocculant
- Pressurize wastewater in charging tank to dissolve air
- Release wastewater from charging tank to flotation tank slowly so air comes out of solution, creating bubbles that lift flocculated particles to surface for removal
- Analyze treated water to determine TSS removal



Results from Existing System

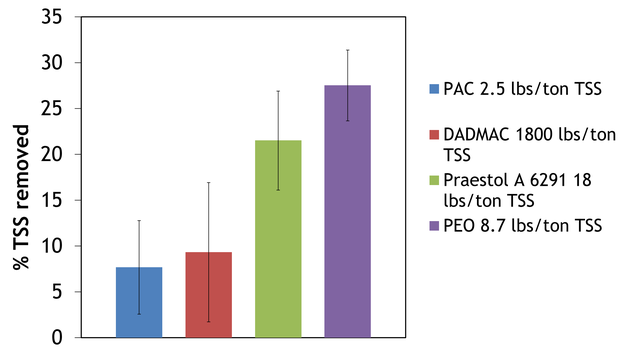


Figure 2: TSS removal on Western Pulp wastewater using various flocculants. Dosages are based on the amount of suspended solids in the wastewater. The most successful flocculant to date is polyethylene oxide (PEO), with 27% removal.

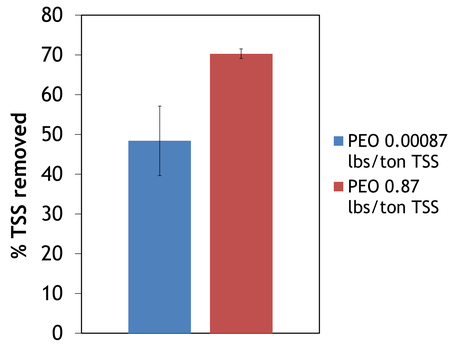
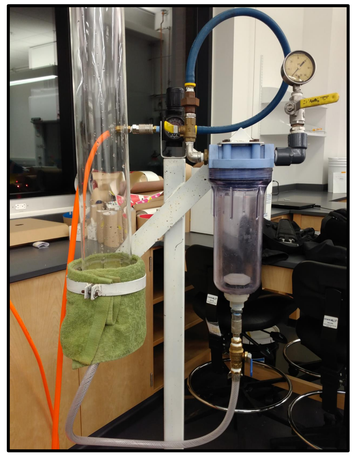


Figure 3: Suspended solids removal twice as effective in Stimson Lumber than Western Pulp wastewater. The initial TSS in Stimson is 1437 ppm, more than 10x Western Pulp (111 ppm).

DAF Redesign

- Larger capacity: Increased size (4 L) allows larger, more visible TSS removal
- Flow: Better distribution and active area to increase TSS removal
- Quality of life: Clear unit to see flocculation, easier to maintain and operate
- Greater pressure capacity: Increased dissolved air concentration at 80 psi



Flocculation

Figure 4: Praestol A 6291 flocculant added to Western Wastewater causes distinct flocculation

Flotation

Figure 5: PEO flocculant added to Stimson wastewater creates a foam during flotation

Conclusions

- PEO dosage of 0.87 lb PEO/ dry ton TSS result in most effective removal
- Dirtier water (higher TSS) provides better visual results for learning
- Re-designed DAF unit will provide a better and more effective lab experience

Future Work

- Produce synthetic waste water for repeatable runs
- Develop and improve redesigned DAF
- Identify chemistries with highest TSS removal for laboratory setting

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- **Western Pulp Products** - Supply of chemistry's and waste water
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