

DISSOLVED AIR FLOTATION (DAF)

Indiana Industrial
Operators Association
RIWP Masters Course

Sources of Oily Wastes

- Machinery lubricants
- Process coolants
- Lubricating oils
- Drawing compounds
- Wastes from metal finishing operations
 - Cleaning prior to electroplating, painting

Problems With Oily Waste

- Free oils (tramp, floating)
- Emulsified or water soluble oil, grease
 - Discharge must be minimized
 - Fouls instrument probes and membranes
 - Membrane biological reactor (MBR)
 - Permit limits for fats, oil & grease (FOG)



Purpose of the DAF Processes

- Solids that are difficult to remove
 - Colloids
 - Very small particles that don't dissolve
 - Emulsions
 - One liquid held in suspension in another
 - Fats, oils and grease (FOG)



Industrial Uses of DAF

- Manufacturing
 - Oil in water
 - White water
- Food processing
 - Fats, oils and grease
 - FOG



Dissolved Air Flotation Process

- Operating principle
 - Solids float and travel upward
 - Removed by skimming
- Three basic technologies
 - Dispersed or dissolved air
 - Biological



DAF Technology

- Dispersed
 - Mixers or diffused aerators
- Dissolved air
 - Pressurized
 - Compresses air
 - Most popular



Pressurized Air DAF Process

- Wastewater saturated with dissolved air
 - Vacuum or pressure chamber
 - Tiny air bubbles are formed
- Bubbles float to surface
- Flocculated particles carried along
 - Removed by skimming

Dissolved Air Flotation Thickeners

- Treatment programs
 - Physical
 - Equipment
 - Chemical
 - Coagulants and polymers
 - Must compliment each other

Dissolved Air Flotation Thickeners

- Physical
 - Influent equalization is a must
 - Adequate size of reactor tanks
 - pH #1 and pH #2
 - Good flocculation chamber
 - Serpentine

Equalization Tank



Serpentine Coil







Chemical Treatment Process

- Coagulation
 - Chemical causes particles to agglomerate
 - Ferric chloride
- Flocculation
 - Agglomerated particles are clumped together
 - Polymers



Chemical Treatment Process

- Selecting coagulants and polymers
 - Lots of jar testing
 - No diffused air bubbles?
 - Alka seltzer
 - Fish aquarium aerator
 - Food blender



Chemistry That Works Best

- Coagulants
 - Low to medium molecular weight
 - High charge density
 - Aluminum/cationic blends
- Flocculants
 - Low molecular weight anionic

Coagulant Dose Pumps





Considerations

- Plant cleaners
 - May destabilize the process
 - Kill your good bugs
- Chelators are usually not an issue
- Metals solubility curve does not apply
- Coagulants, polymers have narrow pH range



G.R.A.S. Chemistry

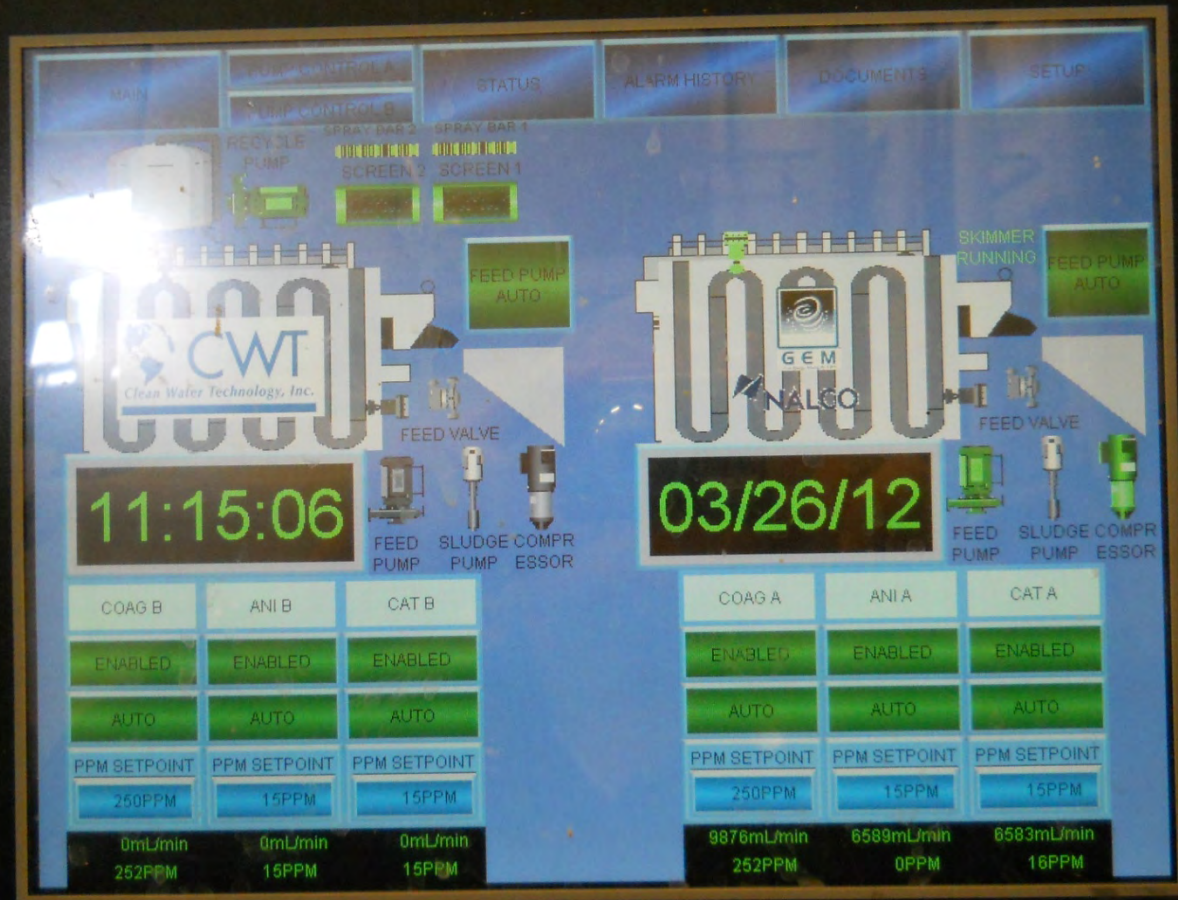
- Coagulants and polymers
 - Generally recognized as safe
- DAF sludge
 - Land application
 - Animal feed industry



Operational Controls

- Air to solids ratio (A/S)
- Recycle rate
- Solids and hydraulic loading
- Chemical conditioning
 - Most important

Control Panel





Operational Controls Continued

- Sludge blanket thickness
 - Controlled by scraper speed
 - Faster = thinner
 - Blanket sinks if too thick
 - Solids carried out in effluent

Flights









Troubleshooting DAF Thickeners

- High SS in effluent (turbidity)
 - Chemical conditioning dose rates
 - Air to solids ratio (A/S)
 - Recycle rate
 - Hydraulic loading
 - Float blanket thickness



Summary

- Pressurized DAF process
- Jar testing to select coagulants and polymers
- Operational controls
- Troubleshooting