Screw Press Dewatering Optimization

By

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Where should your focus be???
What is the objective of your optimization?

- Maximize Capacity: Solids Loading, Flow Rate
- Maximize Cake Solids
- Minimize Polymer Usage
- Stable performance: consistent cake solids
- Reduce Operating Labor
- Lower Energy Costs
- Reduce maintenance costs
- Increase Screw Press availability
- Improve material handling properties

Any others you can thinking of???
Solids Capture!!!

What is Solids Capture:
(Percentage of suspended solids in the feed that ends up in the discharge)

% Capture = \( \frac{C}{F} \left( \frac{F-E}{C-E} \right) \times 100\% \)

Where:
- \( C = \) Dewatered Sludge Total Solids (% TS)
- \( F = \) Feed (% TSS); excluding any dilution from polymer solution flow
- \( E = \) Filtrate (% TSS); excluding any dilution from polymer solution and belt wash water flows
Dewatering Optimization usually focuses on Cake Solids, in this effort filtrate clarity, solids capture, takes a back seat.
Tools for Optimization:

- **Chemical Treatment:**
  - Type
  - Dosage

- **Operator Observations**

- **Equipment settings:**
  - Flows
  - Screw Rpm
  - Cone Pressure
  - Feed Pressure

- **Instrumentation:**
  - Flows
  - Suspended Solids
  - Turbidity
  - Zeta potential

- **Mechanical Condition of Equipment**

Monterey CA, WWTP, Screw Press
Chemical Treatment:

- **Laboratory:**
  - Polymer Screening
    - Charge, Charge Density, Linear / Branched
  - Conditioning:
    - Mixing Intensity, Dosage,
    - Time
  - Bench Simulations

- **Full Scale Trials**
Chemical Treatment

- Form Time, Sludge Volume Ratio.
- Filtrate Clarity
- Flocc Structure
- Spreading
- Cake Release
- Amount of Solids Expressed
Bench Simulations:

- Bench Simulations:
  - Spreading
  - Cake Release
  - Expressed Solids
Observations:

- Flocc Structure
Observations:

- Filtrate Clarity
- Drainage along Screw
Filtrate and Polymer:

Excess Polymer

Perfect
Observation: Filtrate Clarity:

A good plant design should make filtrate clarity observable (preferred) or measured.
Observations:

- **Discharge Cake**
  - Scaly look at cone
  - Powdery look on pile
  - Pile Bounce
Equipment Settings:

- Control Panel Setting:
  - Flows:
    - Feed Flow, gpm
    - Polymer Flow, gph
  - Screw, rpm
  - Screw Torque, amps
  - Cone Pressure, psi
  - Feed Pressure, psi

- Ohaus:
  - Feed Suspended solids
  - Cake solids

- Spread Sheet Calculations:
  - lb/hr, lb/ton
Screw Press Optimization

Cake Solids vs. Solids Loading

Discharge Cake Solids (%) vs. Solids Loading (lbs/hr)
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Discharge Cake Solids vs. Polymer Dosage

Polymer Dosage (active lb/dry ton)

Discharge Cake Solids (%)
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![Graph](attached_graph.png)
Screw Press Optimization

**Cake Solids vs Cone Pressure @ 90lb/hr Solids Loading**

- **Cake Solids, wt%**
  - 18.00
  - 17.00
  - 16.00
  - 15.00
  - 14.00
  - 13.00
  - 12.00
  - 11.00
  - 10.00

- **Cone Pressure, psi**
  - 0
  - 20
  - 40
  - 60
  - 80
  - 100

- **Data Points**
  - Diamond: Cake Solids vs Cone Pressure
  - Line: Linear (Cake Solids vs Cone Pressure)
**Instruments:**

- Pump rpm
- Turbidity Sensors
- Pressure / Weight Sensors: Sludge Levels in Chutes / Pumps etc.
- Belt Scales
- Others, not recommend: Viscosity, Streaming current, zeta potential
Mechanical:

- Flight brushes: required to keep cake heel from developing.
Shower Assembly:

- Important: the shower assembly has:
  - adequate pressure
  - nozzles are clean.
  - Frequency is optimum.
  - Batch or Continuous.
Why is Solids Capture Critical?

- Industry standard 95%, many below 80% and some as low as 60%.
- Dirty filtrate means accelerated wear on dewatering unit.
- Increase labor in keeping facility clean.
- Recycled solids wear on pumps and other equipment.
- Increases dewatering chemical costs and lowers cake solids.
- More important with Smaller size WWTP.
On a Broader Scale Poor Solids Capture Causes:

- Higher energy costs for plant
- Lowers plant performance
- **Creates additional particles that are difficult to dewater.**
  - Bacteria type, filamentous
  - Colloidal Particles
  - Particles with poor surface chemistry for flocculation
- **Best to get these out in the first pass**
Sulfur Springs WWTP Texas

- 17% cake solids was maximum possible
- New Dewatering System with improved capture
- 3 months later, 23% cake solids.
Optimization is multi-dimensional and intricately related:

Increasing: Chemical Dosage / Cone Pressure / Solids Loading

Cake Solids, wt%
Optimization is multi dimensional and the intricately related:

Increasing: Chemical Dosage / Cone Pressure / Solids Loading

Solids Capture, wt%
Stable “Feed Solids Concentration” is of Critical Importance and Often poorly designed.

- **Mixed surge tank.**
  - 60 minutes
  - Dampens out changes
  - Operators have time to react.

- **Chemical dosage**
- **Solids Loading**
- **Cone Pressure**
- **Etc.**
Consistency in monitoring all the factors key

- Develop Relationships that consider all the factors.
- Effort will yield improved overall plant performance.
- It is worth the effort.
Questions?