DEWATERING EQUIPMENT COMPARISON

Operation, Performance, Optimization, Advantages & Disadvantages

BDP Industries
Dewatering Technologies

- Recessed Chamber Press – Plate & Frame
- Centrifuge
- Screw Press / Rotary Press
- Belt Press
- Recent Trends
- Material Properties
- Dewatering Septage & Grease
Recessed Chamber Press
Recessed Chamber Press

- Cloth Shaker Assembly
- Recessed Plate
- Cloth Wash Header
- Filter Cloth
- Plate Support
- Filtrate Ports
- Feed Port
Recessed Chamber Press
Recent Improvements in Technology:

- Increased Automation.
- Control Interfaces.
- Materials of Construction.
Recessed Chamber Press

Advantages:

- Highest filtration pressure: 100 to 225psi.
- Excellent solids capture when conditioned properly.
- Conditioning chemical costs can be lower for some materials.
- Amenable to daily operation. Must insure 2-5 hr cycle can be completed.
- Can process incompressible material.
Disadvantages

- Batch process.
- Complicated Systems for: Feed pump, pre-coating, conditioning and metering of lime, ferric and fly ash. Variable Flow Rate effects dosage.
- Blow outs / Plate Breakage.
- Labor intensive for performing cake discharge and plate washing etc. or spend more $ for an automated system.
- Highest Operation & Maintenance Costs
- Large footprint for press and accessory systems: Feed pumps, conditioning tank, pre-coat make up, lime metering, pressure washer etc.
- Significant building structure to deal with size and weight of press and accessories.
- Frequent maintenance and cleaning.
- Can’t observe process. At end of cycle, cake discharge can be wet due to improper conditioning or blinded cloth.
- Expensive Discharge System: cake breakage and storage required due to batch operation.
- Odor containment difficult.
1) Feed
2) Feed Acceleration in Feed Zone
3) Solid Blanket
4) Clarified Liquid
5) Solids discharge
6) Liquid Discharge
7) Main Drive
8) Scroll Drive
Conveying Solids - Centrifuge

Sludge feed

Cake → Centrate

H₂O
Centrifuge

30” Diameter Bowl
Recent Improvements in Technology:
- Increased Motor Efficiencies.
- Materials of Construction – decreased wear.
- High Speed solid bowl, backdrive scroll on VFD.
- Operational feedback loops – scroll amp draw.
- Refined bowl shapes for particular materials.
- Directional centrate ports
- Automation and remote monitoring
Advantages:
- Highest unit capacity per footprint, reduces number of units for large plants.
- Containment of odor and process fluids.
- Easier to keep operator area clean.
- Less frequent preventative maintenance.
- Maintains cake solids at higher than design loading, although solids capture suffers.
- Smaller building.
- Can process any material with S.G. differences.
- Three Phase Separation is possible.
Centrifuge

Disadvantages:

- Highest energy consumption.
- High usage of polymer.
- Down time for repairs usually takes weeks/months.
- Start-up and Shutdown take time and must be done carefully to avoid damage to unit.
- Operation needs to be continuous.
- Instable sludge feed can make performance difficult to monitor and make proper adjustments.
- Special structural requirements for equipment foundation.
- Hearing protection for larger units.
- Centrate often carries entrained air and polymer.
- Becomes more economically viable with multiple units.
Solids Capture: Centrifuge

Source: WEF MOP 20
Conveying Solids - Centrifuge
Recent Improvements in Technology:
- Brush / Flight Tip Design.
- Pneumatic discharge cone.
- Polymer mixing.
- Independent pre-thickening.
- Filtrate Recycle
- Screen design.
- Dual Mode operation.
- Automation!
Screw Press

Tapered Shaft

Perforated Screen
Basket
Rotary Press

Front Royal, VA WWTP

Source: Treatment Plant Operators Magazine.
Advantages:
- Containment of process fluids and some odor.
- Low energy consumption, similar to belt press.
- Slow speed.
- Low noise level.
- Most maintenance can be handled by staff.
- Facility easy to keep clean.
- High torque possible with compressible material.
- Easy start up and shutdown amenable to intermittent operation, a few hours daily.
- Remote operation possible with correct ancillary equipment.
Screw / Rotary Fan Press

- Disadvantages
  - Low capacity.
  - Low solids capture.
  - Difficult to maintain solids loading/performance if influent concentration is variable.
  - Difficult to clean blinded filtration surface without shutting down and emptying.
  - Some designs need to remove screw for major maintenance.
  - Not meant to dewater incompressible solids.
Replacement brushes
Replacement brushes
Split Basket Construction

- Replaceable Wiper
  - Wear Part
  - Increased Performance
Screw Press

- High Feed Solids
- Low GPM
- Example:
  - 6 - 8% feed
  - 600 – 1,000 lb/hr
  - 27 – 35%
Screw Press
Pre-Thickening Option

- Feed to Unit: 50 gpm at 1% or 25 gpm at 2%
- Average discharge from drum is 5 – 8%

Result: 6 – 8 gpm to the Screw
Pre-Thickening Option

- Reduced Footprint
- Low RPM
- Better Performance
  - Solids Capture
  - Hydraulic Throughput
  - Changing conditions
Belt Press

Gravity Zone

Wedge Zone

Pressure Zone
Belt Press
Belt Press

- Advantages:
  - Low energy requirement.
  - Lowest polymer dosage.
  - Easy start up and shutdown amenable to intermittent operation, a few hours daily.
  - Maintenance can be done by plant personnel.
  - Process is observable allowing quick operator response to unstable conditions to avoid upsets.
  - Most repairs can be made in a couple of hours.
  - Ideal for processing incompressible material.
  - Least expensive total Life Cycle Cost.
  - Higher Cake Solids possible: linear relationship to polymer dosage.
Belt Press

- Disadvantages:
  - Containment of odor and process fluids requires additional attention at design phase.
  - Frequent maintenance and cleaning.
  - Height requirements.
  - Footprint requirements for large plants with multiple units.
  - Sump design is critical: Process upsets can require significant cleaning in certain layouts.
Recent Improvements in Technology:

- Improved Feed Distribution.
- Independent Gravity Zone.
- Dual Mode operation.
- Curved Wedge Zone.
- Improved Plow, more compression, exposing more filter cloth.
- Vertical Compression Zone.
- Floor Level Installation – no platforms.
- Automation.
- Odor control enclosures & piping.
Enclosed Gravity Section
Enclosed Gravity Section
Enclosed Gravity Section
Average Cake Solids (%)

- **Dewatering Box**
- **Chamber Press**
- **Centrifuge**
- **Belt Press**
- **Screw Press**

**Equipment / Sludge Type**

- **Aerobic Digested**
- **Anaerobic Digested**
- **Septage**
- **Lime Stabilized Septage**

- 37% Lime, 7.7% Ferric Chloride
- 35% Lime, 7.1% Ferric Chloride
- 13.4% Lime, 4.5% Ferric Chloride

*EPA 832-F-00-053, September 2000*
Optimization Parameters

- Hydraulic Loading – gpm
- Solids Loading or Throughput – lb/hr
- Chemical Dosage – lb / dry ton
- Discharge Cake Solids – %wt
- Solids Capture – %
Side-by-Side Operation
Side-by-Side Operation
Side-by-Side Operation
What Makes Septage & Hauled Waste Different?

- Incompressible vs. Compressible
- Specific Gravity
- Abrasiveness
- Grease
- Chemical Treatment
- Odor Control and Containment
  - Example: Cake solids 18% – 45%
Model 3DP Belt Press
Belt Press Design Considerations for Septage

- Distribution – Feedbox
- Curved Wedge – Pressure Profile
- Dual Drive – Performance, looping
- Roll Construction – Coatings
- Operation & Maintenance
Wedge Section Design

*Traditional Straight Wedge – less effective with incompressible materials*
Curved Wedge

- Self Compensating for Material Pressure Profile
- Edges Encapsulate Material
- Prior to First Compression Roller
Pressure Section Design

![Graph showing extrusion area and material dewatering curve over time under pressure.]

- Extrusion area
- Material dewatering curve
- Cake pressure
- Time under pressure
FEED DISTRIBUTION

- Uneven distribution causes:
  - Premature clipper wire failure
  - Accelerated wear on roll coating
  - Cake solids concentration is lowered
  - Belt misalignment
Poor Distribution: Clipper Seam
Roll Wear

- Even cake = Even roll coating wear
- Uneven cake = Uneven roll coating wear:
  - Tracking misalignment
  - Lowers cloth life
  - Lowers cake solids
Up-Flow Feedbox with Paddlewheel Distributor

- Eliminates dead zones and plugging.
- Full width belt distribution.
- Uniform cake thickness.
- Slower even roll coating and filter cloth wear.
- Maximizes effective filtration area.
- Improved thickening performance.
- Reliable operation.
Distribution

Initially observed in mining, sand & gravel operations
Dewatering Abrasive Material
3 Meter 3DP - Distribution
Thickening vs. Dewatering

- **Mechanical Thickening**
  - Square feet of open belt media

- **Dewatering**
  - Amount of Pressure
  - Time under pressure
Gravity Section Cake Formation

- “Experimental Techniques in Solid Liquid Separation”, DA Dahlstrom and C.E. Silverblatt
- As cake thickness increases, the filtration rate (lb/hr per ft²) decreases

\[ \text{Faster Belt Speed} = \text{Higher Solids} \]
Belt Press Schematic
Conventional 2-Belt Design
Thank You

questions?
Always screen wastewater as it is dumped
HOLDING TANK

Have a holding tank that can be agitated while pumping into your dewatering device.
AGITATING PUMP INTO TANK TO KEEP SLUDGE HOMOGENEOUS
Submersible trash pump
Hydraulic power unit
POLYMER PUMP
Polymer can be purchased in different size containers
POLYMER MIXER
MIXING MANIFOLD
The key to dewatering is using the right polymer to achieve proper flocking.
Drum lined with PVC tile

Inside of Dewatering Drum
Water passes through slots in PVC tile
Drum can be filled from the top or the bottom.
Filling drum with flocking material
Drum half full
CLEAR WATER DRAINING OUT OF DRUM
Dried material after rotation
Drive chain
Rollers
1. A mix tank which will accommodate multiple loads allowing for a homogenous mixture.
2. A polymer system which will flock the material and give clear effluent.
3. A place to dispose of the clear effluent.
4. A roll-off truck or trailer to pick up the dewatering drum allowing material to be emptied.
5. A place to dispose of the dried sludge.
6. Water to wash the drum after each load has been emptied. (If using a gamma jet power flex nozzle, it requires 40 gallons per minute @ 60-80 psi).