Post Pellet Liquid Application (PPLA)

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Liquid Application - Methods

- Apply at the die
- Spray into a screw conveyor
- Spray into a plenum or weir
- Spray using spinning disks to atomize the liquid
Liquid Application At The Die

- Spray nozzle or nozzles at the pellet mill discharge
  - Volumetric measurement based on turns of the feeder into the pellet mill

- Advantages
  - Liquid sprayed onto a hot pellet
  - Inexpensive and can be installed on existing equipment

- Disadvantages
  - Little to no retention time
  - Fat can be drawn off the surface and end up in the cooler and the cooler air system
  - Fat laden fines are drawn off at the cooler and can affect formulation of the product
  - Fat may trap extra water in the pellet
Post Pellet Liquid Application (PPLA)

Ingredients typically applied by PPLA:

- Liquid Enzymes
- Fat
- Molasses
- Vitamins
- Trace Minerals
- Medicated Feed Additives
Factors that Contribute to Fat Variation in Finished Feed

- Ingredient matrix values
- Types of PPLA equipment
- Application rates
- Sampling
- Quantity of pellet fines
- Analytical method
- Feed processing rates
Continuous Process Equipment

- **Dry Flow System for Feed**
  - Volumetric Feeder
  - Gravimetric Feeder
  - Mass Flow Feeder

- **Liquid Flow System for Fat**
  - Mechanical Liquid Meter
  - Coriolis Meter

- **Spray Nozzles for Fat Application**
Volumetric System – Flow Diagram
Volumetric System – Dry Flow Screw Conveyor
Volumetric System - Dry Flow Rotary Feeder
Volumetric System – Dry Flow Tach Generator
Mass Flow System

- Measures the weight of material conveyed
- Dry material
  - Weigh belt
  - Weigh screw
  - Impact scale
  - CentriFlow
  - Nuclear gauge
- Liquid
  - Coriolis liquid meter
Mass Flow System – Flow Diagram
Mass Flow System – Weigh Belt
Mass Flow System – Impact Scale
Mass Flow System – CentriFlow
Volumetric System – Liquid Component

Positive Displacement Pump
Mass Flow System – Liquid Component
Coriolis Meter
Mass Flow System – Coriolis Meter
Loss In Weight System

- Monitors the loss weight of material from a weigh hopper
- Dry material
  - Garner hopper
  - Weigh hopper
- Liquid
  - Loss in weight liquid scale
Loss In Weight System
Liquid Spray Into a Screw Conveyor

- Screw conveyor with spray nozzles
- Coverage can be improved with the addition of a spray plenum
  - Increases the probability of the liquid hitting the dry product in a uniform fashion
- Disadvantages
  - Nozzles apply liquid to a limited number of particles
  - Depend on the conveyor to spread the liquid
    - Spotty coverage
  - May be difficult to find nozzles to handle the full range of flow
  - Little mixing action with standard flighting
    - Cut & fold or ribbon & paddle flight
  - Nozzles
Liquid Spray Into a Screw Conveyor
Liquid Application
Spray Into a Plenum or Weir

- Plenum is a chute with spray nozzles
- Liquid sprayed as the product tumbles through the air
  - Increases the probability of the liquid hitting the pellet in a uniform fashion

- Weir
  - Product sprayed on one side, flipped over and sprayed on the other

- Disadvantages
  - Same as the screw conveyor
Liquid Application
Spray Into a Plenum or Weir
Liquid Application
Spray Into a Plenum or Weir
Liquid Application - Spinning Disks

- High speed spinning disks atomize the liquid
- Multiple disks = wider spray band
- Slots in each disk allows liquid to migrate to lower disks
- Serrated disk teeth provides multiple planes of liquid discharge = wider band of spray
  - Wider spray band = more product surface area exposed for a greater amount of time
Liquid Application - Spinning Disks

- Advantages
  - Optimum coverage
  - Closed system, no fugitive particles
  - No spray nozzles to clog
    - Liquid delivered to the disks via a hollow shaft
  - Can apply slurries
  - Less head pressure on the liquid pump

- Disadvantages
  - Requires further mixing in a drum or mixing conveyor
  - Requires more headroom than a standard screw conveyor
  - Higher cost
Types of PPLA Equipment
Liquid Application  Spinning Disks

Coated product falls into the conveyor below for further mixing.
Liquid Application Spinning Disks
Addition of Dry Additives

- Dry additives applied after liquids
  - Enzymes
  - Microbial & vitamin products
- Allow time for the liquid to “settle down” after applying
  - Even amount of liquid on all particles
- Can be applied with any of the liquid application methods
  - Sealed system will prevent fugitive particles
- Dry material can be blended with the liquid being applied
  - Compatibility with the liquid
  - Can the applicator handle the slurry?
Addition of Dry Additives
Control System

- Tie all components of the liquid application process together in a central control
  - Possible to expand existing control system
  - Does it require a new control

- Operator interface
  - Push buttons
  - Touch screen
  - Computer based

- Screens should be easy to read and understand
  - Clear depiction of the application process
  - Eliminate clutter
Control System
**Effect of Fat Addition on Pelleting Production Characteristics**

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Richardson and Day, 1976
PPLA – Xylanase Activity

Engelen, 1998
Questions