Optimization of Conditioning Water for Fly Ash and Dry Scrubber Material using High Intensive Mixers

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HIGH INTENSIVE MIXERS

High-Intensive Mixers have been used for years in industrial processing applications to produce a full gamut of materials, from powders, slips, and slurries, to taffy-like materials with viscosities exceeding well over 1,000,000 centipoise (cP). Mixers also pelletize a variety of materials – iron oxide, weld flux, ball clay, and proppant.

It is only recently that the high-intensive mixers have been considered for applications within the utility sector. One of the primary applications given consideration today includes optimization of conditioning water for fly ash.

ASH CONDITIONING WATER

Typically when fly ash is conditioned using existing pug mill / paddle mixers the amount of water required to stabilize the ash prior to transportation and placement is 16 to 20%. This of course varies depending on coal type burned. In some cases the amount of ash conditioning water required is included in the solid waste management permits and identifies the minimum amount of water that has to be added to the fly ash. These requirements have developed based upon the existing ash conditioning equipment capabilities and transportation and land filling requirements. Although today there is much greater concern regarding the amount of water we use at a power plant and the amount we discharge, even if that discharge is to stabilize fly ash. Further the industry normally pays ash management companies a cost per ton for placement on site or at offsite disposal facilities. The Lancaster Products “K” Series High –Intensive Mixer stabilizes (conditions) fly ash using 50% less water than existing pug mill / paddle mixers. This is accomplished by the fact that the water molecules come into individual contact with the ash particles. The combination of: a rotating mixing pan, a counter-current rotating high speed rotor, a counter-current rotating plow, and a stationary mixing pan side wall scraper, eliminates all dead zones within the mixer. There are no dead corners or upswept surfaces where ash can lodge. During mixer discharge, the plow and mixing pan side wall scraper also provide for an extremely efficient material removal from the pan bottom and side wall surfaces. Material is conditioned in under 30 seconds and discharged.
ECONOMICS

With the cost of ash disposal continuing to increase and the concerns to minimize water usage, the High-intensive mixer can save money by saving water. Conditioning ash using 50% less water can save the utility $5 to $15 per ton on disposal. By hauling less water fewer trucks are needed lowering the plants CO2 footprint further. The mixer is low profile, typically fitting into the existing head space of traditional ash conditioning technologies with similar electrical requirements.

ADDITIONAL BENEFIT

The mixer can also be used as a pelletizer. The fly ash / water mixture will pelletize in as little as three minutes. The utility can use the pelletized fly ash on site or market it for use as under drain material, road sub base, foundation backfill or lightweight aggregate.
Optimization of Conditioning Water for Fly Ash and Dry Scrubber Material (DSM) Using High Intensive Mixers

Presented by: Keith C. Day
Overview

- Lancaster “K” Series Mixers
- Fly Ash Conditioning
- Fly Ash Conditioning Economics
- DSM Conditioning
- DSM Conditioning Economics
- Fly Ash and DSM → Beneficial Use
- High Intensive Mixer vs. Pug Mill
Lancaster K-Series
Lancaster K-Series

- “K” Series (K-4, 14 CuFt) to (K-10, 210 CuFt)
- Rotating Pan, Counter-Current Mixing Design
- Mixing Rotors
- Mixing Plow
- Mixing Pan Side Wall Scraper
- Mixing Pan Discharge Valve
- Dust Seals
- Automatic Lubrication System
- Mixer Control
K-Lab Testing
K-4 in Lab

- K4 Mixer
- Required Material 1500 Pounds
- Determine Final Production Rate
- Finalize Process Flow Diagram
- General Arrangement Drawing Developed
- Fly Ash & DSM Tested for BUD(s)
- Evaluate End Markets
Fly Ash placed in K-Lab at 2% moisture
Fly Ash Conditioned with total 5% water
Fly Ash with total 5% moisture
Fly Ash Conditioning Rate

- Fly Ash @ 45#/cf
- 50#/cf conditioned at 10% moisture (normal 16 to 20%)
- K-7 conditions 2,100 cf/hr or 105,000#/hr = 52.5 tons/hr
- Typical load out at one 8 hr shift 6 days/week = 131,040 tons conditioned/year
Conditioning 50,000 tons

With transportation and on-site disposal cost @ $5/ton

Typically fly ash is conditioned at 16 to 20% moisture.

Conditioning 50,000 tons at 16% moisture = 8,000 tons of water or $40,000.

Conditioning 50,000 tons at 8% moisture = 4,000 tons of water or $20,000.

Resulting savings of $20,000 for every 50,000 tons processed

Added benefit pelletizer
DSM from bucket at 2% moisture
DSM Conditioning

- DSM sample 2% moisture
- Charge Mixer Pan 2000 grams
- 30 second mixing time
- Results when pan opened dust cloud
DSM at 5% moisture
DSM beginning to Pelletize at 4 min
DSM beginning to pelletize under 5 min
DSM Conditioning Rate

- 35#/cf DSM @ 2% moisture
- 38.5 #/cf @ 10% (normal 25 to 30%)
- K-7 Mixer conditions 2,100 cf/hr or 80,800 #/hr = 40.4 tons/hr
- Working 8 hr/day 6 days/week = 2,496 hr/year
- 2,496 hr/year x 40.5 tons/hr = 101,088 tons/year
DSM Conditioning Economics

- Conditioning 50,000 tons of DSM
- With Transportation and Off Site Disposal Cost @ $25/ton to $45/ton
- Typical pug mill conditioning of DSM requires 25 to 30% moisture
- 50,000 tons conditioned at 25% moisture = 12,500 tons of water. Disposal cost for the water = $312,500 to $562,500.
- 50,000 tons conditioned at 15% moisture = 7500 tons of water. Difference is 5,000 tons or savings between $125,000 to $225,000.
- Lancaster K-7 can reduce the final moisture required 30 to 50%.
- Added benefit pelletizer
Fly Ash or DSM Pelletized

- Total pelletization time under 6 min.
Typical Fly Ash or DSM Conditioning
Benefical Use Markets

- Liming Agent
- Lightweight Agg.
- Foundation Backfill
- Structural Fill
- Road Sub base
- Under drain
- Fertilizer Filler
- Fertilizer
High Intensive Mixer vs. Pug Mill

- Thorough water dispersion
- More homogenous mix
- More uniform, dense and flowable mix
- Minimizes the quantity of any additive
- Energy goes directly into mixing action not transporting or conveying
- Consistent mix quality (beginning and end the same)
- All surfaces are continually scrapped to prevent build up or trapped material
- Can Pelletize
Questions?