Dry Injection of Sodium Sorbents - Effects of Using Mills

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McIlvaine Company Hot Topic Hour on
"Dry Sorbent Injection and Material Handling in Coal-fired Power Plants Plants"

June 21, 2012

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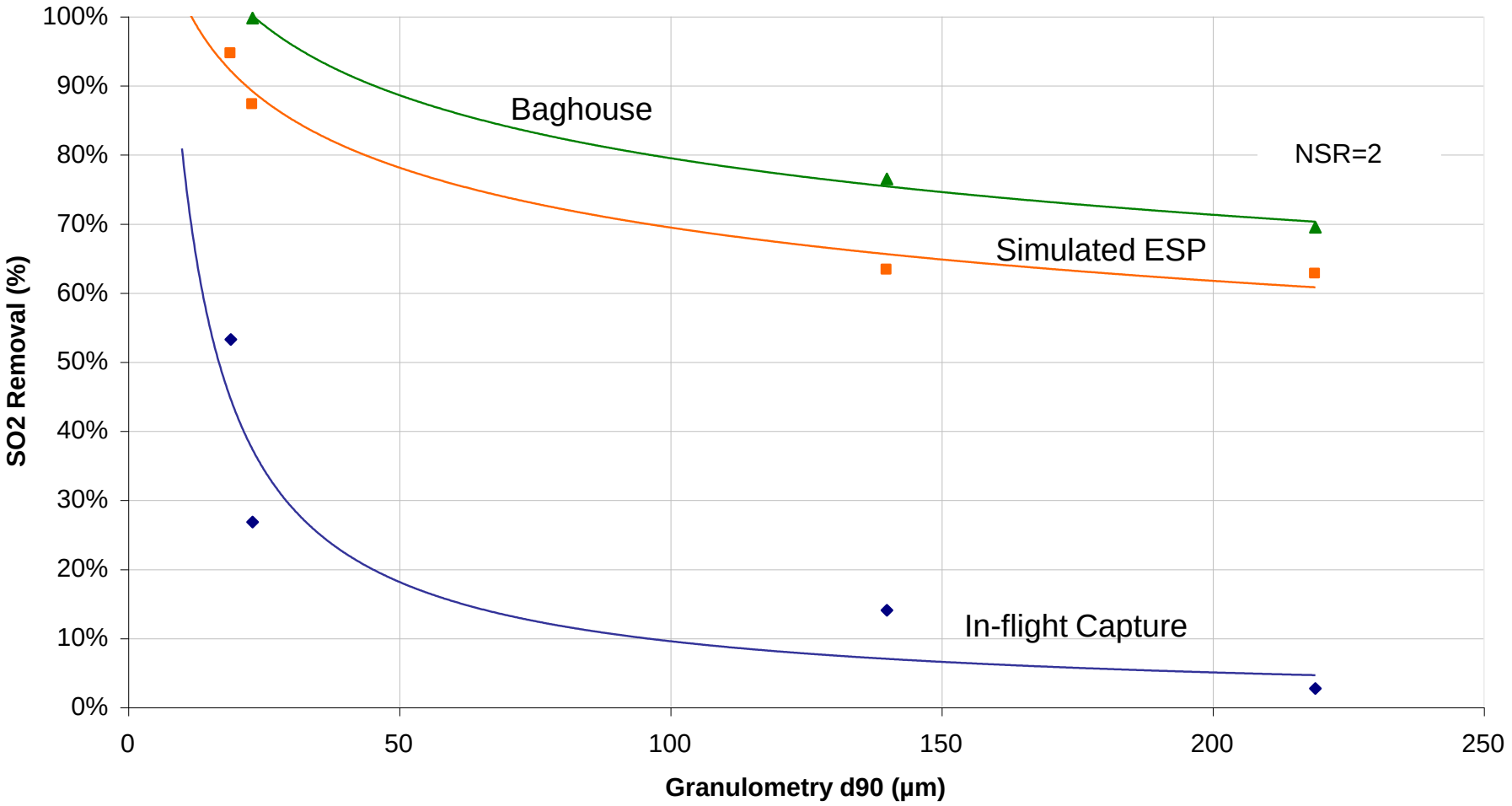
Properties of Trona and Sodium Bicarbonate

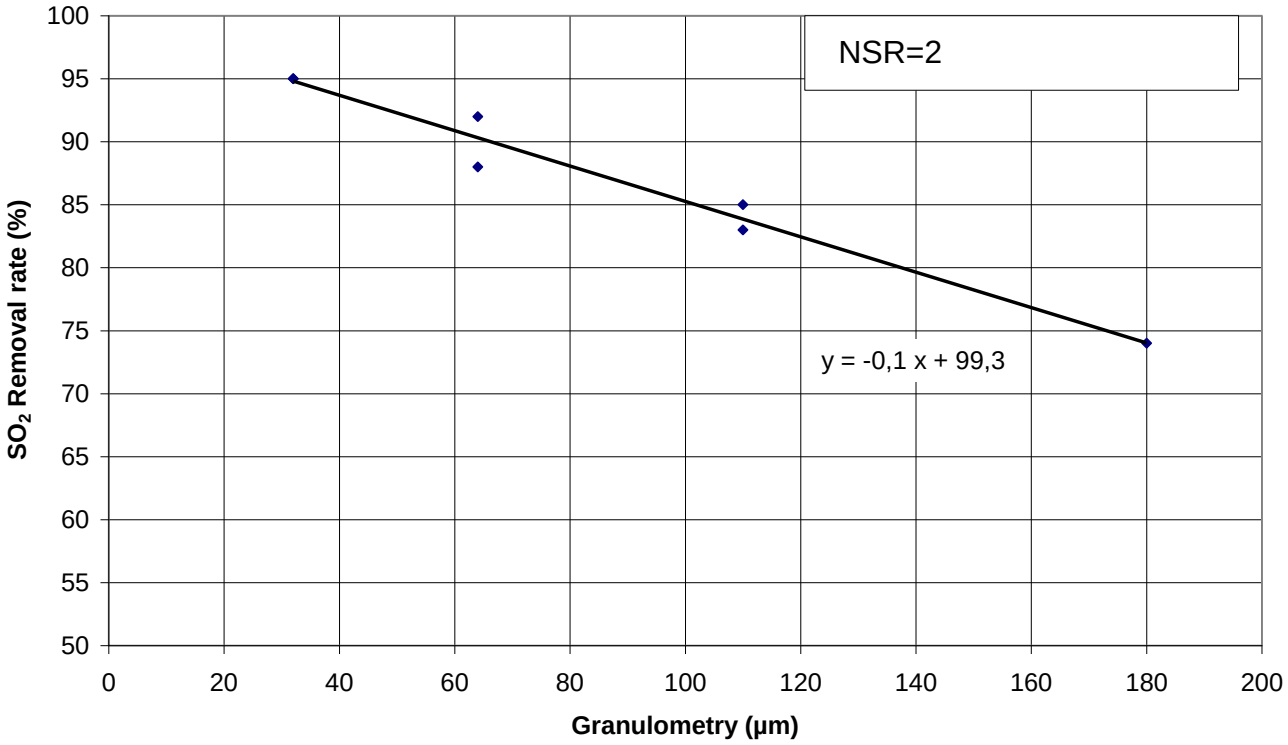
	Trona (SOLVAir® Select 200)	Sodium Bicarbonate (SOLVAir® Select 300)
Formula	$Na_2CO_3.NaHCO_3.2H_2O$	$NaHCO_3$
Particle Sizes	d_{50}: ~ 30 µm $d_{90:}$: ~ 130 µm	d_{50}: ~ 250 µm $d_{90:}$: ~ 500 µm
SO_2 Removal	Up to 90%	Over 95%
HCl Removal	Over 99%	Over 99%
Sorbent Cost	Low	Medium
Milling	Optional	Required

Effect of Particle Size on SO_2 Mitigation – Trona*



*** Pilot test at Solvay**

Effect of Particle Size on SO_2 Removal – Sodium Bicarbonate



SO_2 removal rate increased from 74 to 95% with d_{90} decreased from 180 to 32µm

Pros and Cons of Milling

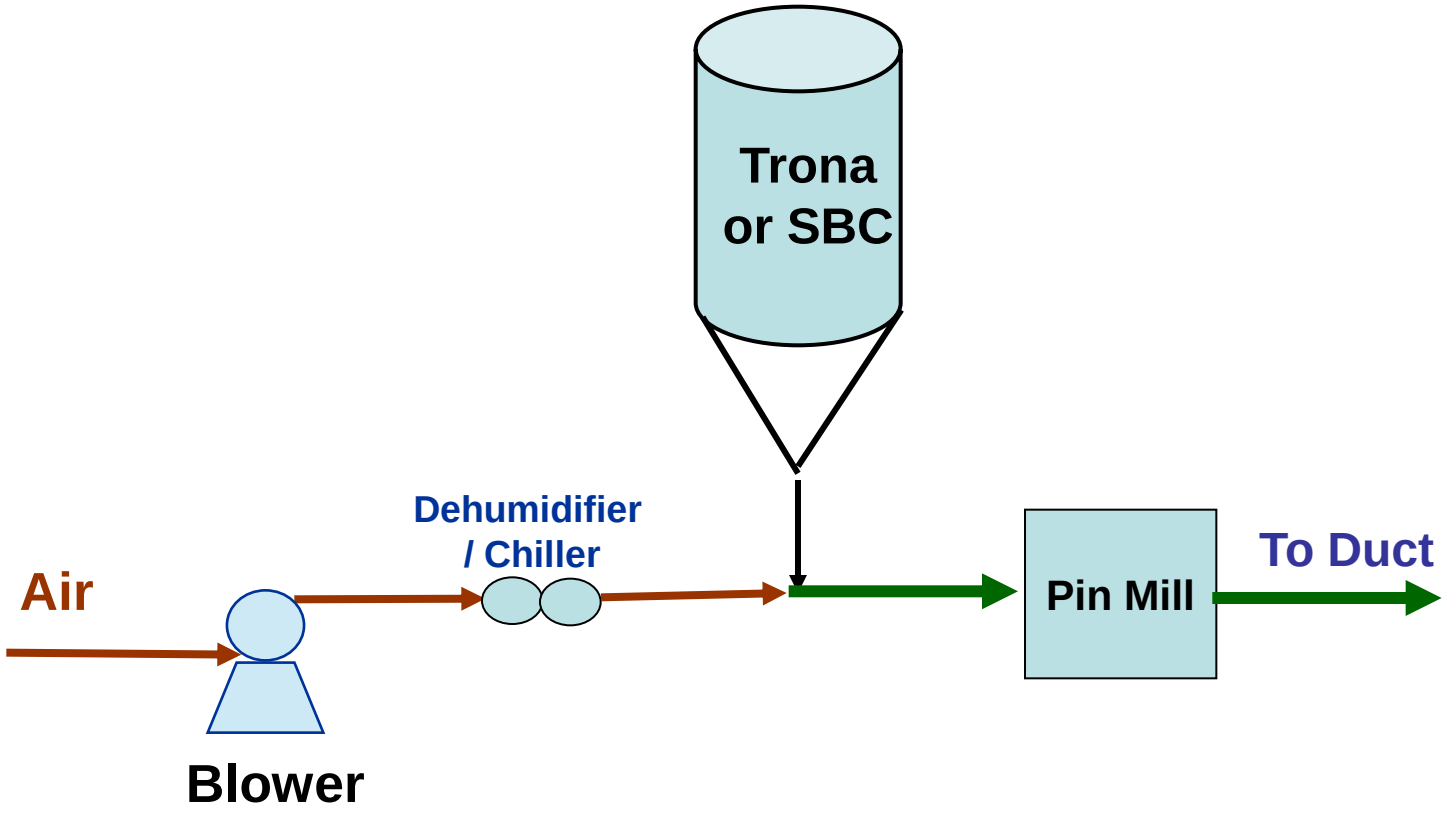
Pros:

- **Finer particles improve surface area, distribution and mixing**
- **Higher mitigation level for acid gases at same sorbent feedrate**
- **Better sorbent usage:**
  - **Less unused sorbent (Na_2CO_3)**
  - **Lower operation cost**

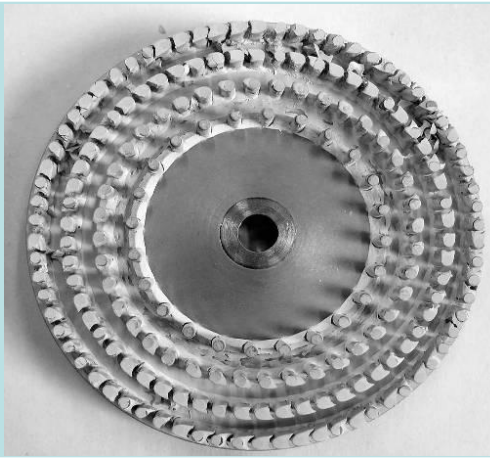
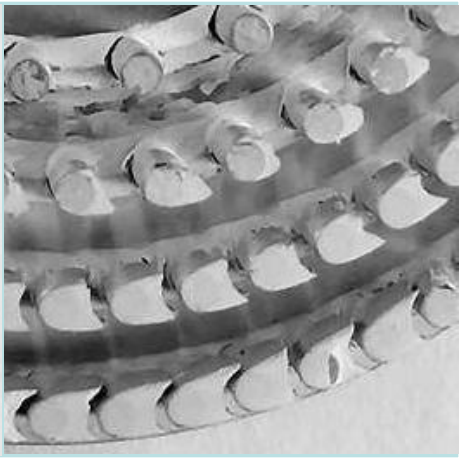
Cons:

- **Capital cost**
- **O&M cost**
- **Reliability of mill**

Milling Trona or Sodium Bicarbonate with Pin Mill



Build-Up After Six Hours

Trona		
Sodium Bicarbonate		

Pros and Cons of Pin Mill

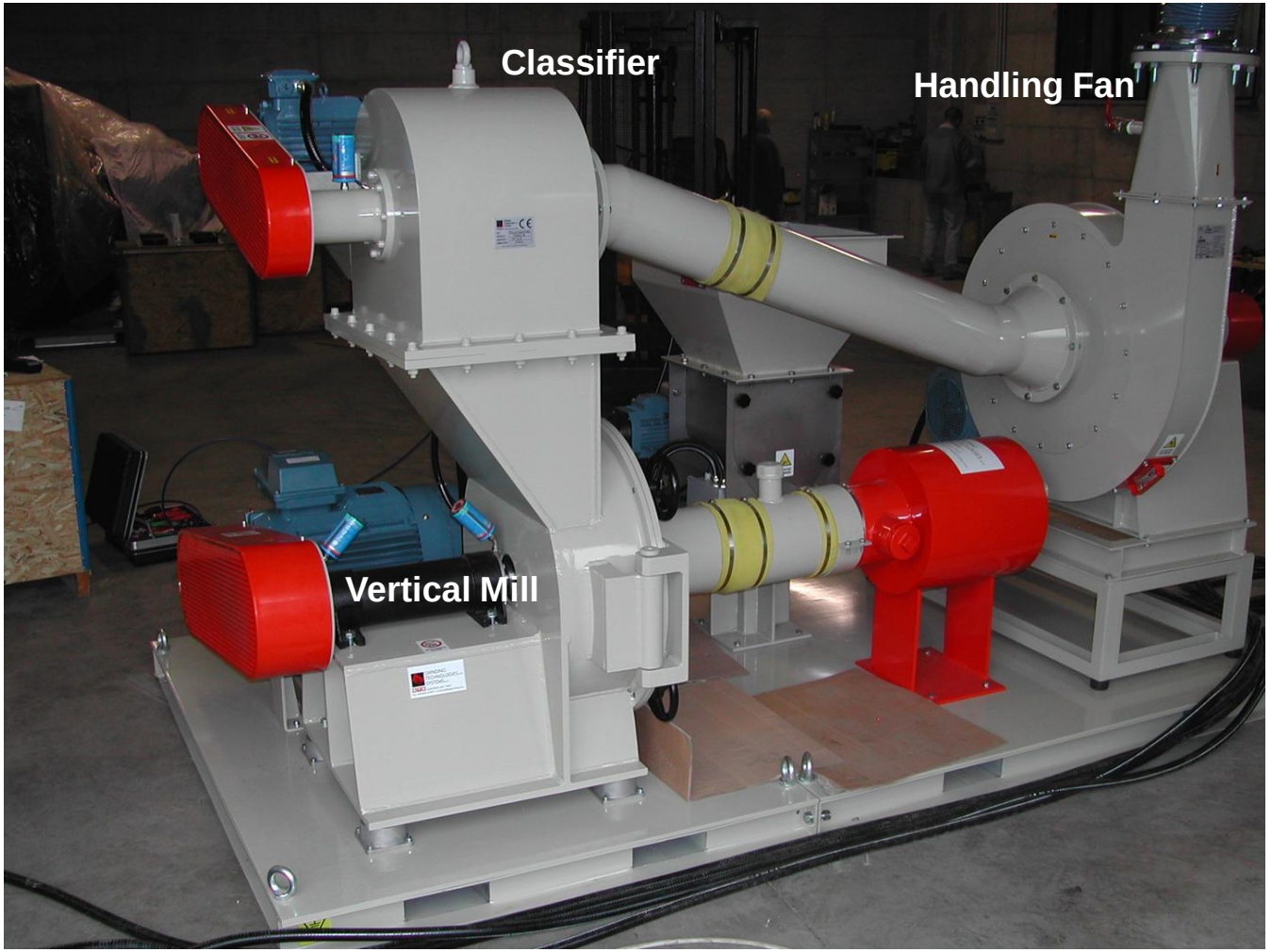
Pros

- Simple, low-cost and easy to operate.
- Low air flow
- Low energy consumption

Cons

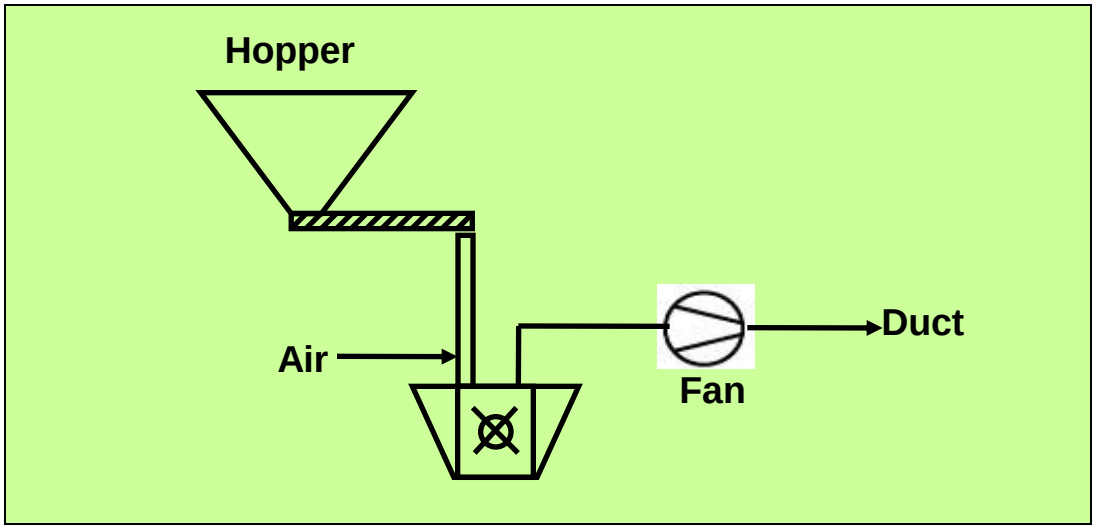
- Coarser particles
- Wide particle size distribution (PSD)
- Particle size gets coarser at higher feedrates

GTS MG 60B for Sodium Bicarbonate

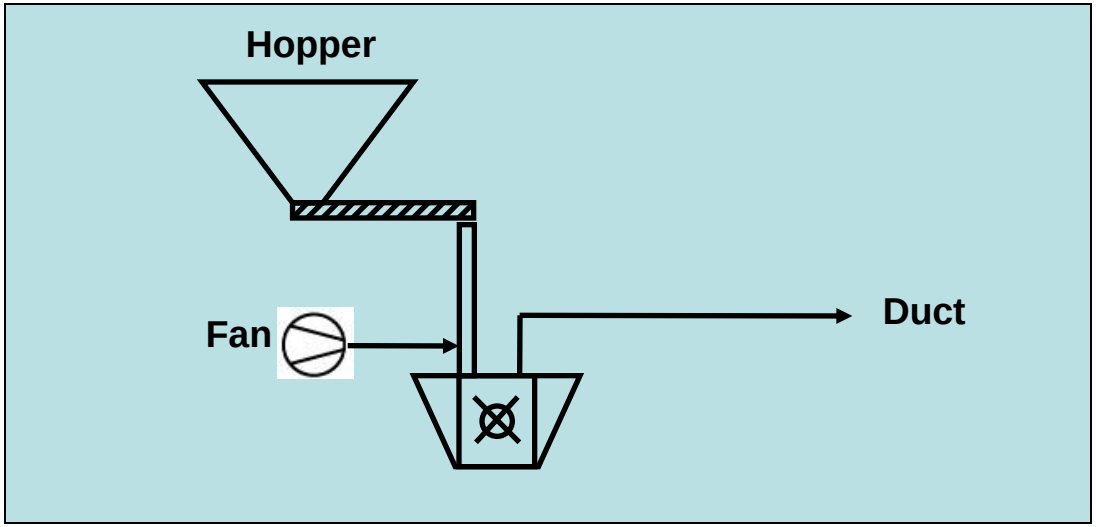


Configuration of Air Classifier Mill

Downstream Fan



Upstream Fan



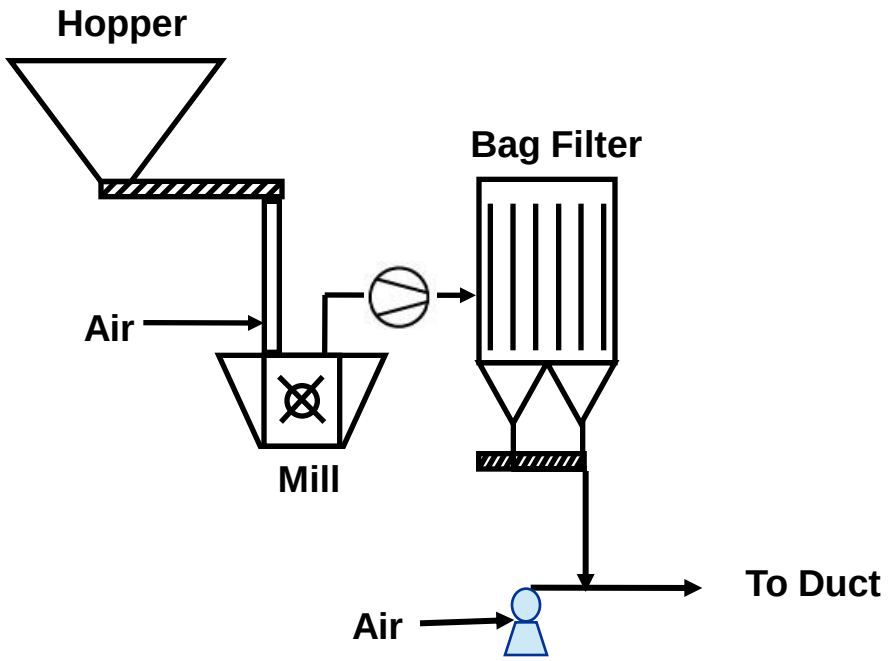
Air Classifier Mill With A Collection Bag

Pros:

- No build-up on fan blades.
- Mill redundancy less critical.
- Air flow in mill not dependent on downstream pressure drop - good for mill tuning and operation stability.

Cons:

- More expensive
- Handling fine powders in storage is difficult - long term storage not advised



Recommended for high material feedrates (> 2000 lb/hr)

Build-up from Milling Sodium Bicarbonate

*Test with wet sodium bicarbonate

- High temperatures (> 150 ºF) inside mill cause calcination of trona or sodium bicarbonate to form Na_2CO_3 and water, thus build-up.
- Adding additives has shown good effect.
- Mill needs to be cleaned on-line periodically

After on-line cleaning with limestone gravel

Pros and Cons of Air Classifier Mill

Pros:

- Very low particle sizes can be obtained (d_{90} < 15 µm).
- Particle sizes not dependent on material feedrates.

Cons

- High power consumption.
- High air flow.
- Severe wear when abrasive components are present (i.e. silica)
  - Requires special materials of construction
- More complicated than a pin mill

When You Purchase a Mill, Consider …

- Sorbent Flowrate (lb/h) @ desired particle size
- Power consumption
- Lead time for mill delivery
- Need for air blowers
- Costs
  - Maintenance / redundancy / spare parts
  - Equipment cost
  - Installation cost
  - Warranty cost
- Reference installations
- Turnkey or not

Summary

- **Milling trona or sodium bicarbonate can increase the sorbent efficiency or acid gases mitigation rate (SO_2, SO_3 and HCl).**
- **Design a milling system instead of purchasing just a mill**
  - Sorbent feedrate
  - Downstream pressure drop
  - Temperatures at mill inlet and outlet
  - Mill cleaning
- **Capital as well O&M costs need to be considered during planning.**

Questions?

For more information, please visit www.solvair.us

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