SOLVAir® Solutions
Sodium Dry Sorbents for Flue Gas Treatment
September 1, 2016

Soda Ash & Derivatives
A leading player and a very competitive supplier
Global Business Unit  Soda Ash & Derivatives
Key Facts & Figures

1863-2016: 153 Years of Chemical Engineering

4,260 employees*

90 countries served worldwide

12 industrial sites worldwide

• The world's largest producer of Sodium Carbonate

• Global leader in Sodium Bicarbonate

Products

Sodium Sulfite

Trona

Sodium Bicarbonate

Sodium Carbonate

* As of January 1st, 2014
SOLVAir® Solutions

WE DO

✓ Develop and continue to improve Emissions Control strategies
✓ Supply DSI sorbents: trona & sodium bicarbonate
✓ Provide design specifications
✓ Assist at plant start-up and after
✓ Suggest solutions to optimize the existing flue gas treatment systems
✓ Technical, logistics, and commercial support

WE DO NOT

◆ Design, supply or build flue gas treatment facilities
◆ Sell spare parts or equipment packages
◆ Provide process guarantees
Applications

Why Sodium DSI?

SO₂

Removal >98%

HCl

Removal >99%

SO₃

Removal less than measurable

Ceramics

Power

Waste Incinerators

Metal

Pulp and Paper

Cement

Biomass

Glass
Sodium Sorbents Flue Gas Treatment NAM
Number of users by application in the industrial field

*2015 Data
Trona = Natural form of Sodium Sesquicarbonate

Chemical Formula

\[ \text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O} \]

<table>
<thead>
<tr>
<th>Type</th>
<th>Processing</th>
<th>Application</th>
<th>Use</th>
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</thead>
<tbody>
<tr>
<td>Select 200</td>
<td>Refined</td>
<td>Flue Gas Treatment</td>
<td>As-is or Milled on site</td>
</tr>
<tr>
<td>Select 150</td>
<td>Refined, milled</td>
<td>Flue Gas Treatment</td>
<td>As-is</td>
</tr>
</tbody>
</table>
Sodium Bicarbonate
SOLVAir® Select 300 & 350

Chemical Formula: NaHCO$_3$
Select 350 pre-milled, ready to use
Select 300 milled on site
Reaction Chemistry: Thermal Activation

At T > 275°F the Sodium Sorbents rapidly form Soda Ash: Na₂CO₃

**Trona** *(Injection at 275°F - 1500°F)*

2(Na₂CO₃•NaHCO₃• 2H₂O)(s) + heat(△) → 3Na₂CO₃(s) + 5H₂O(g) + CO₂(g)

**Sodium Bicarbonate** *(Injection at 275°F - 600°F)*

2NaHCO₃(s) + heat(△) → Na₂CO₃(s) + H₂O(g) + CO₂(g)
SOLVAir® Products: Surface Area

Rapid thermal activation causes an 10-20X increase in specific surface area ("popcorn" effect)

High surface area and small particle size, as well as chemical affinity, make Sodium Sorbents highly effective in reacting with acid gases
MILLING: an option to evaluate

Finer particles improve distribution and mixing
≡ Higher treatment efficiencies
≡ Less unused sorbent
≡ Less fly ash production

Consider in design phase:

Type of mill for Particle Size and Volume to process

![SO2 Removal Rate vs Particle Size](image)
**Acid Gas Reactions**

**ALCALI + ACID GAS → SALT**

\[ \text{Na}_2\text{CO}_3 + 2 \text{HCl} \rightarrow 2 \text{NaCl} + \text{CO}_2 + \text{H}_2\text{O} \]

\[ \text{Na}_2\text{CO}_3 + \{ \text{SO}_2 + \frac{1}{2} \text{O}_2 \} \rightarrow \text{Na}_2\text{SO}_4 + \text{CO}_2 \]

\[ \text{Na}_2\text{CO}_3 + 2 \text{HF} \rightarrow 2 \text{NaF} + \text{CO}_2 + \text{H}_2\text{O} \]
Parameters Influencing Performance of Sorbents in DSI

- Lance Placement
- Mixing
- Sorbent Chemistry
- Dispersion
- Particle Size
- Competing Pollutants
- Temperature
- Residence Time
- Removal Efficiency
- ESP
- Bag House
Sodium Sorbents and de-NOx Catalytic Systems

Gas composition limits required at entry in catalytic de-NOx:
below 20 ppm SO$_2$ at 300-480F
Translates sometimes to efficiencies of +90% in SO$_2$ removal
Sodium Bicarbonate is the premier DSI sorbent able to
achieve sustained performance under these conditions and
has the ability to react quickly to changing SO$_2$ levels
SOLVAir® Solutions Advantage

What can we do for you?

Technical support
- Sorbent consumption estimations
- Estimation of by-product production
- Fly ash analysis
- Technical specifications for storage and handling
- Flue gas treatment optimisation expertise
- Over 20 years of knowledge in the air pollution control market

Logistic support
- Terminals
- Railcar Supply
- Transload Locations
- Milling Facilities
- Packaging – Super Sacks, Bulk Trucks

Commercial support
- Different products for different needs
- Multi year contracts
- One on One Support
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