

Sustainable FGT solutions for WtE

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SOLVAir® Solutions has been launched by Solvay, a market leader in sodium products. Its main mission is to offer and continuously develop competitive and sustainable environmental solutions used for air emissions control and associated waste, through a range of products, services, technologies and treatment systems. The SOLVAir® team has developed an outstanding know-how to design sustainable environmental processes by recycling waste downstream of gas cleaning operations and by increasing energy efficiency of its customers' installations, creating in that way a global solution for FGT process and count till today more than thirty years of contribution to this sector.

1 Treatment principal, process and performances

The basic principal of neutralization is known and presented in the next equation:

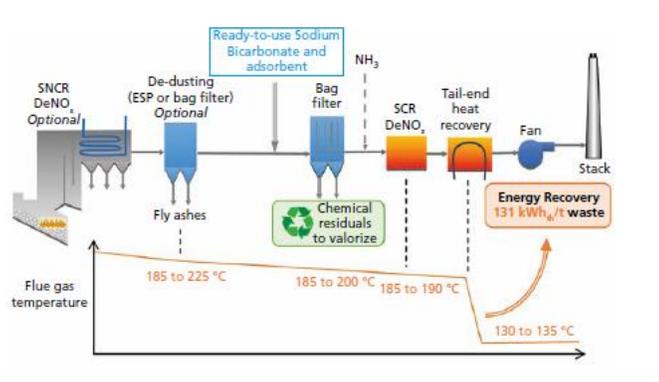


Figure 1. Best configuration for WtE proposed by SOLVAir team(Balland-Sartorius,2017)

1. **De-Dust 1st filtration step:** Enables to clean the flue gas from fly ashes and improves the quality of the residuals coming from the second filtration step (namely in case of recycling)
2. **Storage, Dosing and Sorbent injection:** Finely ground bicarbonate is dosed accordingly to needs to comply with emissions at stack. Sorbent injection (PID control). Before neutralization, sodium bicarbonate will activate into a high-specific surface medium in contact with warm raw gases. Thanks to this activation the contact surface with acids is increased and the availability of product to react is maximized. Adsorbent separate injection completes removal of heavy metals and PCDD/F
3. **Reaction + filtration:** High performance de-dusting is obtained with a bag filter. The full acids mitigation is obtained inside the product cake of the bags. An internal residue recirculation can be used to optimize stoichiometric ratio (sorbent use + residue production). The advantage to produce a lower weight of residues than the injected sorbent weight (typically weight factor 0.7 between residues produced and sorbent injected). Additionally to that residues can be revalorized in SOLVAY recycling units (France and Italy) where salts will be purified for a further industrial use. This solution give to WtE plants the possibility to improve their environmental footprint.

4. DeNOx: A selective catalytic reduction of NOx will operate in the best conditions in temperature range 180-200 °C as sodium bicarbonate enables a very high SOx mitigation level. No need to reheat the flue gases, reduced risk of fouling or poisoning by reaching very low SOx emissions (< 5 mg/Nm³ as yearly emission average is possible for SO₂).
5. Tail-end energy recovery: The marketable energy can be increased up to 131 kWh/t waste thanks to a tail-end heat recovery exchanger system (for instance for district or industrial heating supply). This additional energy is always recoverable.
6. Clean gases release: Gaseous emissions are monitored at stack with the appropriate analytical systems and used as input for sorbent flow control.

Although a lot of flue gas treatments configurations are possible, depending on customer constraints, existing methods, financial and operating constraints, the most efficient layout retained for sodium bicarbonate is represented in the scheme above.

2 Practical experience feedback

In the next paragraph you will have the possibility to identify by yourself the result of this innovative proposition, based on two examples in Belgium and Switzerland. Both operators report only positive things from the conversion to SOLVAir® sodium bicarbonate and the proposed revamping (as referred in the previous paragraph), such as eliminate constraints linked to grinder operations, bigger flexibility in pollutant treatment range, previously limited by grinding capacity and maximized energy efficiency.

2.1. WtE plant of Ostend, Belgium

One of our best case WtE Ostend start up with SOLVAir® sodium bicarbonate in 2004 and now use ready to use product for more than 3,5 year(from 2014). Residues analysis show us an average stoichiometric factor based of 1.19 for acid mitigation rates reaching up to 99.8 percent in a single pass with ground sodium bicarbonate process.

Species concentrations mg/Nm ³ , dry, 11% O ₂	Raw gas before cleaning (Min. / Avg. / Max.)	Cumulated average	Legislation (24 h average)
Dust		< 1	10
HCl	600 / 1,400 / 5,000	6	10
SO ₂	300 / 400	7	50
NO _x	200 / 400	90	100
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V+Sn ²		< 0.06	0.5
Hg ²		0.006	0.05
Cd + Tl ²		< 0.01	0.05
TOC		3	10
PCDD/F ³		< 0.003	0.1

¹ with ready to use sodium bicarbonate based sorbent, since 6/2014

² punctual measurement of 11/09/2014

³ ng TEQ/Nm³, dry, 11 % O₂

Figure 2. Performance of ready-to-use product in Oostende since mid-2014(Balland-Sartorius,2017)

2.2. WtE plant of Horgen, Switzerland

Wanting to expand its operations till 2030, WtE plant of Horgen was revamped and converted from wet to dry flue gas treatment with sodium bicarbonate, in 2015. Applying the solution proposed by the SOLVAir® team, Horgen plant reaches emission levels lower than the requested ones. Additionally to this achievement, we also succeeded to reach a stoichiometric factor of 1.0 which basically means that the total sorbent quantity has reacted with acid gases. Horgen plant was an extra proof that a very efficient flue gas treatment is possible, and can be optimized in matter of sorbent need and residue production when SOLVAir solution is used.

Pollutants measured August 2016	Units	Emission limits (daily)	Monthly average
HCl	mg/Nm ³ dry	20	1.6
HF	mg/Nm ³ dry	2	0.2
SO ₂	mg/Nm ³ dry	50	13
NO _x	mg/Nm ³ dry	80	21
Dusts	mg/Nm ³ dry	10	0.7
Zn/Pb	mg/Nm ³ dry	1	0.07
Cd	mg/Nm ³ dry	0.05	0.006
Hg	mg/Nm ³ dry	0.05	0.01
CO	mg/Nm ³ dry	50	16
PCDD/F	ng/Nm ³ dry	0.1	0.013
NH ₃	mg/Nm ³ dry	5	5.3
TOC	mg/Nm ³ dry	20	2

Figure 3. Performance of ready-to-use product in Horgen after revamping (Balland-Sartorius,2017)

3 Conclusions

Concrete industrial examples show evidence of the outstanding performance of ready to use (ground) sodium bicarbonate in WtE. Nowadays, more than 400 industrial units (not only WtE) worldwide are equipped with sodium bicarbonate based flue gas treatments.

Using as performance factors: high level of flexibility, reliability, increased global performance, energy savings (ex. electricity, tail-end heat exchanger), compatibility with existing systems and revamping-friendliness, cost-competitiveness (optimized sorbent consumption and residue production), our solution is well-known and recognized in the industrial world. It is also classified as BAT (Best Available Technique) in EU BREF for the following sectors: Ceramics, Common Wastewater, Iron & Steel, LCP, Glass, Cement & Lime, and last but not least Waste Incineration.

• Sources

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