Flue gas cleaning equipment factsheet

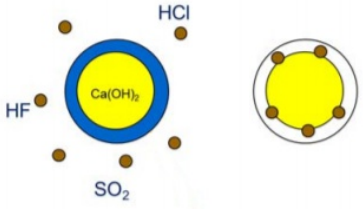
Even though modern boilers aim to achieve not only high combustion efficiency but low emissions as well when using agrobiomass, compliance with the emission limits of various regulations without the use of additional flue gas cleaning equipment is not always possible.

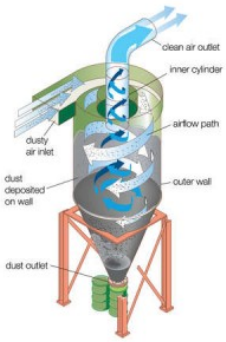
Depending on the application there are multiple solutions available in the market that can remove pollutants such as particulate matter, acidic gases and nitrogen oxide emissions.

For **dust emission abatement** usually cyclones, electrostatic precipitators (ESP) or bag filters are used.

For **HCl and SO_2 removal** dry sorption systems are often used, while for the **denitrification** of exhaust gases the SNCR method is very effective.

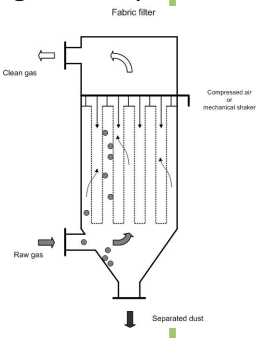
The **separation of acidic flue gas constituents** via **dry sorption** is a simultaneous and absorptive gas/solid-reaction which takes place in the sorbent employed in the process. In this process, the gaseous pollutants are bound to the surface of the introduced solid. The additives can then be separated from the flue gas together with the dust particles (typically in a subsequent fabric filter). These systems are characterised based on the additive applied and can be either sodium-based (application of $NaHCO_3$) or lime-based (application of $Ca(OH)_2$) systems.



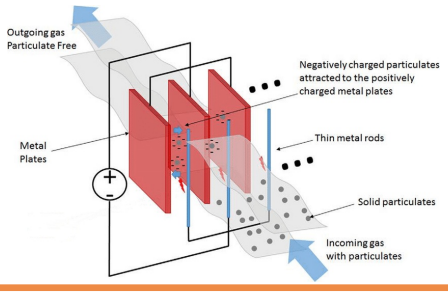


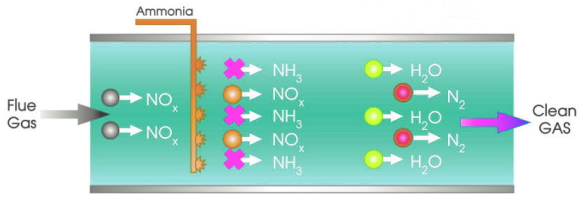
Dust control - Cyclones are conical containers that remove particulates from high speed rotating flue gas flows through vortex separation. Flue gas flows in a helical pattern before exiting the cyclone in a straight stream through the center of the cyclone and out the top. Particles in the rotating stream have too much inertia to follow and thus strike the outside wall, then fall to the bottom of the cyclone where they can be removed.

Dust control - Fabric filters use filtration to separate dust particulates from dusty gases. They are one of the most efficient types of dust collectors available, and can achieve a collection efficiency of more than 99% for very fine particulates. However, fabric filters are not applied in small-scale applications due to their demand for compressed air for cleaning, the high space demand and the fact that condensation of water vapours in the filter has to be avoided, which cannot be guaranteed during partial load operation of small-scale boilers.



Dust control - Electrostatic precipitators (ESP) use electrostatic forces to separate dust particles from flue gases. One or more (depending on filter size) high-voltage discharge electrodes are placed between grounded collecting electrodes. Particles receive a negative charge as they pass through the ionized field between the electrodes and are then attracted to a grounded or positively charged electrode and adhere to it.





NOx control - Selective non-catalytic reduction (SNCR) involves injecting either ammonia or urea into the firebox of a boiler at a location where the flue gas is between 900 and 1,100 °C to react with the nitrogen oxides formed in the combustion process. The resulting product of the chemical redox reaction is molecular nitrogen (N_2), carbon dioxide (CO_2), and water (H_2O). Since a certain furnace volume is needed to disperse and evaporate the additive, SNCR is not meaningful for small—scale boilers.

Image sources:dry sorption - Karpf, R. H. (2015). Basic features of the dry absorption process for flue gas treatment systems in waste incineration., cyclone - www.baghouse.com, fabric filter - www.emis.vito.be, ESP - Becker, K. H., Zhu, W., & Lopez, J. L. (2016). Microplasmas: Environmental and Biological Applications. Encyclopedia of Plasma Technology, SNCR - www.ifsolutions.com

Find out more about flue gas cleaning equipment manufacturers in AgroBioHeat's Agrobiomass Heating Observatory

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