

Hurricane HR Cyclones to Capture Fine Fly Ash Particulate Enabling the Use of Wood Waste Fired Thermal Oil Heater for Sonae Indústria



FOREWORD

Advanced Cyclone Systems, S.A. (ACS) designed and supplied a turnkey Hurricane® cyclone system installed downstream of an existing multicyclone to capture fine fly ash particulate (burnt and unburnt), thereby enabling the use of wood waste fired thermal oil heater.

With a total of 21 plants located in 6 countries on 3 continents, **Sonae Indústria** is one of the largest wood-based panel producers in the world. At the end of 2014 the company had 3 596 employees worldwide and a consolidated turnover of 1 015 million Euros.

The MDF capacity in Europe was expanded by the installation of a second product line at Mangualde in 1995, and by the end 1998 Sonae Indústria had an industrial and market presence outside Europe, in Canada, Brazil and Southern Africa.

IDENTIFYING THE PROBLEM AND SOLUTION

The company was forced to use a natural gas fired hot gas generator for drying fibre despite having the necessary amount of thermal energy available in the exhaust stream of a wood waste fired thermal oil heater. The problem of using the biomass thermal oil heater laid on the emission of fine burnt and unburnt particulate which were carried over with the dried fibre and finally deposited on the final product - wood panel boards. These were systematically rejected by quality inspections. ACS was given the challenge of solving this immense problem and of enabling the use of the existing biomass fired thermal oil heater. The system to be designed would have to cope with two distinctive operating conditions due to the different moisture content of the biomass, namely summer and winter.

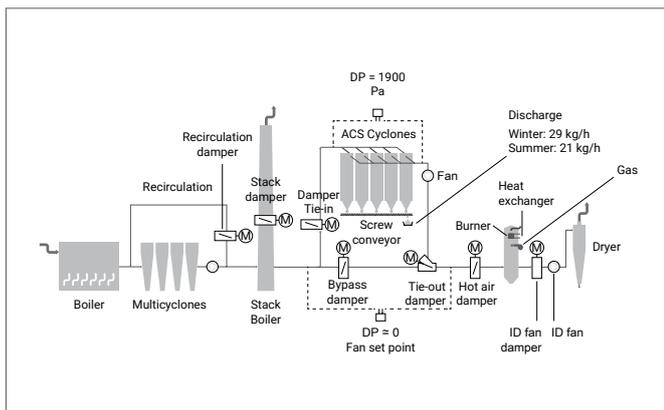


Fig. 1 – Existing process scheme

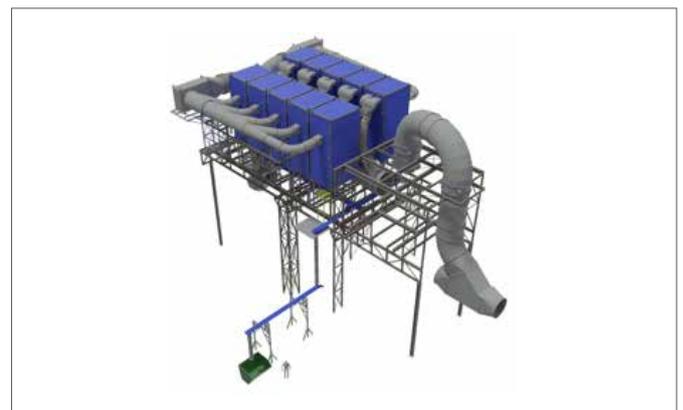


Fig. 2 – ACS solution [10 batteries of 8 Hurricane cyclones with $\varnothing 800\text{mm}$]

ABOUT HURRICANE CYCLONES

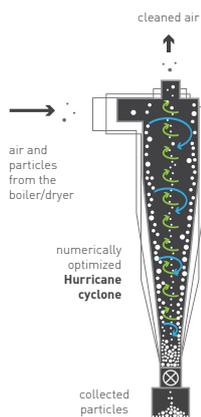


Fig. 2 – Hurricane cyclone

Hurricane cyclones are patented numerically optimized cyclones. **Hurricane** geometries maximize powder collection for each different application, while minimizing reentrainment and keeping pressure drop at reasonable levels. Hurricane cyclones demonstrate impressive efficiencies in capturing very fine powders with a Median Volume Diameter (MVD) of less than 5µm.

These cyclones are the output of nonconvex nonlinear problems formulated and solved after years of work in partnership with the Faculty of Engineering of Porto and incorporate the most recent findings of the impact of agglomeration in the cyclone collection efficiency (Chemical Engineering Journal 162 (2010) 861–876). **A single Hurricane is more efficient than any other known cyclone available in the market for the same pressure drop.**

For more information, visit our website: www.acsystems.pt

DESIGN BASIS

• Summer design conditions:

- Type of fuel **[Pine bark and wood waste residues]**
- Particle size distribution **[Fig. 3]**
- Gas flow temperature (°C) **[303]**
- Actual flow rate (Am³/h) **[247 000]**
- Normal flow rate (Nm³/h) **[104 000]**
- Inlet concentration (mg/Nm³_{dry}) **[239]**

• Winter design conditions:

- Type of fuel **[Pine bark and wood waste residues]**
- Particle size distribution **[Fig. 4]**
- Gas flow temperature (°C) **[278]**
- Actual flow Rate (Am³/h) **[217 000]**
- Normal flow Rate (Nm³_{dry}/h) **[96 000]**
- Inlet concentration (mg/Nm³_{dry}) **[353]**

• Estimated Efficiency Curves – Summer:

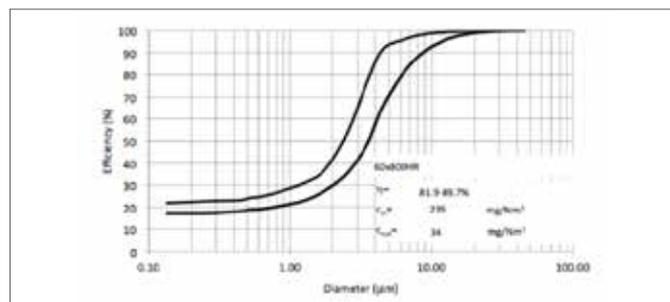


Fig. 4- Particle size distribution used in simulations (Coulter) – Summer

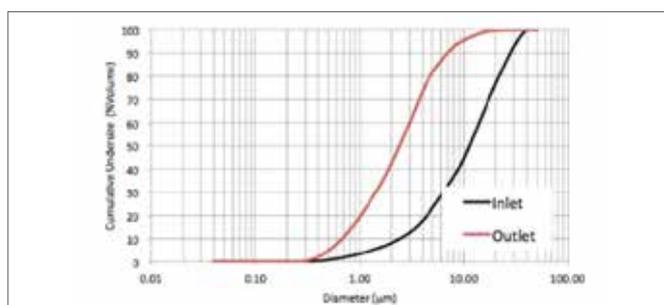


Fig. 3 - Particle size distribution used in simulations (Coulter) – Summer

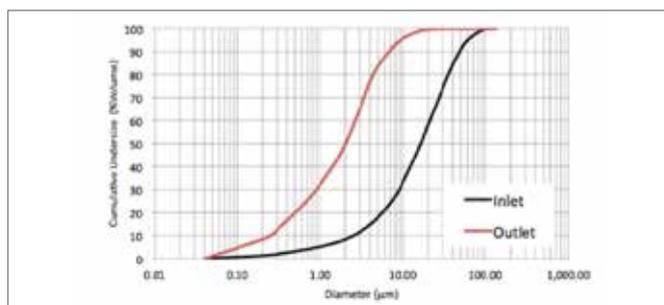


Fig. 4- Particle Size Distribution used in simulations (Coulter) – Winter

• Estimated Efficiency Curves – Winter:

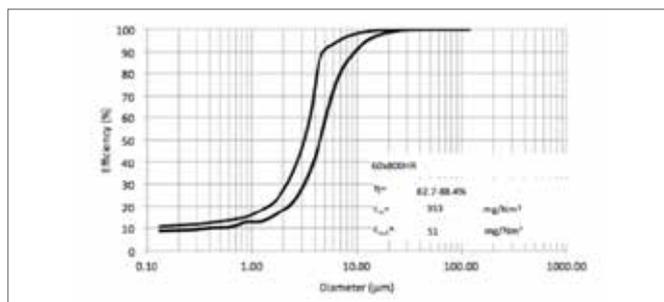


Fig. 4- Particle size distribution used in simulations (Coulter) – Winter

VERIFIED RESULTS

- Inlet Concentration (mg/Nm³_{dry}) **[880]**
- Verified Separation Efficiency (%) **[91.2]**
- Verified Outlet Concentration (mg/Nm³_{dry}) **[<77]**
- Verified total pressure drop (Kpa) **[1]**

CONCLUSIONS

The results proved to be better than expected in terms of separation efficiency, allowing Sonae using biomass of a lower quality and higher moisture and still be under the threshold of particulate concentration to have a top quality product. Additionally, the system proved to work always at a pressure drop under 1kPa due to new designed outlet gas plenums of the system resulting in increased energy savings and shorter paybacks.