Advanced Cyclone Systems

EMISSION CONTROL

CASE STUDY

WtENERGY ADVANCED SOLUTIONS | Switzerland | 2020

Hurricane TX System

to reduce PM emissions from MBM gasification off gases with a syngas rate of 30 000 m^3/h at 750°C

FOREWORD

ACS designed and supplied a **Hurricane system** for **WtEnergy**.

Waste to Energy Advanced Solutions was born in 2017 thanks to 20 years of experience of its founder Andrés Ponce on gasification, biofuels and clean energy generation (thermal and electric).

In 2019, Antonio Crous joins the project as co-founder, to scale the business commercially and develop the implementation of technology within strategic industries and sectors.

WtEnergy has developed a unique cleantech technology, with a wide know-how and large number of projects behind it.

ACS's system was installed for the separation of particulate matter at high temperature from the off gases of Meat and Bone Meal gasification.

IDENTIFYING THE PROBLEM AND SOLUTION

ACS was challenged to clean the syngas particulates from MBM gasification (Fig. 1).

The objective was to separate 89 – 95% of the particulate matter at high temperature (750°C) with allowance up to 800°C (for mechanical design).

The hot gas had a high dust concentration of 103 g/Nm^3, on the maximum flow rate of 30 000 m^3/h at 750°C.

ACS designed a numerically optimized Hurricane TX cyclone with ø 1750 mm, with dip-leg and hopper, fully calculated to withstand the maximum temperature and pression.

The designed efficiency is 91,1 – 96,3% for a pressure drop of 0,9 kPa on the maximum flow rate.

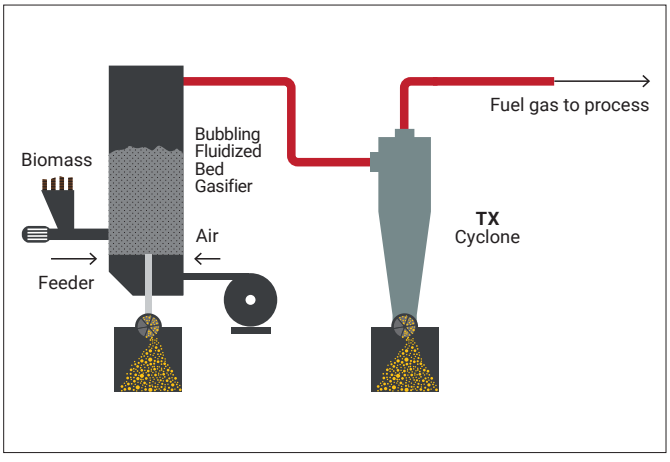

Fig. 1 – Process diagram

ABOUT HURRICANE CYCLONES

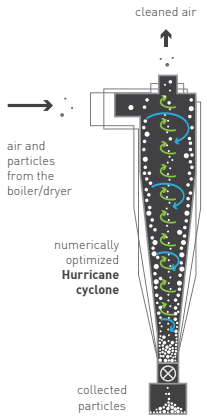

Fig. 2 – Hurricane Cyclone

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 Volume Median Diameter (VMD) 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.

DESIGN BASIS

- Solids **[MBM particulate]**
- Particle size distribution **[Fig.3]**
- Temperature (°C) **[750]**
- Actual flow rate (m^3/h) **[30 000]**
- Normalized flow rate (Nm^3/h_{dry}) **[7 050]**
- Moisture content (% H20 v/v) **[7.1]**
- Gas absolute pressure (Pa) **[96 014]**
- Particulate concentration at inlet of ACS (mg/Nm^3_{dry}) **[102 972]**
- Site location **[Indoors]**

SYSTEM SPECIFICATIONS | EMISSIONS

- Expected separation efficiency (%) **[95.2 – 98.6]**
- Expected emissions (mg/Nm^3_{dry}) **[4 983]**
- Guaranteed minimum efficiency (%) **[95]**
- Pressure drop (kPa) **[1.2 +/- 10%]**

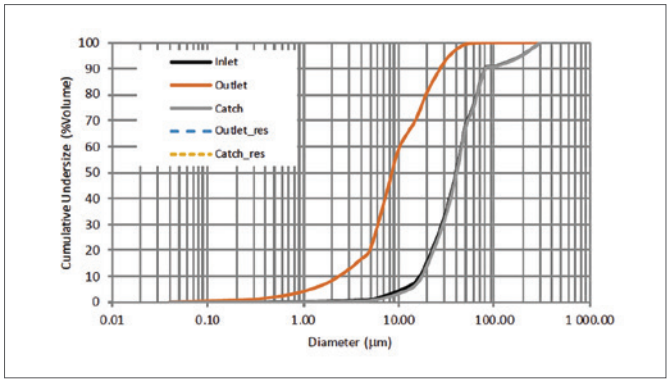

Fig. 3 – Particle size distribution used in simulation

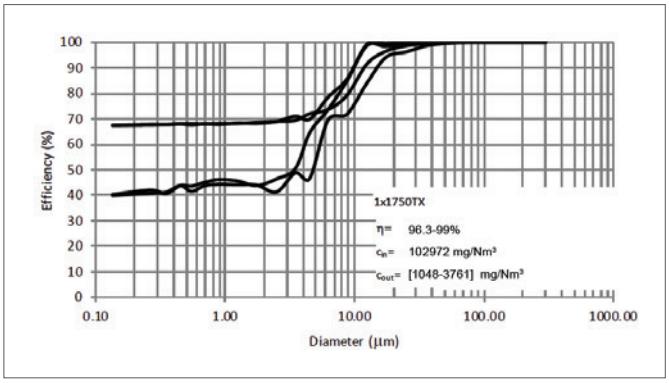

Fig. 4 – Predicted maximum and minimum grade efficiency curves with corresponding global efficiency values

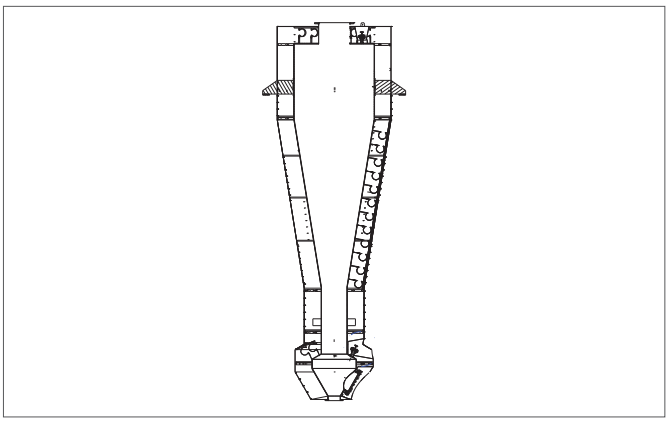

Fig.5 – ACS solution [1 TX ø1750]

CONCLUSIONS

ACS' solution was installed in the first quarter of 2021 and has been running perfectly ever since, cleaning the syngas in this exciting WtEnergy's 18MWth waste to cogeneration project, which valorizes more than 28 000 t/year of MBM residue with expected 30 000 tons of CO_2/year reduction.