Advanced Cyclone Systems

EMISSION CONTROL

CASE STUDY

JAREMAR | HONDURAS | 2012

Hurricane system *to reduce particulate matter from a palm waste boiler working with a flow rate of 114.935 m³/h @ 204ºC*



FOREWORD

Advanced Cyclone Systems, S.A. (ACS) designed and supplied a Hurricane Cyclone System for Grupo Jaremar in Honduras, with the objective of reducing Particulate Matter (PM) emitted by a Palm Waste Boiler from **1500mg/Nm³** to less than **150 mg/Nm³**.

Grupo Jaremar is comprised of a group of subsidiaries companies located in Honduras, dedicated to the cultivation of palm oil plantations, crude palm oil extraction and refining, fractionation and commercialization of edible oils and shortenings.

As many other palm oil mills, Jaremar, is self-sufficient in terms of energy. However, burning of biomass fuel in a boiler generates a serious air pollution problem due to inappropriate boiler operation and inefficient dust collection system (multicyclone). New regulation in Honduras forces companies to progressively comply with emission limits, starting at 1000mg/Nm³ in 2010, down to 150mg/Nm³ in 2015.

Jaremar operates several palm mills in Honduras, and decided to solve the emission problem in two of them, namely AGROTOR, operating a 35 ton/h Mechmar water tube boiler (114.935 m³/h @ 204ºC), and CAICESA, operating a Fraser boiler (85.127 m³/h @ 256ºC).

This case study focuses only on the first case.

IDENTIFYING THE PROBLEM AND SOLUTION

In 2012, the existing furnace in Agrotor had a very incomplete and inconstant combustion, attributed to several factors, among which the unstable and uncontrolled fuel feeding and the defective air distribution inside the furnace. Also, an incomplete combustion results in many unburned particles that negatively affect the existing multicyclone efficiency, since they tend to disagglommerate in finer and very light and porous particles. Indeed, PM emissions at the stack were very high, rising to **2495mg/Nm³**.

After confirming what particle size distribution (PSD) to consider for the case (see Fig.1), ACS designed a Hurricane system comprising 36 Hurricane HR numerically optimized cyclones, with ø800 mm, disposed in six batteries of six elements.

The system is capable of reducing emissions to under 150 mg/Nm³ at a pressure drop of 1.0 kPa, maintaining that boiler emissions after existing multicyclone are under 1500 mg/Nm³. Consequently, the client committed to a series of boiler improvements, including a more automatized feeding system and some boiler grate adjustments, in order to meet the requirements.

DESIGN CONDITIONS

- Fuel [Mesocarp Fibre (80%) and Palm Kernell Shell (20%)]
- Boiler [Mechmar 35ton/h Water Tube]
- Fly ash Particle Size Distribution [Fig.2]
- Gas flow Temperature (ºC) [204]
- Effective Flow Rate (m^3/h) [114.935]
- Normal Flow Rate (Nm^3/h) [56.920]
- Current Inlet concentration to Hurricane system (mg/Nm^3) [2495]
- Future inlet concentration to Hurricane system (mg/Nm^3) [1500]

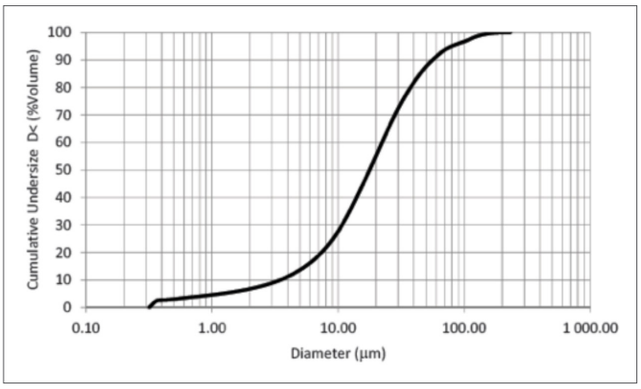


Fig. 2 - Assumed Particle Size Distribution (PSD) from Boiler burning a mixture of Mesocarp Fibre and Palm Kernell Shell

SYSTEM SPECIFICATIONS AND PERFORMACE

- Maximum pressure drop (Kpa) [1.0]
- Guaranteed emissions (mg/Nm^3) [150]
- Exp. emissions for current inlet concentration (mg/Nm^3) [222]
- Expected emissions for future inlet concentration (mg/Nm^3) [134]
- Expected efficiency (%) [>91]



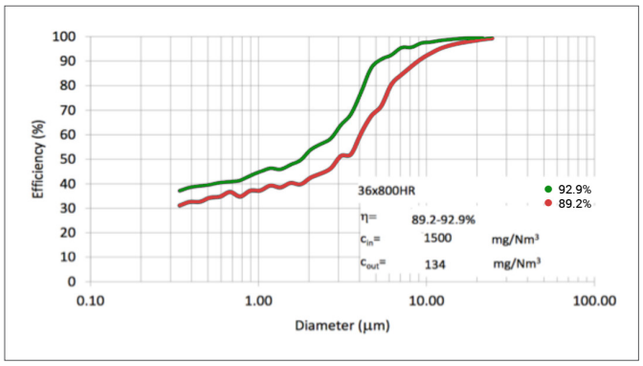
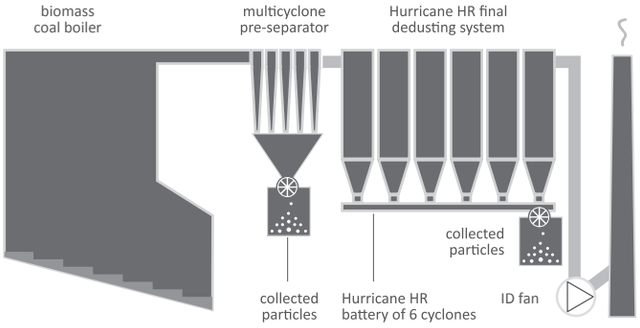
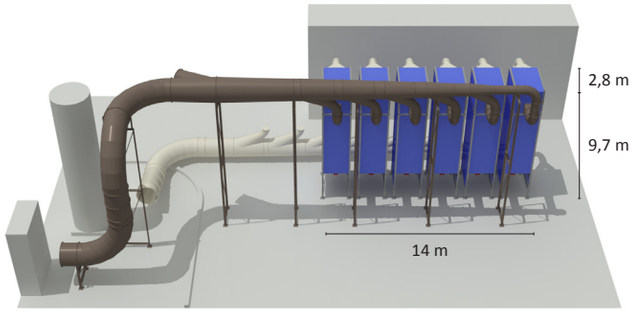


Fig. 3 - Predicted maximum and minimum grade efficiency curves with corresponding global efficiency values

SCOPE OF SUPPLY & GENERAL ARRANGEMENT

ACS and its partner Grupo Madeesma in Honduras provided an almost turnkey project for grupo Jaremar, inclusing the nuclear system (6 batteries of 6 cyclones each) with insulation and discharge equipment (screw conveyor and rotary valve), ductwork and new ID fan.





CONCLUSIONS

Currently, the boiler has not yet been fully improved to meet the design conditions before the Hurricane System (<1500 mg/Nm^3) and emissions in the last report mount to 192 mg/Nm^3, which is below the current limit of 550mg/Nm^3. Until 2015, the boiler is expected to be fully operational, as expected, to meet the 150 mg/Nm^3.

Grupo Jaremar is very satisfied with the performance and is in the process of ordering another system for a third plant in Honduras.

Efficiency verified results (>91%) confirm that the Hurricane Cyclone System can achieve PM emissions under 150 mg/Nm^3 for inlet concentrations of fine particulates (escaping a multicyclone) of 1500mg/Nm^3, thus achieving imposed emission standards with an equipment which has lower investment costs, when compared with ESPs, and lower maintenance and operating costs, when compared to Bag Filters.