EMISSION CONTROL

CASE STUDY

THERMOLAQUAGE DE VENDÉE | CHAVAGNES EN PAILLERS, FRANCE | 2013

Hurricane HR System to increase powder recovery in an electrostatic painting booth

FOREWORD

Advanced Cyclone Systems (ACS) has designed and supplied a Hurricane cyclone system for Thermolaquage de Vendée (Chavagnes en Paillers, France).

Thermolaquage de Vendée (TLV) specializes in electrostatic powder coating, for industrial needs. The company was established in 2008 in Chavagnes en Paillers, France. With around sixty employees, TLV it is much more than a simple industrial painter: TLV stands out for its ability to organize and control all the logistics of stock and production flow.

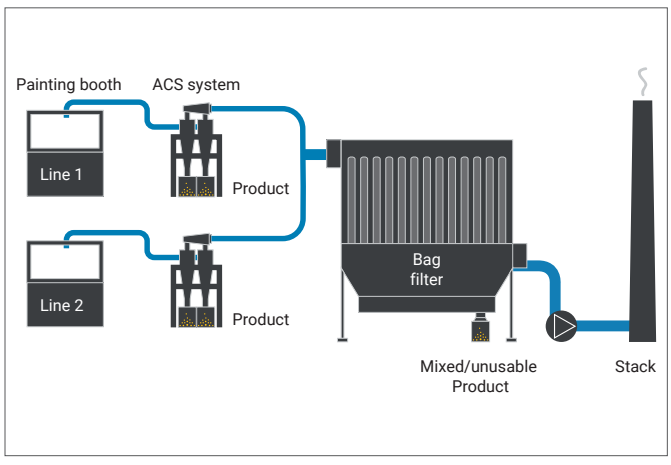

Fig. 1 – Process diagram

IDENTIFYING THE PROBLEM AND SOLUTION

The principle of electrostatic powder coating is to spray a powder paint (polyester resin) on a support, by giving it an electrostatic potential so that it adheres to the support. The powder is polymerized on the support at a temperature of 180 to 200°C.

TLV contacted ACS regarding its vertical line, for painting 7m high aluminum profiles, vertically and continuously. This powder coating line is equipped with 2 booths, allowing it to alternate between dark and white colors.

The spraying of the powder is done in the booths under vacuum, which makes it possible to contain the powder in the support (fine powder with a median diameter of 30 to 32µm) and to recycle the excess powder via cyclones' separation. Furthermore, during spraying, some part of the powder ends up in the cabin walls and floor. This part is also recycled back, via the two cyclones, during the cleaning cycles, after the painting. Each cyclone was designed for a suction flow rate of 12 000m^3/h and serves the goal of Powder Recovery. After the cyclones, there is a bag filter as a backup, for atmospheric emission control. The product collected in the bag filter cannot be re-used because it has color contamination.

With a daily consumption of around 800kg per booth, the problem that TLV was facing is related to losing too much powder to the final bag filter, due to low efficiency of the existing cyclones. Client requested ACS to design new cyclones for 95% separation and ACS installed two new high efficiency hurricane HR 1400 cyclones, with 97.1 - 97.6% global separation efficiency.

ABOUT HURRICANE CYCLONES

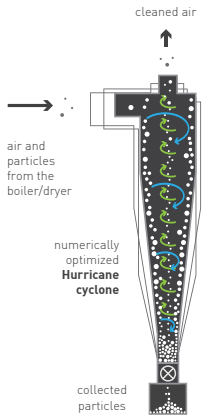

Fig. 2 – Hurricane cyclone

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

- Type of particles **[Powder coating]**
- Particle size distribution **[Fig.3]**
- Gas flow temperature (°C) **[31]**
- Normalized flow rate (Nm^3/h_{dry}) **[17 725]**
- Absolute pressure operation (kPa) **[99.163]**
- Inlet Concentration (Nm^3/h_{dry}) **[<1812]**

SYSTEM SPECIFICATIONS | EMISSIONS

- Expected separation efficiency (%) **[97.1 - 97.6]**
- Expected emissions (mg/Nm^3_{dry}) **[<47]**
- Emissions to guarantee (mg/Nm^3) **[55]**

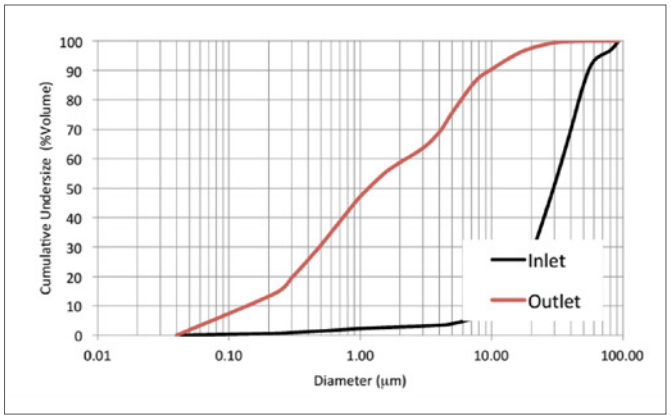

Fig. 3 – Particle size distribution used in simulation

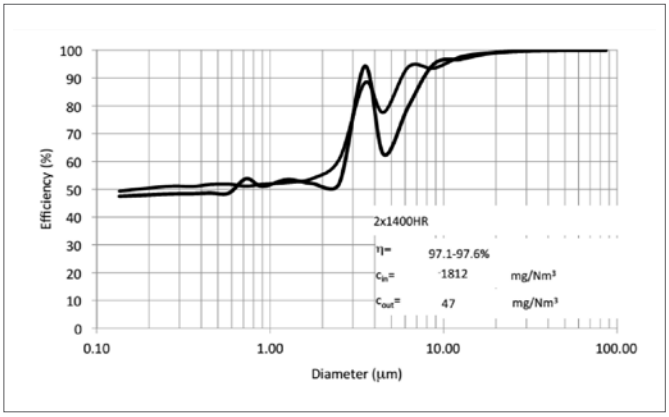

Fig. 4 – Predicted maximum and minimum grade efficiency curves with corresponding global efficiency values

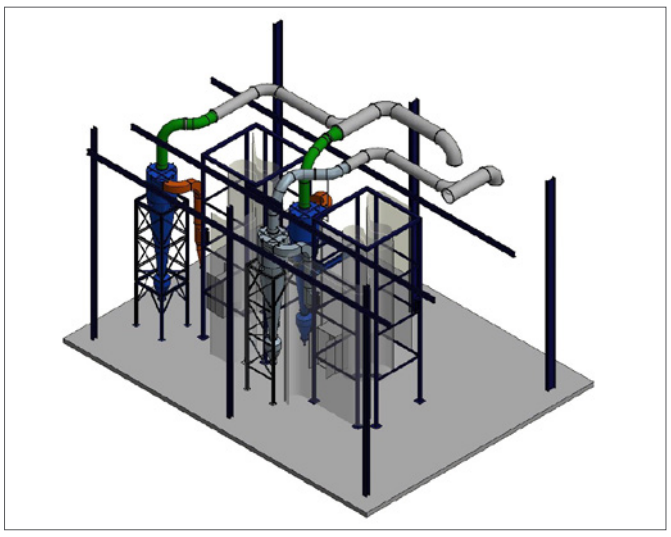

Fig.5 – ACS Solution [2 HR Hurricane cyclones | ø1400mm]

CONCLUSIONS

Typical conventional cyclones for painting booths have a recovery efficiency in the range of 90-95%.

By increasing the recovery to ~97.5% with the hurricane cyclone, client avoids losing valuable product while keeping the recovered particle with a size that is still valid for painting. The lost product (~2.5%) is expected to be very fine (90%< 10 microns) with no painting value so, overall it was a good balance of efficiency increase.