Advanced Cyclone Systems

EMISSION CONTROL

CASE STUDY

Mondelēz | Curitiba, Brazil | 2021

Hurricane AT System
for downstream Juice Powder Recovery of a bag filling machine (3 857m³/h at 30°C)

FOREWORD

On behalf of our newest client Tang, **Advanced Cyclone Systems** designed and supplied five **Hurricane AT** cyclone systems for soluble juice powder recovery from the dedusting system of the bag filling line. The system was installed at the **Mondelēz International** Tang plant in Curitiba, Brazil. **Tang** is a drink mix brand that was founded by General Foods Corporation in 1957 and first marketed in 1959.

The brand is currently owned by Mondelēz International, a spin off of Kraft Foods Inc. Mondelēz is an American multinational confectionery, food, beverage and snack food holding company based in Chicago (Illinois), with an annual revenue of about $26 billion in over 160 countries.

Their international portfolio includes several billion dollar brands such as Belvita, Chips Ahoy!, Oreo, Ritz, and many more.

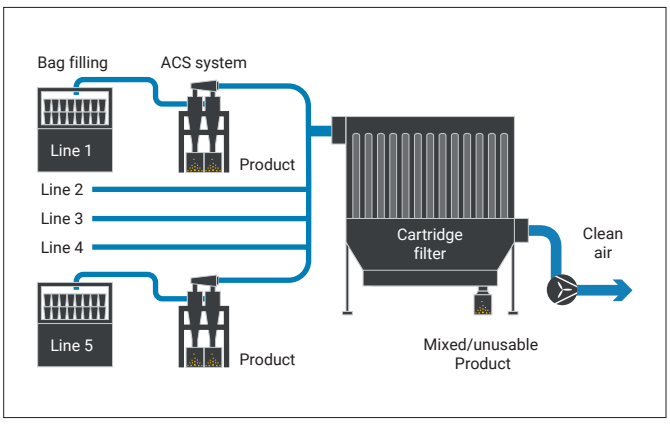

Fig. 1 – Process flow diagram from existing installation

IDENTIFYING THE PROBLEM AND SOLUTION

The Tang plant in Curitiba has five machines to fill the powder packs. During that process a small portion of the product escapes the powder bags and enters the atmosphere. In the past, this resulted in **Mondelēz losing about 600kg of product per day across the five lines** – about 120kg in each one.

Now installed at every machine on the plant, ACS designed and supplied five Hurricane AT-systems, each composed of two Hurricane AT-cyclones with a diameter of 530mm, a discharge hopper and a container, to capture the collected powder. The escaping particles are now exhausted through the dedusting systems of our highly efficient cyclone system and conveyed to a cartridge filter to clean the air flow before going out to the atmosphere. We also supplied CIP nozzles along with the system as Mondelēz frequently changes the juice flavors and the system needs to be cleaned before the rotation.

This step is of importance because the product is contaminated and cannot be used for further production. Thanks to the additional cyclones at the plant, Tang is now able to fulfill governmental emission regulations. By installing our system, **Mondelēz is reducing losses by about 99%** – which results in a drastic reduction of loss from previously 600kg/day to now 7kg/day.

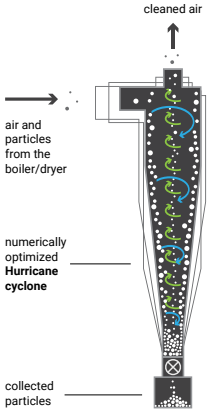

Fig. 2 – Hurricane cyclone

ABOUT HURRICANE CYCLONES

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 efficiency 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 on 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.

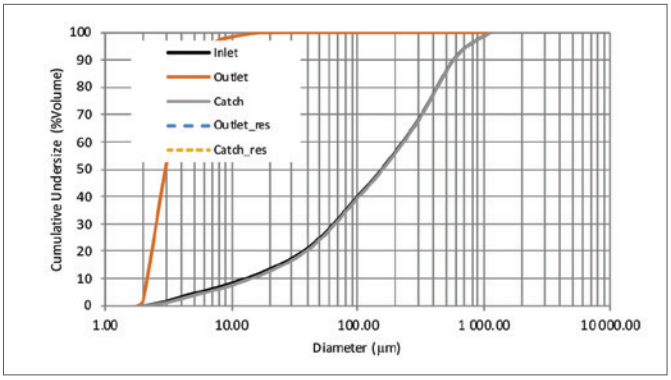

Fig. 3 - Particle size distribution used in simulations

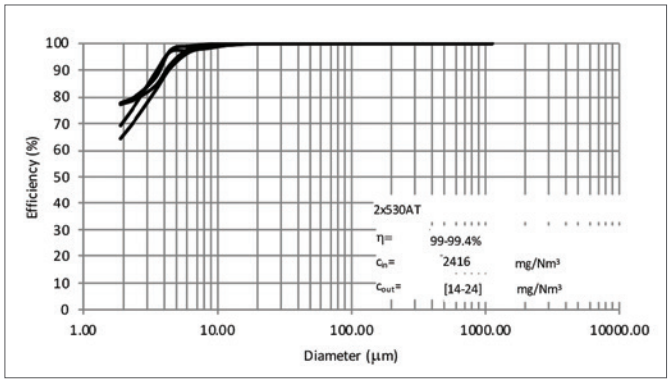

Fig. 4 – Predicted maximum and minimum grade efficiency curves with corresponding global efficiency values

DESIGN BASIS

Powder	**Soluble Juice Powder**
Particle size distribution	**Fig. 3**
Temperature (°C)	**30**
Actual flow rate (m^3/h)	**3 857**
Moisture content (% v)	**0.1**
Absolute pressure (Pa)	**90 596**
Powder concentration at inlet (Nm^3/h)	**2 416**
Site location	**Indoors**

SYSTEM SPECIFICATIONS | EMISSIONS

Expected emissions (mg/Nm^3_{dry})	**24**
Guaranteed maximum emissions (mg/Nm^3_{dry})	**30**
Powder recovery rate (Kg/h)	**7.4**
Expected pressure drop (kPa)	**1.47**

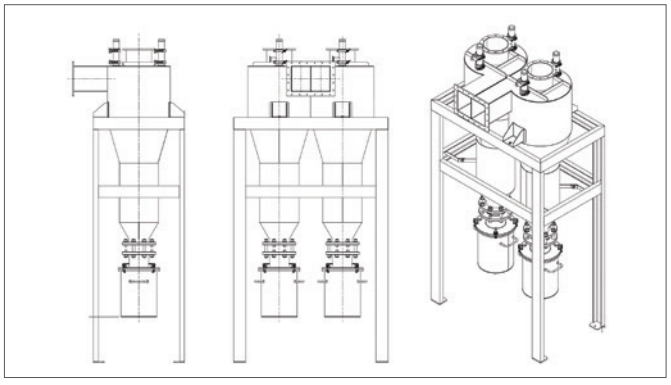

Fig. 5 – General arrangement of the Hurricane cyclone system

CONCLUSIONS

It was a challenging project since there were space and volume restrictions but a great success for our company's portfolio. On the one hand, the client is recovering practically all the product that was lost before, around 200 tons annually, which has had an immense economic impact on the company. On the other hand, the costs and frequency of maintenance on the cartridge filter decreased, reducing the downtime of the filling line.