Advanced Cyclone Systems

EMISSION CONTROL

CASE STUDY

Firmenich | Ålesund, Norway | 2021

Hurricane RE Cyclones
to Maximize Fish and Seafood Flavours Recovery from a Flash Dryer (16 800m³/h at 80°C)

FOREWORD

Advanced Cyclone Systems designed, supplied, and installed a Hurricane RE Cyclone System to maximize fish and seafood flavour powder for Firmenich in Ålesund, Norway.

Firmenich SA, a private Swiss company headquartered in Geneva, is the largest privately-owned fragrance and taste company in the world, employing 11,000 people across 46 manufacturing plants and six R&D centers. Firmenich has created perfumes for over 125 years and produced a number of well-known flavors, reaching about 4 billion consumers everyday day, in markets such as food, fragrance and beauty.

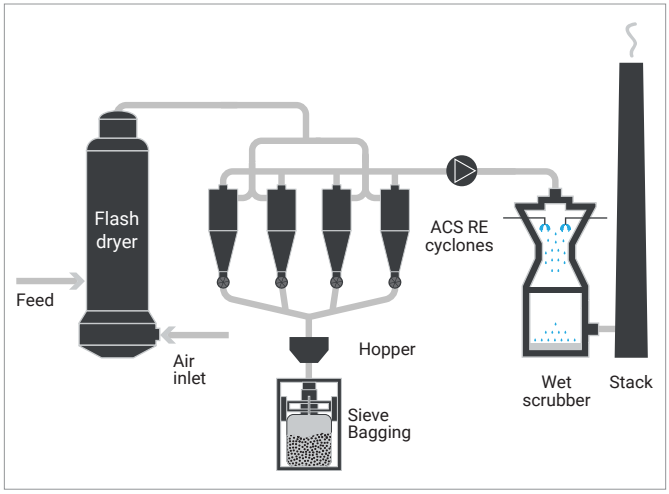

Fig. 1 – Process scheme

IDENTIFYING THE PROBLEM AND SOLUTION

The existing cyclone installed on the Hosokawa flash drying line had estimated losses of more than 9%. Apart from the losses, the client was also concerned because these losses were overloading the wet scrubber downstream.

To design the most efficient system for this case, several samples were collected and sent to our offices in Porto. We analysed particle size distribution and apparent density. Some trial runs were made in our pilot, with product from the client, that further reinforced our confidence in the projected results.

The model chosen was the Hurricane RE that was numerically optimized for the actual flow and also the increased flow the client will operate at in the future, after a refurbishment of the dryer and fan.

The system is composed by 4 Hurricane RE cyclones ø1450mm installed in parallel that discharge through 4 rotary airlocks to a common hopper. All equipment was manufactured in stainless steel AISI 316L with food grade finishing. Cyclones are equipped with pressure detectors and explosion suppression bottles, CIP nozzles and 50mm rockwool insulation covered in welded stainless steel cladding. ACS installed the system at the client´s plant in Norway.

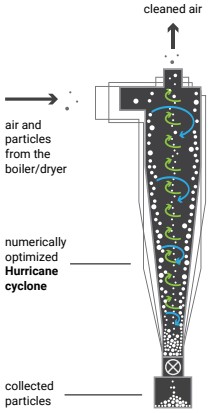

Fig. 2 – Hurricane cyclone

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.

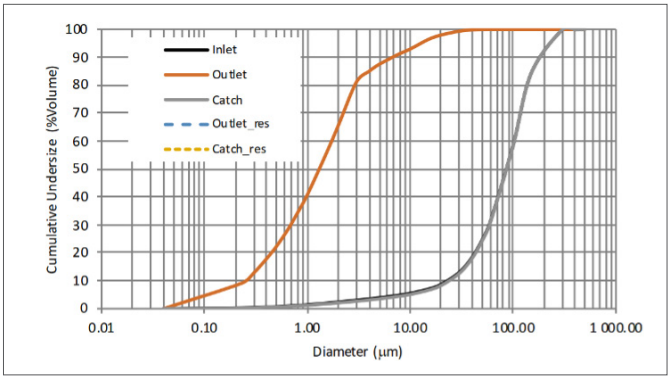

Fig. 3 - Particle size distribution used in simulations (Coulter)

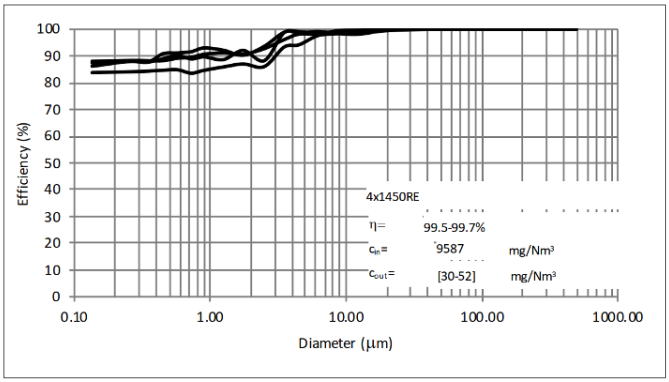

Fig. 4 – Predicted maximum and minimum grade efficiency curves with corresponding global efficiency values

DESIGN BASIS

- Powder **[Fish and Seafood Flavours]**
- Particle size distribution **[Fig. 3]**
- Temperature (ºC) **[80]**
- Site location **[Indoors]**
- Actual flow rate (Am^3/h_{wet}) **[16 800]**
- Inlet concentration (mg/Nm^3_{dry}) **[9 587]**

SYSTEM SPECIFICATIONS | EMISSIONS

Expected results:

- Predicted efficiency with Hurricane cyclone (%) **[98.1-99.7]**
- Expected total pressure drop (kPa) **[1.3]**
- Expected emissions (mg/Nm^3_{dry}) **[30-167]**

Verified results:

Firmenich confirms, after testing, that yield has improved dramatically across the board, with an average increase of 10%.

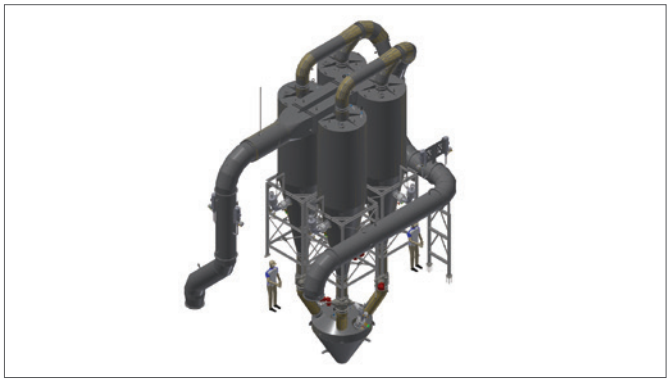

Fig. 5 – General arrangement of the Hurricane cyclone system 4 Hurricane RE cyclones ø1450mm

CONCLUSIONS

The separation efficiency predictions surpassed the numerical results. The improved separation efficiency of the Hurricanes provided an overall increase in yield of about 10%.

Firmenich was happy to share these results with us along with their global satisfaction with our approach to cyclonic separation.

Together with the client, we are now analyzing other possible plants that could benefit from our technology.