Advanced Cyclone Systems

EMISSION CONTROL

CASE STUDY

NTE Process | Konin, Poland | 2021

Hurricane HR System
for powder capture after a lithium hydroxide spray dryer (51 000m³/h at140°C)

FOREWORD

Advanced Cyclone Systems designed, supplied, and installed a Hurricane HRbH high-efficiency cyclone system to maximize the recovery of lithium hydroxide particles after a Spray Dryer for **NTE Process**. The final client for this project is **Johnson Matthey**, a global leader in sustainable technologies and specialty chemicals, known for their expertise in advanced materials and catalyst manufacturing.

NTE Process, a renowned company specializing in the development of innovative process solutions, collaborated with Johnson Matthey for the first commercial plant of their battery division. Johnson Matthey, with a rich history of over 200 years, operates worldwide, employing more than 13,000 people across various sectors including clean air, clean energy, and chemical processes

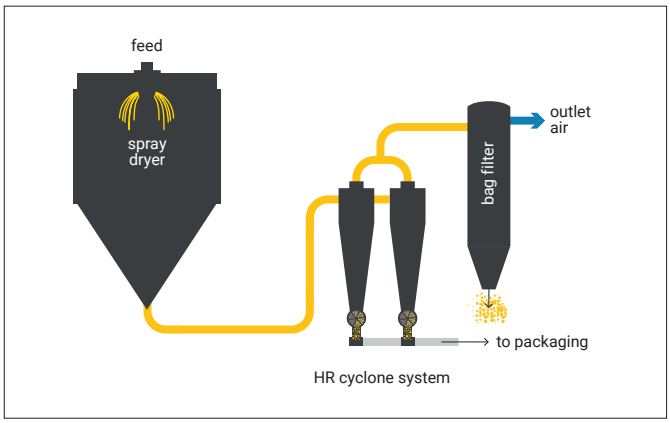

Fig. 1 – Process diagram

IDENTIFYING THE PROBLEM AND SOLUTION

Johnson Matthey required a cyclone system capable of achieving a collection efficiency of 98% for particles with a 5-micron size in their lithium hydroxide production process. The primary challenge was to design a system that could meet these stringent efficiency requirements without contaminating the high-purity lithium hydroxide particles with stainless steel, which would negatively impact battery performance.

To address this issue, Advanced Cyclone Systems designed and supplied Hurricane HRbH cyclones lined with alumina tiling. The alumina lining ensures that the lithium hydroxide particles are not contaminated by stainless steel, maintaining the high purity required for optimal battery performance. The system comprises 2HRbH2100 cyclones with an actual flow rate of 51,000 m³/h and operates at a temperature of 140°C, ensuring efficient and contamination-free particle collection. This solution not only meets the efficiency requirements but also upholds the quality standards critical for Johnson Matthey's battery materials.

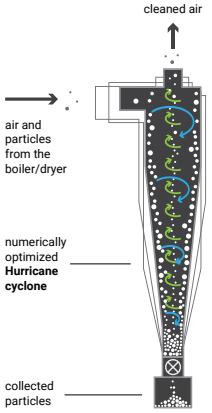

Fig. 2 – Hurricane cyclone

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.

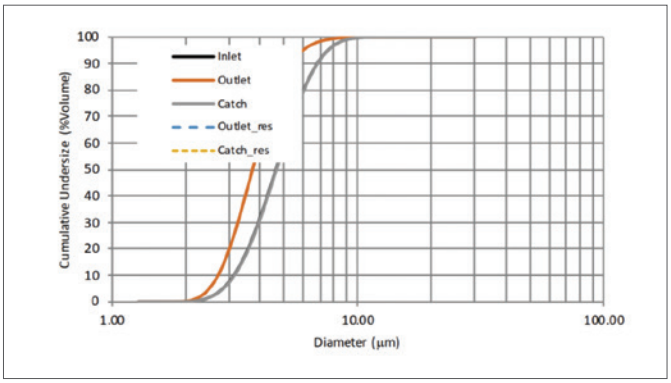

Fig. 3 - Particle size distribution used in simulations

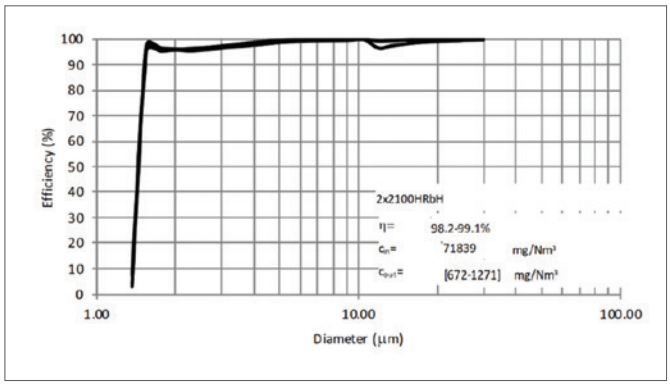

Fig. 4 – Predicted maximum and minimum grade efficiency curves with corresponding global efficiency values

DESIGN BASIS

- Powder **[Lithium Hydroxide]**
- Particle size distribution **[Fig. 3]**
- Temperature (°C) **[140]**
- Actual flow rate (m^3/h) **[51 000]**
- Inlet concentration (mg/Nm^3_{dry}) **[71 839]**
- Site location **[Indoors]**

SYSTEM SPECIFICATIONS | EMISSIONS

- Predicted efficiency with new Hurricane cyclone (%) **[98.2 - 99.1]**
- Expected emissions (mg/Nm^3) **[672 - 1271]**
- Powder recovery rate (Kg/h) **[7.4]**
- Expected total pressure drop (kPa) **[2.1]**

GENERAL ARRANGEMENT

ACS successfully carried out he project with on time delivery for this challenging high-efficiency cyclone system.

The collaboration between Advanced Cyclone Systems and NTE Process has proven to be highly effective, paving the way for potential future projects to further optimize and enhance Johnson Matthey's production capabilities.

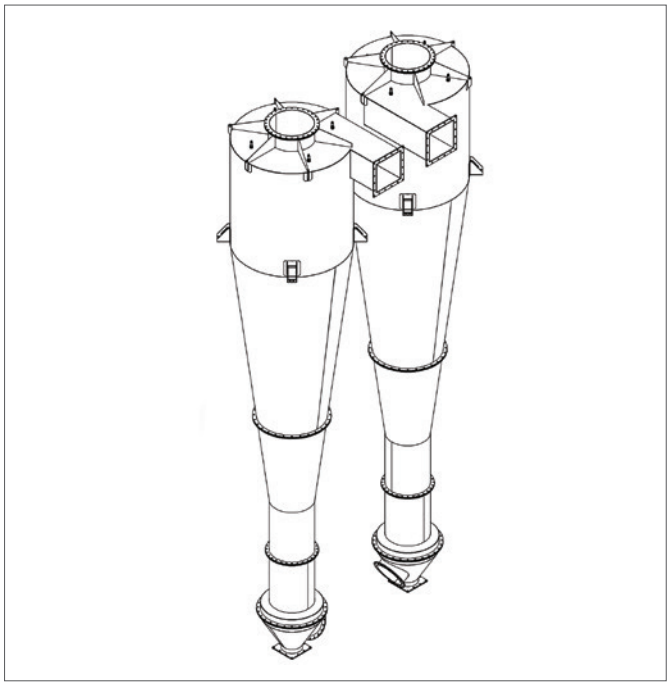

Fig. 5 – ACS solution [2 HR ø2100]