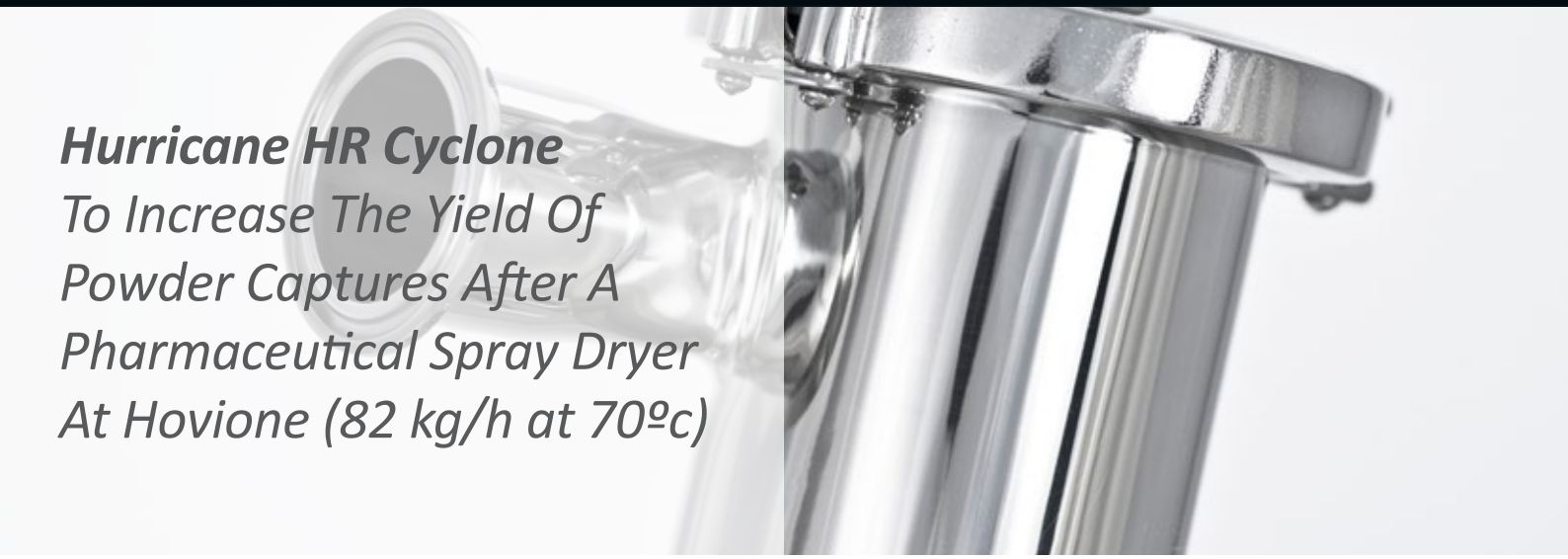
Advanced Cyclone Systems

POWDER RECOVERY

CASE STUDY

HOVIONE | LOURES, PORTUGAL | JUNE 2010



Hurricane HR Cyclone To Increase The Yield Of Powder Captures After A Pharmaceutical Spray Dryer At Hovione (82 kg/h at 70ºc)

FOREWORD

Advanced Cyclone Systems, S.A. (ACS) designed and supplied a Hurricane Cyclone for **Hovione**, a multinational Portuguese company. Hovione provides high technology products (ex: API's) and innovative services to the pharmaceutical industry. It has research centers in Portugal, USA and China; industrial-scale production units in Portugal, Ireland and China; and offices in Hong Kong, India and Switzerland.

ACS was asked to replace the cyclone from the spray dryer manufacturer in New Jersey (USA). The goal was to increase the recovery of very fine and valuable powder (Fig. 1).

IDENTIFYING THE PROBLEM AND SOLUTION

To increase powder recovery, considering a design flow rate of 82 kg/h, a median particle size of 1.6 µm and a true particle density of 1.61 g/ml, ACS designed and supplied a high efficiency cyclone, the Hurricane HR with ø130mm.

Hovione provided the detailed operating conditions and the total particle size distribution (Fig. 2). Using ACS's numerical simulation tool – PACyc (Particle Agglomeration in Cyclones), ACS estimated a reduction of powder losses from 40% down to 16%.

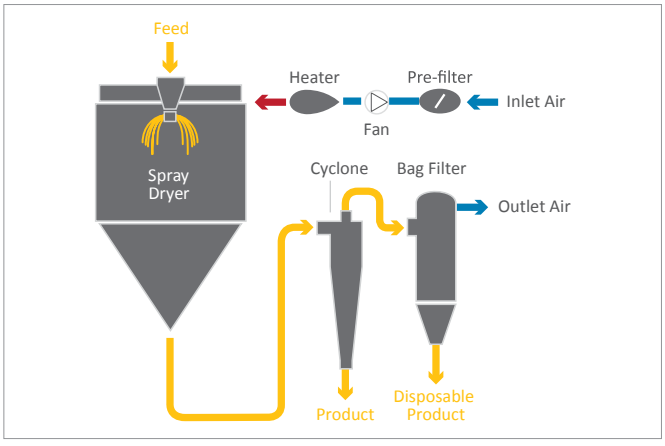


Fig. 1 – Existing process scheme

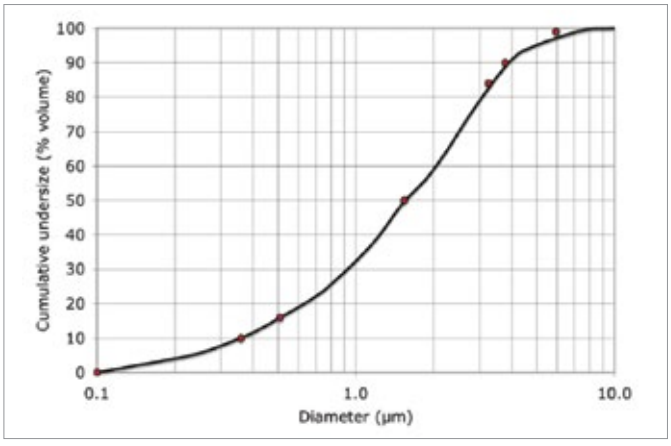


Fig. 2 – Particle size distribution

ABOUT HURRICANE CYCLONES

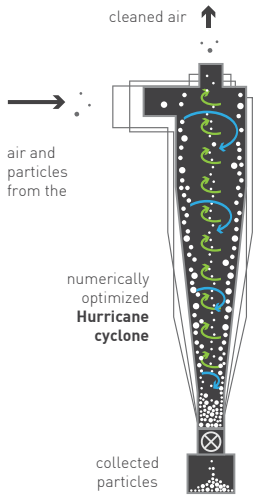


Fig. 3 – Hurricane system scheme

Understanding how cyclones work

The separation dynamics inside a cyclone is very difficult to model. Cyclones are usually designed empirically or, less often, according to models which do not consider the interparticle agglomeration inside the cyclone. ACS has developed its own unique model for cyclone efficiency prediction which takes into account agglomeration in turbulent flow fields **– The PACYC MODEL (Chemical Engineering Journal 162 (2010) 861–876.**

Optimizing cyclone efficiency

Supported by the PACyc Model, ACS can rapidly generate millions of virtual prototypes (cyclone geometries) and, through numerical optimization, select the best geometry for each given case. The design takes into consideration several economical and operational constraints, such as size, pressure loss or manufacturing cost. **ACS Hurricane HR cyclones have demonstrated to be more efficient than any other known cyclone available in the marketplace for the same pressure drop and manufacturing cost.**

ACS' competitive advantage is sustained by a unique ability to accurately estimate – and consequently guarantee – a requested efficiency, resulting in better cyclones, tuned for their specific application.

DESIGN BASIS

- Type of powder **[Inhalable API]**
- Particle density d_s (g/ml) **[1.61]**
- Particle size distribution **[See Fig.2]**
- Gas composition **[N_2]**
- Design flow rate (Kg/h) **[112]**
- Solids content (g/h) **[50]**
- Gas temperature (ºC) **[89]**
- Operating pressure (mbarg) **[Atmospheric]**

HURRICANE SPECS | EXPECTED PERFORMANCE

- Diameter (mm) **[130]**
- Material **[AISI 316L S.S.]**
- Internal surface finishing **[Ra < 0.4 µm]**
- Internal welds **[Ground Smooth to Ra < 0.4 µm]**
- External finishing **[Ra < 0.4 µm]**
- External welds **[Ground Smooth to Ra < 0.4 µm]**
- Expected collection efficiency (%) **[78.3 – 83.1%]**
- Verified collection efficiency (%) **[84%]**

CONCLUSIONS

The separation efficiency predictions matched the experimental results in the clients' facilities and a substantial increase in powder collection was verified. ACS's global efficiency proved to exceed 80%, while the competitor cyclone never reached efficiencies above 60%. The success provided by this installation led to the supply of addicional cyclones.

Fig. 4 – Hurricane cyclone