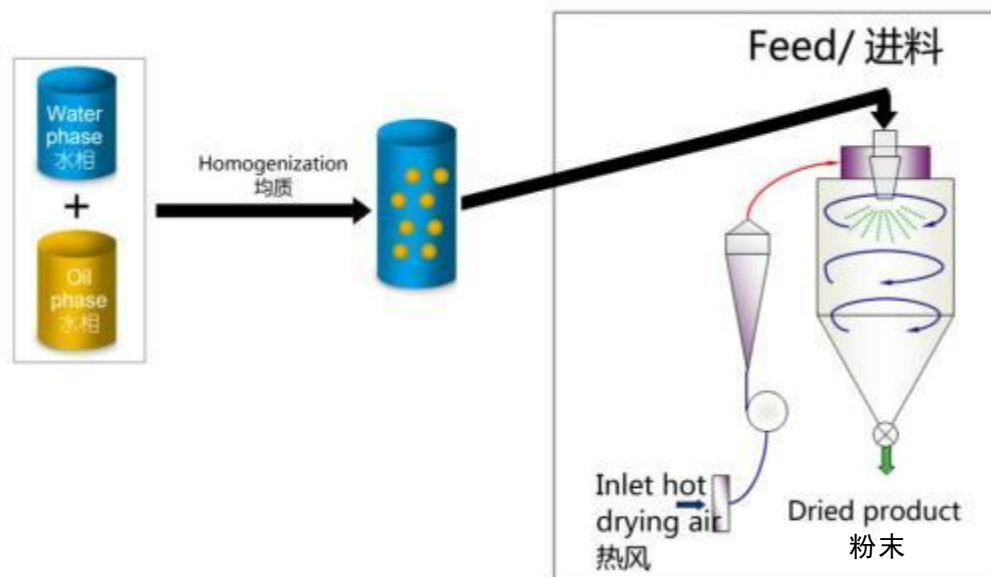
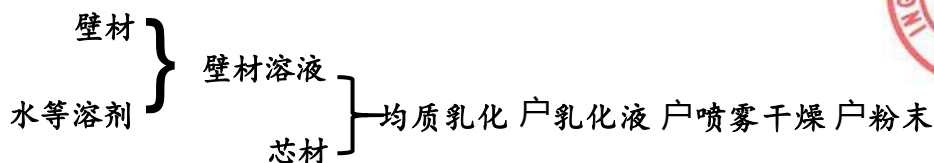


总述 Introduction

喷雾干燥基本流程：



- 微胶囊厂共包括6个单元：前处理（配料、乳化包埋、杀菌）、CIP、二次包埋配混料、GEA-NIRO 喷雾干燥塔配带FSD-GRANULATOR、干混系统与GMP真空充氮包装系统。
- Microcapsule powder plants contain six units:
 - A. Pretreatment (feeding, emulsification,sterilization)
 - B. CIP
 - C. FSD-GRANULATOR & Secondary embedding feeding
 - D. GEA NIRO spray dryer (Type: FSD-160-N), equipped with FSD-GRANULATOR
 - E. Dry blending system
 - F. GMP packing system
- 蒸发量：320 ~ 500Kg / h ，粉末产量：5 ~ 10吨 / 天。
Evaporation Capacity : 320 ~ 500Kg / h.

Production capacity for powder : 5~ 10 tons/day.

➤ 装置特点

采用**GEA-NIRO**的FSD喷雾干燥与FSD-Granulator™ 的造粒系统，可以对产品性状进行微调，可有效提高产品性能，如：更强大的附聚功能，更少的细粉，更好的产品流动性、分布性与分散性，更少的磨损，更好的产品外观，尤其适合高活性物质

GMP设施与厂房满足婴幼儿奶粉配料标准（100,000级）。

➤ Characteristics:

A. **GEA-NIRO FSD spry dryer and granulating system of FSD-Granulator™ , Give powder products better performance by fine adjustment, such as the better agglomerating function, fine&thin powder, the better flowing properly , distributivity, dispersibility & appearance. Suitable for various kinds of highly active material.**

B. **GMP facilities and plant suitable for infant formula (Class 100,000).**

➤ 包装规格：1Kg、5Kg、10Kg , 25Kg , 可定制。

➤ Packing sizes(GMP) : 1Kg , 5Kg , 10Kg , 20Kg , 25Kg , and would be customized according to customer's requirements.

1. 前处理系统 Pretreatment system

1.1 投料系统 Feeding system

油相以外的原辅料经过水粉混合装置混合后进入乳化罐，脂质及其抗氧化剂则投入油相罐。

Solid materials be batch charged to mixer and mixed with water, then sent to emulsifying vessel. Oils & fats with antioxidants be sent to oleic phase mixing vessel with shear

1.2 乳化均质系统 Emulsification and homogeneous system

油相与水相经过剪切乳化、高压均质，油脂分散微小油脂（ $0.2 \sim 0.4\mu\text{m}$ ），形成稳定的O/W型乳浊液，然后经GEA高压均质机送去喷雾干燥。

Oleic phase and aqueous phase be sheared and emulsified in the embedding vessel with shear, and then sent to High Pressure Homogenizer, become stable O/W emulsion. Then sent to spray drying system by GEA High Pressure Homogenizer.



1.3 自动CIP清洗系统 The automatic CIP system

定期对系统进行CIP原位在线清洗，确保前处理系统处于洁净无菌状态，CIP在线清洗是按照程序自动化执行，避免人为误操作等偶然因素影响。

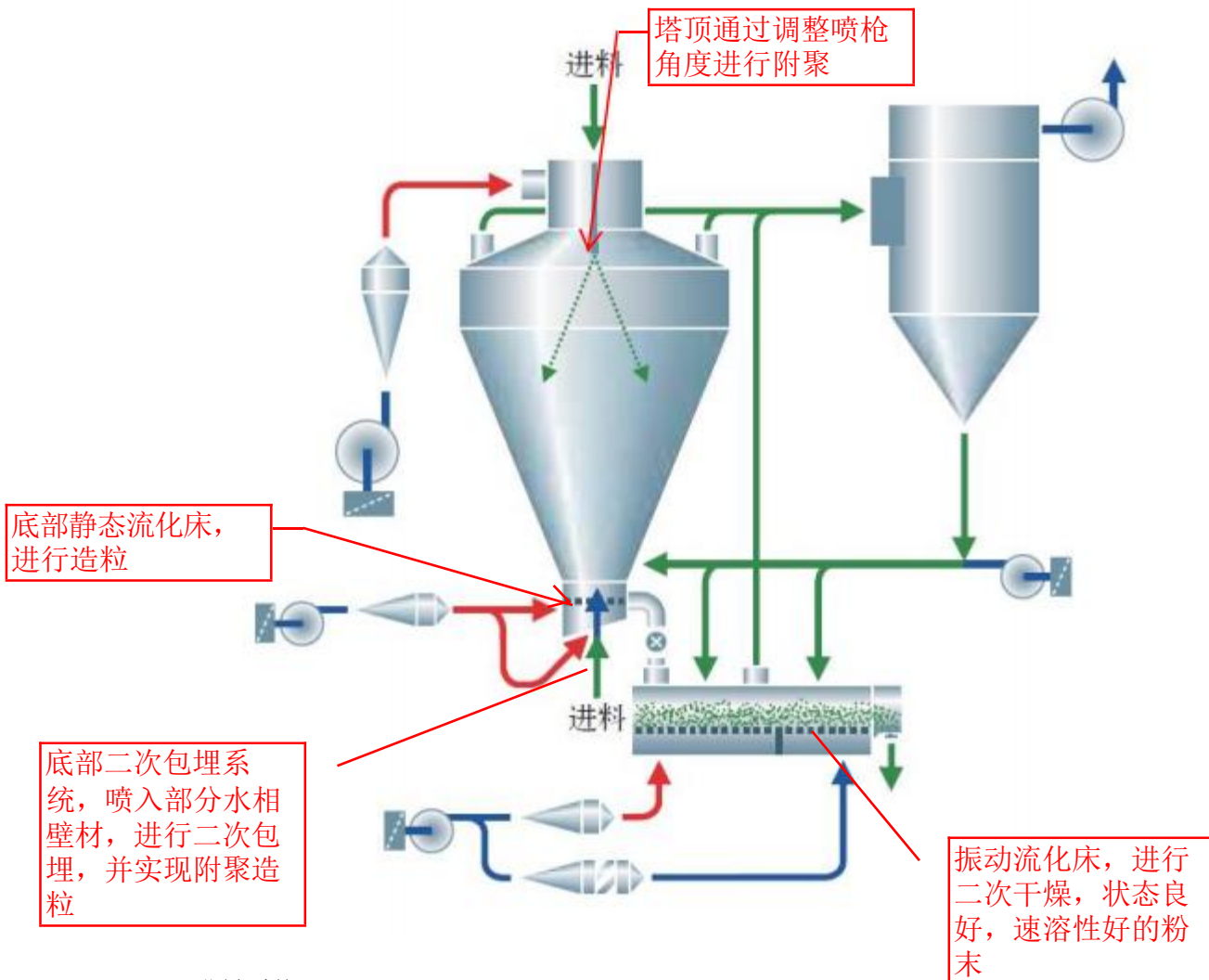
Programmed and automatic CIP online cleaning system avoid maloperation and other accidental errors, clean and sterile status would be maintained from beginning to end.

2. GEA-NIRO 喷雾干燥系统 Spray drying system

型号: FSD-160-N , 配备 FSD-Granulator , 设计蒸发量为400kg/h (最大500kg/h)。

高效空气过滤器 : H13级。

Type: FSD-160-N, Equiped with FSD-Granulator , Evaporation capacity is 400 kg/h (Max.500Kg/h). HEPA filter : H13.



2.1 进料系统 The feeding units

有2套进料单元, 其一是主物料, 送去喷雾干燥 (塔顶微孔喷片), 其二送去FSD附聚造粒与二次包埋。

There are two sets of feeding system , one for Spray drying (Micro-Nozzle Plates) , another for FSD-Granulator by the Special Three Fluidic spray gun.



2.2 雾化器系统 Atomization system

雾化进料液，根据乳液特性与粉末粒度要求，有3种尺寸的喷片可供选择。

In order to achieve the desired droplet size , there are 3 sizes of Micro-Nozzle Plates for choice.

2.3 风系统 Air system

包含供风系统、工艺气体加热系统、静态流化床的热风系统等，为喷雾干燥提供洁净热风。

进风温度：155 ~ 175°C，出风温度：70 ~ 90°C。

Air supplying system, heating system for process gas and static fluidized bed of hot air system are included, to provide clean hot air for spray drying.

Spray dryer Inlet : 155 ~ 175°C, outlet : 70 ~ 90°C

2.4 FSD-160-N 喷雾干燥塔，配备二次附聚造粒与包埋功能

FSD-160-N Spray Dryer with FSD-GRANULATOR

构成：干燥塔体、内置静态流化床、FSD-Granulator造粒与包埋装置、旋转阀等。

Including : the dryer cylinder, inside static fluidized bed, the bottom FSD-Granulator & secondary embedding system b, rotary valve, etc.

目前国内最先进的喷雾干燥系统，除了塔上部附聚功能外，塔下部静态流化床处配置 FSD-Granulator 装置，它采用三流体喷嘴从静态流化床上部喷入乳液来加强附聚与造粒功能，从而实现对粉末粒度与密度的微调。尤其适合于生产高活性脂质粉末。

产品优势：微胶囊磨损更少，细粉含量极少，无焦糊粒，产品附聚好、流动性好、分散性好，粒度分布更均匀，更好的外观。可以满足客户对于密度与粒度的不同需求，可以生产与奶粉形状完全一致的微胶囊粉末。

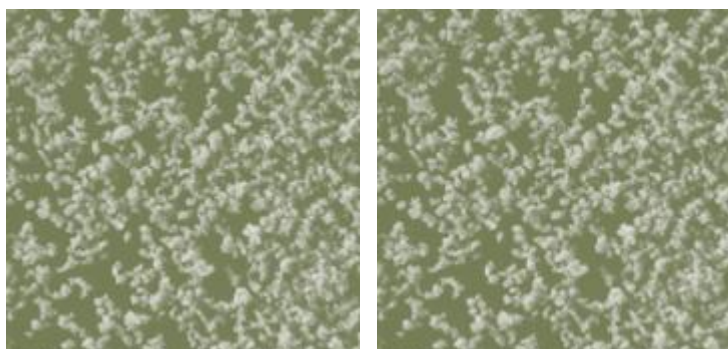
GEA NIRO Spray drying system is the most advance plant in China, Besides function of agglomeration at top of the spray dryer, a set of FSD – Granulator is equipped at the bottom of the Dryer, it has a set of three-fluid nozzle for the agglomeration and granulation.

Powder products have more the advantages: stronger agglomeration, less fine powder, particle size distribution more uniform, better flowability, more wondetful dispersibility, less wear and broken, better appearance.



GEA-NIRO FSD-Granulator™ 系统（专利申请中）

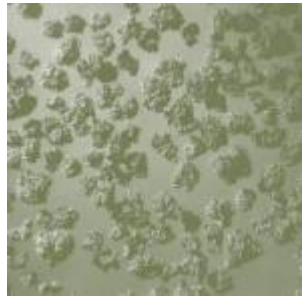
FSD-Granulator™ 系统成功的应用于许多产品。试验结果显示 FSD-Granulator™ 系统能够提供更优的造粒效果同时保持堆积密度。通常情况下，提高颗粒粒度往往导致产品堆积密度下降。



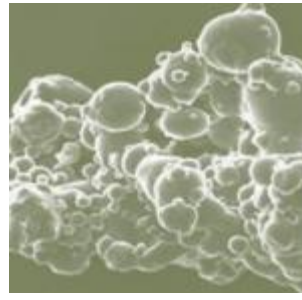
从左往右：
 1、FSD™ 喷雾干燥塔：
 产品颗粒直径: 180 my
 堆积密度（浇注法）: 0.35 -0.36 g/ml
 2、FSD-GRANULATOR™系统：
 产品颗粒直径::500my
 堆积密度（浇注法）: 0.36 -0.37 g/ml



紧凑型颗粒



附聚颗粒



附聚颗粒的 SEM 照片

2.5 外置振动流化床系统 The external vibration fluidized bed system

用于最终干燥与冷却产品，然后再经过一个振动筛筛分后，产品去干混与包装单元。

To dry and cool products by air fluidized bed filtration. Through a circular vibrating screen to blending and / or packing.

2.6 二级旋风细粉回收系统 The secondary cyclone powder recovery system

将旋风分离器分离出的细粉连续地送入塔内附聚，或送入流化床。

Continuous conveying of powder separated by cyclone separator into tower for agglomeration , or into the fluidized bed.

2.7 CIP自动原位在线清洗系统 The automatic CIP system

所有与物料接触的设备 and 管道都通过CIP自动进行清洗。

All equipment and pipeline that have direct contact with material are cleaned by automatic CIP.

3. 真空充氮粉末包装系统

Vacuum& Nitrogen-filled packaging system for Powder

3.1 规格与精度

包装规格：1KG,5KG,10KG,25KG，可定制。

Packing sizes：1KG、5KG、10KG、20KG，Max.25Kg.

3.2 质量控制

微生物控制：**GMP等级为10万级（D级，ISO7）**

GMP standard: 100.000 (Grade D , ISO7) .

真空充氮包装残氧值：通常 $\leq 1\%$ ，限定值 2%

residual oxygen headspace: $\leq 1\%$ Normal , 2% Max.

双重检测异物控制：粉末在线金属检测，内包X射线异物检测。

Online metal detection system & X-ray detection system

安全控制：安全与防爆系统依照欧洲标准，GEA-NIRO成套。

Safety and explosion protection systems (GEA) are built according to European standards.

产品混配与流动性调节：可通过气力干混系统实现。

Pneumatic dry blending system: blend different products, or blend very few of ingredients(such as anticaking agent) into the products.

THE END