Preparation of cellulose and cellulose ether

Cellulose derivatives, such as MC, CMC, HEC, HPMC, MHEC etc, depending on the application, are contained as additives in many products in order to influence their characteristics.

In the construction industry, they control the water binding ability of cement, gypsum and fillers. As wallpaper paste, CMC is possibly the most well known product. As additives in washing detergents, the derivatives prevent graying and discoloration. Cellulose derivatives, when used in foodstuffs, enhance composition, form, structure and consistency. In the pharmaceutical industry, CMC is used in tablets to define active ingredient release and as a binding agent.

Cellulose powders ground with Precision Knife Mills have a large surface area and improve the reaction time and the fill weight in the reactor. Afterwards the cellulose ether is washed and granulated and the product, still moist, is ground and homogenized by means of knife mills or double stream mills. The drying process is thereby simplified and improved.

Afterwards the cellulose ether is ground to a fineness of less than 0.5 mm, or pulverized to less than 0.18 mm in a Turbofiner, type PLM or a Contra-Selector Mill, type PPSR, depending on the requirement. Simultaneous grinding and drying is possible on these mills by hot air induction, thereby significantly simplifying the process. Cryogenic grinding systems with counter rotating pin mills produce the finest CMC-powders for the pharmaceutical industry.

For each grinding step PALLMANN has the most suitable processing solutions. These processes have proven themselves for many years and are presently successfully used all over the world.
Fine grinding with Precision Knife Mills

The starting material for the production of cellulose ether is cellulose of hard wood, coniferous, or cotton (linters). Cellulose material is available in sheet, roll, or loose form, such as pre-cut cotton bales. The Precision Knife Mill, type PS-C can grind each of these different types of cellulose.

Conveyor belts are utilized to feed loose material and a metal detector prevents any metallic contamination. Cellulose sheets or rolls are fed into the grinding chamber via an integrated draw-in device. Fine cellulose powders so-produced, distinguish themselves through high bulk density and improve the reaction and the fill weight in the reactor.

The Precision Knife Mill has been specifically designed for the production of these powders. The upper part of the housing can be opened hydraulically thereby granting easy access to the grinding chamber for cleaning and maintenance.

Decisive advantages:

- Production of fine powders with smooth surface and high viscosity
- Homogeneous end product with high bulk density
- Very good flowability
- Cool grinding by optimized air flow
- Quick and easy cleaning

Fig.1

1. Precision Knife Mill, type PS-C
2. Multi-knife-rotor
3. Belt-conveying
4. Feeding of roll material

Fig.2

Fig.3

Fig.4
Precutting of moist cellulose ether

After washing and granulating, the cellulose ether has a moisture content of up to 60% and is available as press cakes or irregular lumps. For downstream drying or for the chemical recovery of alcohol from stripped alcohol ethers homogeneous granules are desired.

Press cakes are ground by means of Knife Mills, type PS, between rotating and fixed knives. The fineness is determined by the size of the screen holes. Gas tight mills are available when nitrogen inerting is necessary.

Lumps can be directly fed into a Double Stream Mill, type PSKM. The lumps are ground through impact and shearing action on a combination of grinding path and screen rings. The obtained homogeneous particles simplify the feeding into the dryer and improve the drying process.

Each mill can also be supplied in stainless steel design.

Decisive advantages:

- Homogeneous particles
- Easy drying of product and recovery of alcohol
- Less drying energy necessary

1. Knife Mill, type PS-C
2. Knife Mill, type PS
3. Double Stream Mill, type PSKM
Fine-grinding of dry cellulose ether

After the drying process the cellulose ether is still too coarse, and must be ground finer in order to be used as an additive in corresponding areas of application. The Turbofiner, type PLM is used for this purpose. The material is ground in a high-turbulent air flow between the fast rotating beater plates and the stationary grinding zone.

The material is fed by vibratory feeder, dosing screw or rotary air lock either through a cyclone separator or directly into a filter. Then, it is separated on a screening machine according to its fineness. Coarse particles are reintroduced into the grinding process.

Decisive advantages:

- Product-gentle fine- and finest grinding
- High throughput capacity
- Maintenance-friendly
- Bearing completely separated from the grinding chamber
- Quick and easy cleaning

1. Turbofiner type PLM
2. Grinding installation with Big Bag
3. Grinding installation with Turbofiner type PLM
Dry-Grinding of moist cellulose ether

After the reactor, the cellulose ether is of elastic to plastic consistency. A fine and dry powder is necessary for further use of the cellulose ether. The Turbofiner, type PLM allows product-gentle pulverizing and simultaneous drying of moist cellulose ethers with a starting moisture of 60% of the weight.

Ambient air is sucked in and cleaned by an inlet air filter and heated up to 190°C by an air heater. Moist feed material is transported via a rotary valve into the hot air stream and into the mill which pulverizes the material in a high activity rotational field by means of micro whirls. The pulverized product is pneumatically transported and dried again on the way from the mill to the filter. The filter separates the ground material from the conveying, respectively the drying air, and discharges it via a discharging device out of the filter. The retention time of the material in the mill as well as the degree of drying is determined by the air flow. Afterwards the ether is screened, mixed and ensiled. The pulverizing system is designed for an explosive pressure of 10 bar (ü) and is secured by means of an explosion barrier.

1. Turbofiner type PLM
2. Dry-Grinding installation
Technology Center

The PALLMANN Research and Technology Center offers worldwide the most unique opportunities for testing and developing size reduction and preparation techniques. As a special service of the technology center, customers can carry out development test runs for material and process selection. Test runs with standard machines and installations as well as exact test performance assist in minimizing the investment risks and checking, respectively optimizing the economy concept and results of the selected systems.

Technical Data:

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The PALLMANN Group of Companies

The PALLMANN Group of companies is a leading manufacturer for size reduction machines and systems for the process industries. PALLMANN Maschinenfabrik develops and manufactures machines and complete systems according to customer requirements or as standard solutions for the preparation of almost any material as well as recycling products. In its headquarters in Zweibrücken, PALLMANN operates one of the world’s largest research and technology centers as well as a training- and service center. More than 130 different test machines are available for the preparation of a wide variety of materials. A downstream laboratory analysis of the test material as well as the preparation on a production scale is possible. In addition to the manufacturing facilities in Europe, North- and South America, the PALLMANN group of companies operates a world-wide spare parts- and service network.

**Engineering and Service:**
- Design and manufacturing
- Research and development
- Production scale testing
- Laboratory analysis
- Worldwide service
- Spare parts
- Controlling
- Process Control
- Installation & Start-up
- Overhaul & Repair

**Products:**
- Agglomerators
- Pulverizing Systems
- Disc Mills
- Turbo Mills
- Pin Mills
- Laboratory Mills
- Universal Mills
- Complete Grinding Systems
- Knife Mills
- Profile Shredders
- Rubber Granulators
- Pipe Crushers
- Air-Swept Mills
- Impact Mills
- Industrial Granulators
- Cryogenic Grinding Systems

**System solutions for:**
- Pulverizing
- Granulating
- Agglomerating
- Recycling

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