GYPSUM PROCESSING EQUIPMENT

Gypsum is a soft sulfate mineral composed of calcium sulfate dihydrate, with the chemical formula CaSO\textsubscript{4}-2H\textsubscript{2}O. In nature it can be found in gypsum quarries. Well known is the burned gypsum called ‘Plaster of Paris’, mined from the quarries in the Montmartre district of Paris.

Commercial quantities of gypsum are found in Brazil, Pakistan, Jamaica, Iran (world’s second largest producer), Thailand, Spain (the main producer in Europe), Germany, Italy, England, Ireland, Canada and the United States. The largest gypsum quarry in the world is located in Milford Station, Nova Scotia, Canada. Several small mines also exist in places such as Kalannie in Western Australia, where gypsum is sold to private buyers for changing the pH levels of soil for agricultural purposes.

Gypsum also occurs as a byproduct in the production of phosphate and is recovered via flue-gas desulfurization at some coal-fired power plants. This synthetic gypsum can be used interchangeably with natural gypsum in some applications. The purity of the last two forms can be considered as highly pure (> 95%). Raw gypsum has to be cracked (or calcinated) before it can be used. Common uses of gypsum are for example:

- Gypsum board
- Plaster ingredient (surgical splints, casting moulds, modeling)
- Fertilizer and soil conditioner
- Filler in the food industry
- A component of cement used to prevent flash setting of concrete
- In foot creams, shampoos and many other hair products
- Impression plasters in dentistry

Gypsum is known in the following chemical states:

- di-hydrate, CaSO\textsubscript{4} - 2H\textsubscript{2}O, the set gypsum or the natural gypsum crystals in quarries;
- hemi-hydrate, 2 CaSO\textsubscript{4} - H\textsubscript{2}O or CaSO\textsubscript{4} - ½H\textsubscript{2}O, calcium sulfate hemi-hydrate or di-calcium sulfate mono-hydraat, gypsum plaster powder that upon the addition of water absorbs water of crystallisation, and thus is hard again and forms the di-hydrate;
- gamma-anhydraat, CaSO\textsubscript{4}, the water-poor variant that can be used as a drying agent;
- béta-anhydraat, CaSO\textsubscript{4}, the anhydrous variant that is used as a filler.

Production of plaster from natural gypsum

High-quality gypsum rock is extracted at quarries or mines. Large rocks are crushed into small pieces in a grinding mill. At some

Ventilex gypsum processing equipment

Benefits:

- High energy savings—up to 40%
- Long lifetime, reliable dryers
- Low maintenance
- Advanced control strategies
- Accurate product temperature control
- Abrasive materials without excessive wear

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Heating above 250 degrees gives fully waterless β-anhydrate.

Production of plaster from synthetic gypsum

There is no significant difference between the production of plaster from natural gypsum, synthetic gypsum or recycled gypsum. Although some extra cleaning steps will take place to remove contamination (for example cardboard from recycled wallboard). This cleaning steps will necessitate extra drying of the raw material before calcination can take place.

Calcined plaster is called stucco and forms the primary raw material in the production of wallboard.
Imtech Ventilex calcination equipment

Ventilex is a leading supplier of gypsum and plaster dryer production lines. We offer a highly developed product line that is in use at the leading producers worldwide.

Experience has shown that significant benefits, the most important being much improved fuel economy, arise from the use of fluid-bed dryer/cooler technology rather than the traditional rotary drum.

The basic principles of the Ventilex line are drying, calcination and cooling through ambient air of the gypsum and plaster.

The dryer is a so called fluid bed dryer in which a product or solid is made fluid by an upward moving flow of gas. This means that product with a certain moisture content is fed over a perforated plate under which heated air is supplied and by moving up and down the whole at the same time, the product is moving (fluidizing).

Depending on the shaking frequency of the dryer bed and the moisture content of the product the product is conveyed in the longitudinal direction of the dryer.

Based on a quantity between 15 - 30 tonnes/hr of gypsum/plaster containing 6 - 15% moisture a final moisture content of less than 0.5% will be achieved.

After being dried the gypsum is conveyed the calciner where it is calcined at the temperature needed for the desired application.

Heating slightly above 150 degrees leads to hemi-hydrate, 2 CaSO4 - H2O or CaSO4 - ½H2O.

Heating slightly above 180 degrees gives gamma an-hydrate, CaSO4, the water-poor variant.

Heating above 250 degrees gives bèta-anhydrate, CaSO4, the waterless variant.

Finally the plaster powder is fed into a static bed cooler where it’s cooled down to a maximum temperature of 60 degrees at an ambient temperature of 30 degrees.

Process air released through filter systems is partially recirculated (gases from the dryer to the calciner, gases form the cooler to dryer) and in part discharged from the chimney (flue gases from calciner).

There is also the possibility to use only the dryer, in which case the gases from the dryer are discharged outside. This recirculation of the filtered gases gives the Ventilex gypsum processing equipment great advantages regarding energy saving.

Imtech Ventilex Gypsum Processing equipment

Two major areas of interest in drying systems for minerals are to be considered:

1. Drying systems for minerals consume a lot of energy leading to significantly higher operational costs and low margins.

2. Greater wear-and-
tear on account of the abrasive nature of the materials being processed also means frequent maintenance and repairs or replacement expenses.

Fluid bed dryers from Ventilex are the ideal solution for the minerals industry because they are developed to dispel the aforementioned issues:

- Ventilex high-efficiency bed dryers typically provide you with 30-60% energy cost savings, the lowest energy consumption among dryer beds.

- Sturdy stainless steel construction backed by Dutch excellence in engineering and manufacturing requires less maintenance.

- The state-of-the-art PLC control system offers advanced temperature and humidity controls to deliver optimal processing capacity and quality.

- Ventilex gypsum dryers are recognized as one of the finest fluidized bed dryers and calciners and are used by leading companies all over the world.

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