

SUPERHEATED STEAM DRYER AND PROCESSOR

Environmental and energy saving drying technology
Heat treatment of oil seeds, beans and proteins



Leading technologies. Individual solutions.

Superheated Steam Drying And Processing



Closed loop system

The Superheated Steam Dryer (SSD) is a closed loop pneumatic conveying type dryer. The wet solids are fed into the flow of pressurized superheated transport steam by means of a pressure tight rotary valve, plug screw or similar. The Superheated Steam Processor (SSP) can be used for drying and/or heat treatment of many products.

Indirect heating

The transport steam is superheated indirectly via a tubular heat exchanger using medium pressure steam, flue gases or thermal oil. Alternatively, electrical heating may be used.

Fast Drying

In the subsequent drying ducts, moisture is vaporized from the product, forming excess transport steam and lowering its degree of superheat. Normally, the residence time in the system is only 5-60 seconds. For some materials a second superheater is necessary to achieve the required dryness.

Cyclone separation

Transport steam and the dried material are separated in a high efficiency cyclone and the product is discharged from the dryer by means of another pressure tight rotary valve.

Fan Circulation

From the cyclone, the transport steam is recycled by a centrifugal fan to the inlet of the first heat exchanger. The excess steam generated is continuously bled off.

Steam generation

The generated excess steam is normally at a pressure of 0-4 barg. It can be reused either directly or after a re-boiler generating clean steam.

Steam recompression

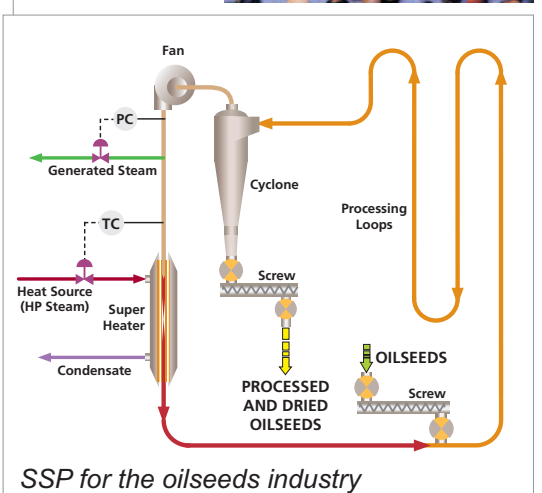
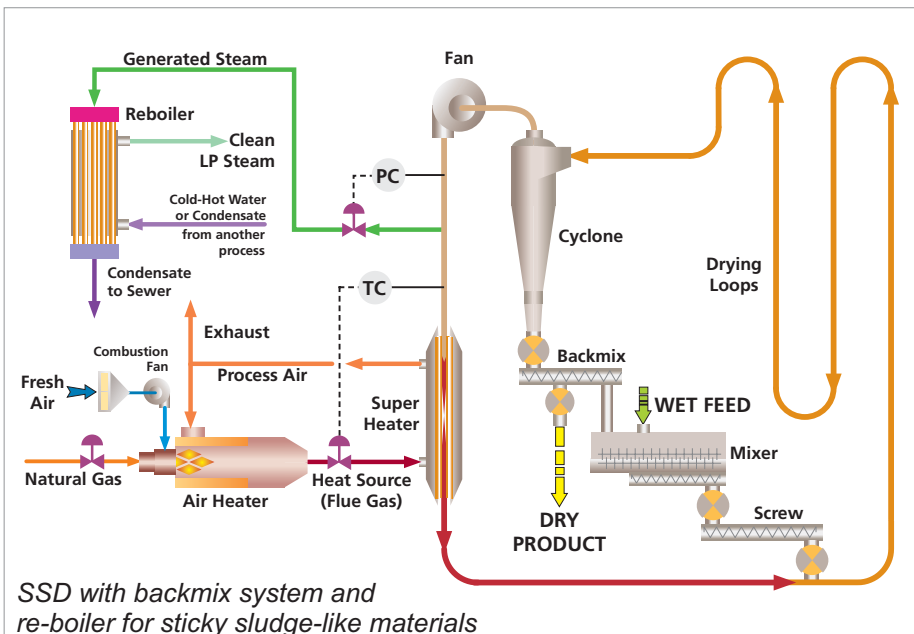
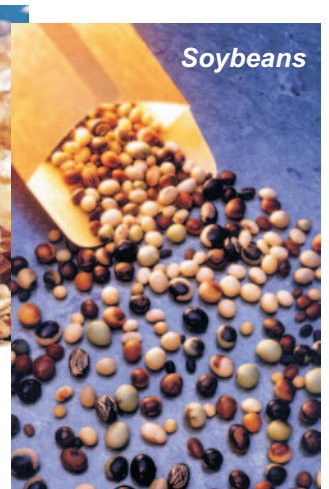
If there is no external use for steam from the dryer, it may be recompressed to 10-20 bar by using a screw or turbo steam compressor and used as the heating media in the superheater. This type of energy recovery is called Mechanical Vapor Recompression (MVR). Power consumption is usually 150-200 kWh/ton evaporated water.

Dried Products (SSD)

Paper pulp	Bagasse
Cellulose derivatives	Corn byproducts
Mineral wool	Grain
Wood Chips	Distillers grain
Peat	Spent brewers grains
Sawdust	Sugar beet pulp
Bark	Potato waste
Biomass	Fish meal
Sewage Sludge	Tobacco
Manure	Citrus peel and pulp
Grass	Coffee grounds
Luzern	Spices
Straw	Minerals

Heat Treated Products (SSP)

Canola seed	Canola meal
Soybeans	Soy meal
Sunflower seed	Sunflower meal
Linseed	Linseed meal



Advantages



Sawdust

Superheated Steam Dryer (SSD)



Biomass

Energy recovery

Primary consumption is about 750kWh/ton evaporated water without any heat recovery. 70-90% of the energy is recoverable by reusing generated steam in another process, for heating purposes, or by using MVR. With a condensing turbine the generated steam can produce about 200 kWh electricity per ton evaporated water.

Safety and environment

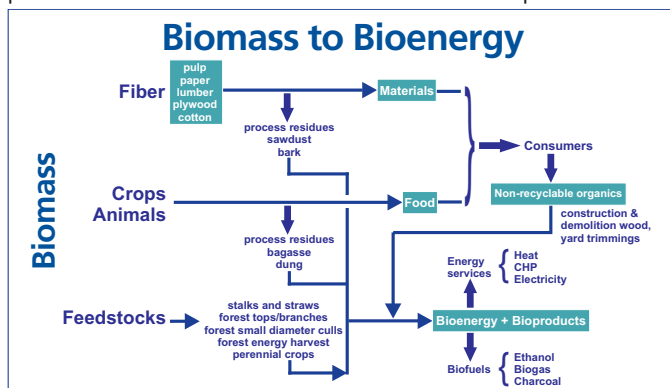
Steam atmosphere eliminates the risk of fires or explosion, since no oxygen is present. Using a closed pressurized steam system there are no particles or volatile compounds vented to the atmosphere, nor any visible steam plume. The possible volatiles from the product can easily be handled or treated in the condensate, where they are collected by condensation of the generated steam.

Ease of Operation

Rapid startup, shutdown and response are some benefits of using indirectly heated steam systems. Also, the control of a low and uniform moisture content is easily achieved.

Excellent product quality

The unique drying conditions in the Superheated Steam Dryer are favorable for the drying of many products where quality is important. There are no air or flue gases that can oxidize or contaminate the product. Controlled temperatures and short residence times (5-60 seconds) make the technology suitable for drying of sensitive products. Due to the drying principle, a very uniform dryness of the product is achieved. The conditions in the dryer make it possible to provide heat treatment and/or effective sterilization of products.



Added Value

Energy recovery

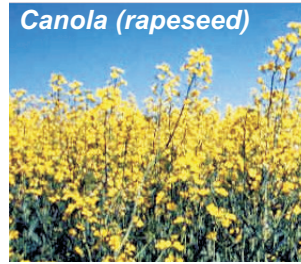
Integration in CHP plant with SSD for biomass pellet production. 90-95% of the energy recoverable as electricity and district heating.

Chemical recovery

Stripping of chemicals from solids, for example acetylated fibres. Chemicals are recovered as condensate.

Less taste change

Drying and expansion of tobacco without change of taste and quality.



Canola (rapeseed)

Superheated Steam Processor (SSP)



Conditioning

The Superheated Steam Processor can be used for conditioning of whole seeds or beans in only 5-10 seconds. Also, cracked, de-hulled or flaked raw material can be treated. The unique concept of using the steam provides a way to deactivate enzymes and to optimize moisture content before expelling the extraction.

The impact on oil quality after water de-gumming is obvious to the industry, but also the protein for ruminants can be improved.

Quality of Oil and Lecithin after simple water de-gumming

Enzymes are completely deactivated due to the immediate rise in temperature and the uniform treatment at high turbulence. An excellent oil quality can be produced by a simplified physical refining and further savings achieved in the chemical refining:

- very low content of NHP after water de-gumming
- easily refined oil
- increased oil yield from chemical refining
- reduced P and COD from chemical refining
- low mineral content

Rumen Protected Protein

Due to the heat treatment in a moist atmosphere at high temperature but short duration, the protein utilization will be increased when fed to ruminants. The amount of protein bypassing the rumen will increase by about 50% to be used in the intestine for increased milk production and weight gain (meat). It is assumed this effect is due to a change of protein molecular structure to a less water soluble open protein compared to the native global structure. The protein is not denatured during the Superheated Steam Process and the intestine digestibility is maintained.

Additional benefits

- 50% higher utilization of protein
- healthier cows, less diarrhea, higher fertility
- reduced pollution from nitrogen output
- no salmonella or other bacteria in the feed
- reduction of anti-nutritional factors, trypsin inhibitor and urea activity etc.
- gelatinization of starch for piglets
- no reduction in feed quality for swine and poultry



Soybeans

Increased protein value

Increased bypass protein value in cattle feed - more milk and meat per kg of feed.

Increased oil value

Better quality of oil and longer shelf life.

Sterilization

Complete killing of all bacteria in animal feed, fertilizer and sludge.



Bunge Germany is using our Superheated Steam Processor for heat treatment of canola, soybeans, and sunflower seeds which increases the quality of oil and protein.
Mannheim, Germany



Energi E2 is drying 50mt/h of woodchips before pelletizing.
Total energy recovery from the dryer is more than 85%.
Koge, Denmark



Barr-Rosin Superheated Steam test unit.

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