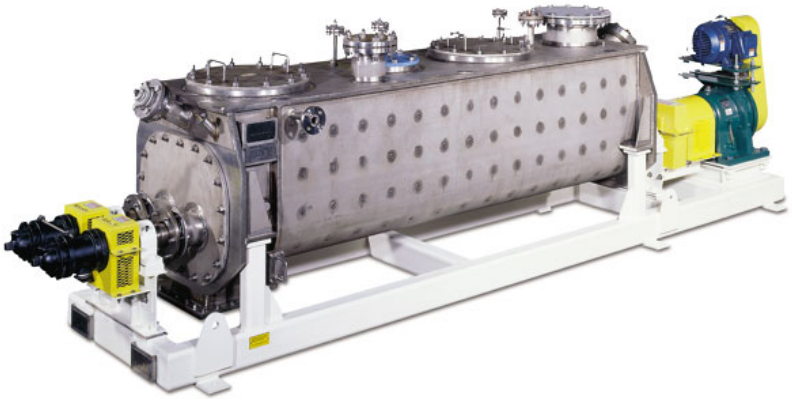
Hot Paddle dryer

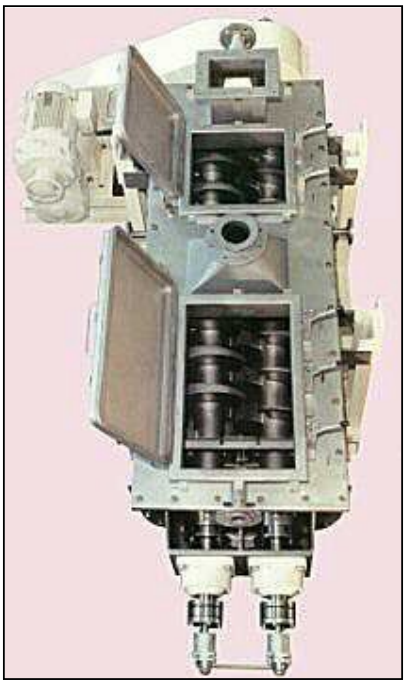
Technofab Engineering Services



Paddle Dryer / Cooler

Purpose: Technofab Hot Paddle Dryer is a machine used for heat treatment of powders, granules, filter cakes and pasty products in a fully continuous process.

These processes include drying, cooling, crystallization, calcinations & melting, evaporating solvents, sterilising, etc. Purpose of this machine in our case would be drying..



Hot Paddle Dryer consists of a heated trough containing rotating heated paddle shafts. The product is fed into the front of the machine. The trough is oriented at a small angle of inclination, placed slightly in unloading position. The product moves to the outlet by virtue of gravity. Here the paddles do not serve a transport function. They are designed for maximum heat transfer. At the outlet side, the product moves out of the machine via the overflow unit.

Salient features include:

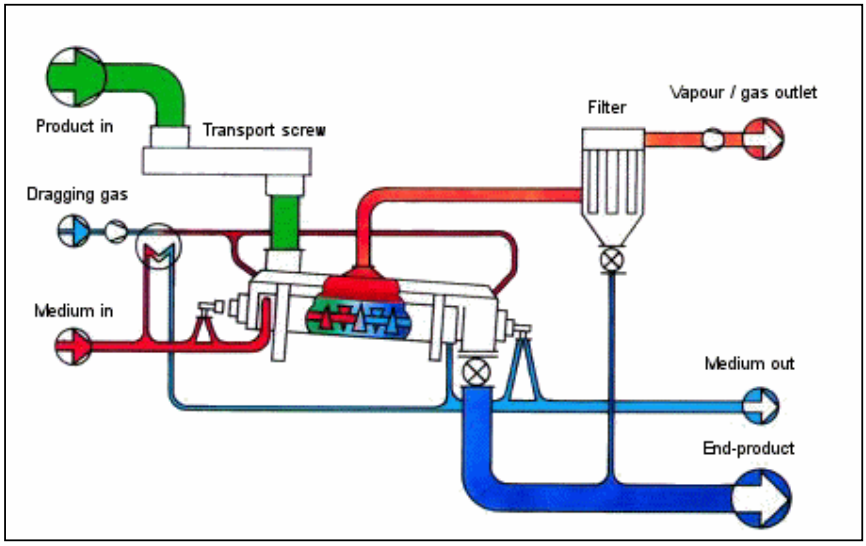
- Excellent control of the retention time and temperature. This results in a uniform product quality;
- No drying air required to dry the product;
- Minimal dust production due to the slowly-turning paddle shafts;
- Better heat transfer due to the specially-shaped paddles.

The hot paddle dryer is a machine that can be used for varied processes in different sectors of processing industry

Multifaceted thermal processes

Hot Paddle Dryer is a machine which has wide range applications. These applications include those where stringent checks are set on uniform product quality (accurate retention time control and/or strict temperature control), a careful treatment of the product is required in order not to damage it or cause it to generate dust, or precisely the robustness of the machine. The construction of this dryer is compact in comparison with other machines. The hollow shape of the paddle shafts ensures that the total internal surface area serves as a heat exchanger. It provides many square metres of heat-transfer area on a limited amount of floor space.

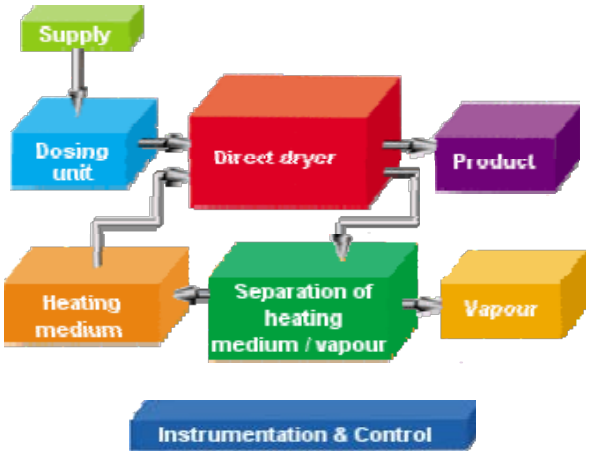
Working:
The product is fed into the machine through the top cover at front side. Because the machine is slightly inclined at an angle, the product moves evenly through the machine by virtue of the force of gravity. Consequently, the paddles do not have a transport function. The paddles provide good heat transfer to the product and mixing of the product. At the end of the machine, the end-product moves over the overflow unit and leaves the machine via the underside. The product comes into intensive contact with the walls of the trough, the shafts and the paddles. These are all heated by circulating the heating media through it.



The product level reaches slightly above the paddles. Above the product level there is a space for vapour collection. The vapours accumulated in that space are removed from the machine. The working principle of the Paddle Dryer, with low rotation speed of the paddle shafts and indirect drying principle, contributes to a negligible or even zero substance emission. When it is nevertheless decided to use a gas cleaner, such as a scrubber or filter, its size can remain small due to the low flow rates.

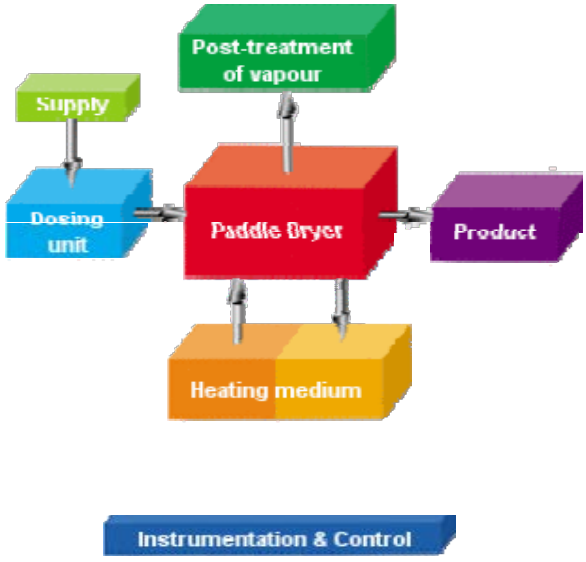
Direct drying versus indirect drying
Hot Paddle Dryer works on the basis of the indirect drying principle. Indirect drying has various advantages in comparison with direct drying.

Direct drying
In direct drying, the heat of gases/vapours is transferred immediately to the product. The hot gasses come in direct contact with the product. Direct contact results in a number of Consequences including:



- The product may often not come into contact with gasses/vapours (e.g. due to product contamination, hygroscopic products, etc.);
- Intensive product contact with gasses generates dust;
- Relatively large volumes of hot air/gasses must be cleaned, which requires gas cleaning equipment;
- The recovery of solvents is more difficult (although irrelevant in our Iron Oxide drying application);
- Much unused heat leaves the dryer again.

Indirect drying with the Hot Paddle Dryer
In indirect drying, the heat is transferred to the product via a metal wall. The heating medium (steam, thermic fluid / oil or water) remains separated from the product.



That has a number of advantages, including:

- No direct contact between the product and heating medium;
- Little or no dust formation due to slowly-rotating paddles shafts;
- Intensive product contact through Specially shaped paddles with relatively higher heat-exchanging surface;
- No need to use sweep gas/air. The result is very less or sometimes no flow waste gasses that have to be cleaned. Furthermore, toxic, odorous and flammable products can be processed safely;

Higher heat transfers coefficients

Hot Paddle Dryer produces an intensive contact with the product during the rotation of the shafts. The **heat transfer coefficients are high** as a result of the specific paddle design.

The wedge-shaped paddle ensures for excellent contact on both sides of the paddle and mixes the product in radial direction. In addition, the wedge-shaped paddle ensures for shear forces on the paddle surface, which keeps the paddle clean and contributes to improve heat transfer.

View of a half-filled Hot Paddle Dryer. The paddle shafts use a staggered grip. Optimal mixing and heat transfer.

The paddle shafts turn in opposite directions. Paddle plates are attached to the paddle. The paddle plates keep the walls of the trough clean and also provide for extra mixing.

The paddles are attached to the shafts in such a way that during turning they "grip" between the other paddles. This configuration reinforces the mixing effect and heat transfer due to the increased shear forces.

Efficiency of Hot Paddle Dryer

The compact construction

As mentioned earlier, the Hot Paddle Dryer is a compact machine. That is because it has many square metres of heat-exchanging surface relative to the content. Two hollow shafts with hollow paddles turn in opposite directions in the horizontal trough. The trough has a ω-(omega) shape that follows the contour of the paddles.

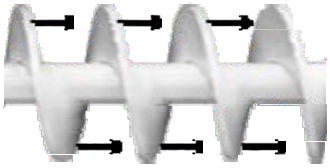
The paddle shape

Moving parts are crucial for the system. They have been expertly designed. Excellent heat transfer is ensured when the product is refreshed regularly and remains in good contact with the heat-exchanging surface.

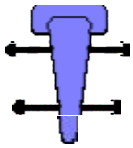
The paddles of the Paddle Dryer play a large role in creating these optimal conditions.

Specific paddle shape for maximum heat transfer and self-cleaning capacity.

- The fragile product is not damaged because the smooth paddle shape does not force it to flow;
- The uniquely-shaped paddle has a self-cleaning capacity. The wedge-shaped paddle produces shear forces on the paddle surface and this keeps the paddle clean and contributes to a higher heat transfer;
- Even pasty and/or sticky products that do not flow freely can be processed efficiently;
- An even flow (plug flow) through the machine gives each product particle an identical retention time and ensures a high uniform product quality;
- The front and back of the paddle transfer heat to both sides because they are not placed in slanted position. It therefore has a propelling force on both sides. This is in contrast with transport screws or other paddle dryers that only transfer heat on the propelling side.

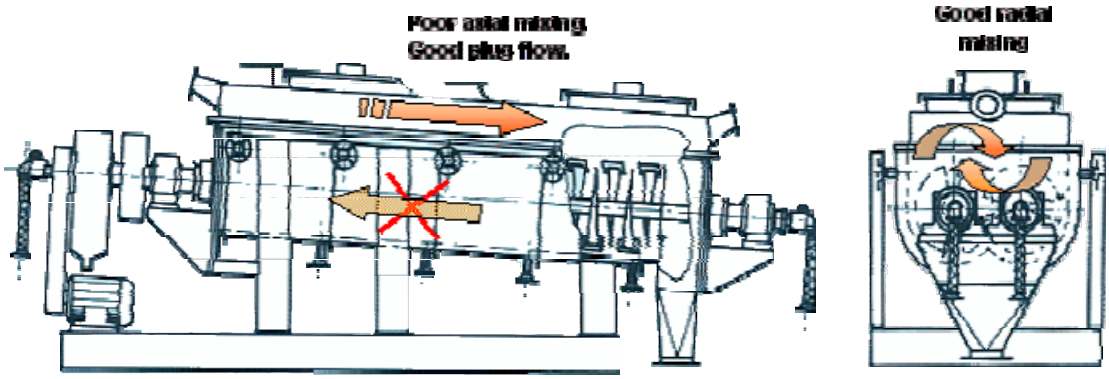


Transport screw:
Product contact = heat flow
in only a **single** direction.



Paddle:
Product contact = heat flow
in **both** directions.

As the product moves through the machine, the paddles ensure that the product is well mixed and that it flows easily through the machine.
The paddles give excellent mixing in radial direction. The product is mixed poorly in axial direction. As it moves further into the machine, the product increasingly meets the end specifications with preservation of the plug flow.



The shafts are accurately aligned. The paddles turn alongside one another and this creates a good ratio between product / heat-exchanging surface and product flow. The dustproof cover of the Hot Paddle Dryer can also be adjusted for a process under vacuum or overpressure.