Solvent Extraction

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SOLVENT EXTRACTION

•Oil extraction is done by dissolving the seed in a solvent.

•It recovers all the oil from the oilseed.

•The cake which is left behind is devoid of oil but rich in fibre and protein.

•The quality of oil is similar to that of expeller oil.

•Solvent extraction plant consists of a extractor, in which oilseeds and solvents are mixed thoroughly.

•Then the oil is freed from the solvent in a series of stills and stripping columns with associated condensers.

•Then oil is cooled and filtered for further storage.

•In 1850's carbon disulfide was used as solvent but because of its bad odour, its use was discontinued.

•After 1870's , light petroleum fractions have become available and real solvent extraction could be performed.

•Solid-liquid extraction or leaching is the diffusive transfer of soluble components to a surrounding solvent.

•The extracted components (oil) can be recovered by simple evaporation of solvent.

•It is mainly used for extraction oil from soybean, minor oilseeds, rice bran ,oil cakes, and other low oil bearing material.

•The rate of penetration of solvent in to the particle depend upon the thickness of the particle.

•The thickness should be 0.2-0.3mm.

•Less thickness results efficient extraction of oil.

SOLVENT

•Hexane can be used as a solvent.

•The boiling point of hexane is 64°C.

•Recovery is possible due to volatility of solvent.

•It has low viscosity.

•It is easily flammable.

The oil solution(hexane+oil) is filtered to remove the foots(fine solid particles).

•Distillation is carried out to obtain oil and hexane solvent.

•The cake which is saturated with solvent ,when subjected to heat gets freed from solvent.

•Processing of 100-300 tonnes / day is more economical than 30-50tonnes/day.

•The loss of hexane in this process is 5-15%.

SOLVENT EXTRACTOR

•Solvent extraction consists of a series of four operations.

1. Physical removal of oil from the seed in the extractor,called extraction.

2. Desolventizing-toasting of the de-oiled seed.

3. Distillation to remove the solvent from the extracted oil.

4. Recovery of solvent, for reuse in the extractor.

•Both batch and continuous type solvent extractions are in the practice.

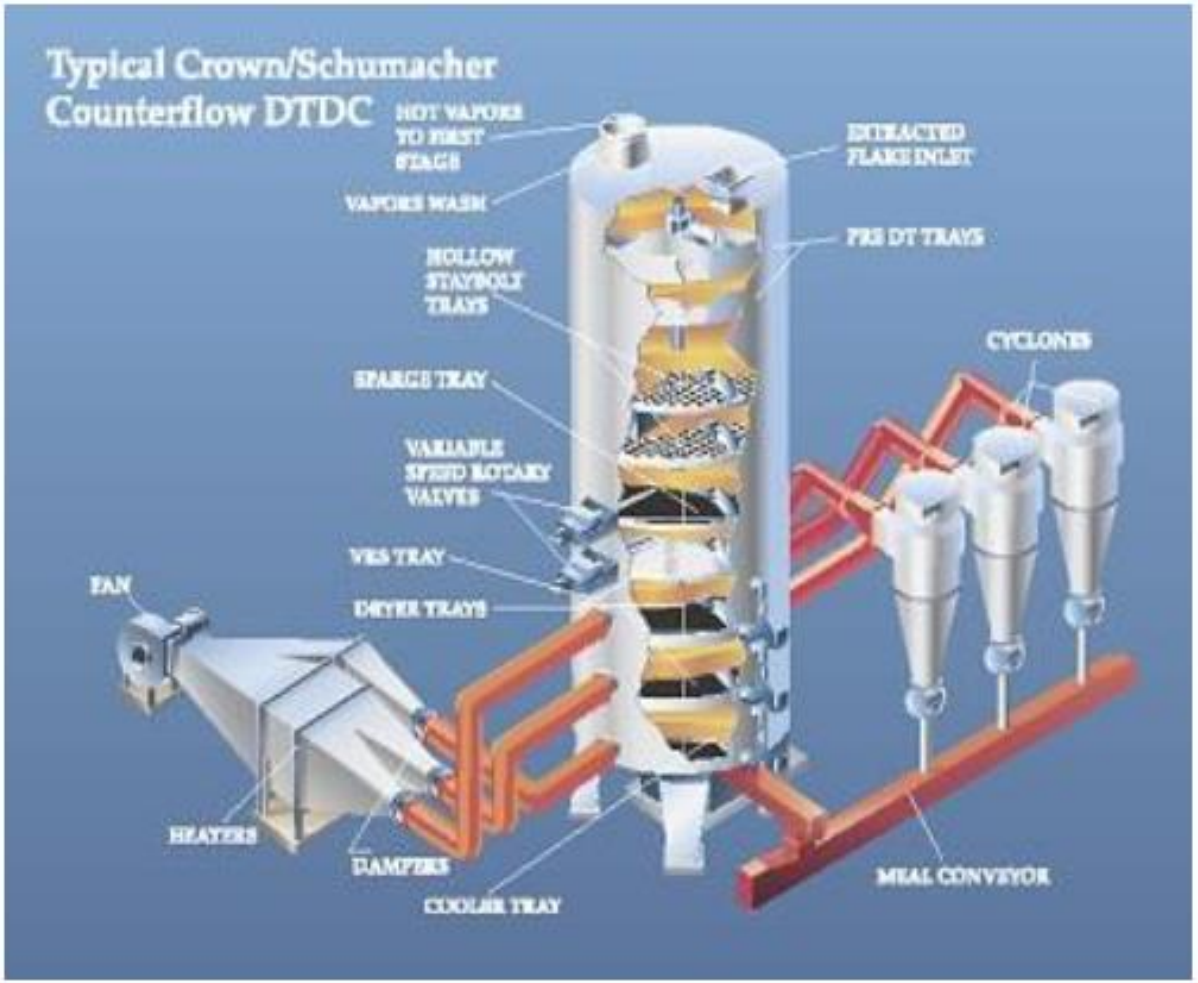
Desolventizing-toasting

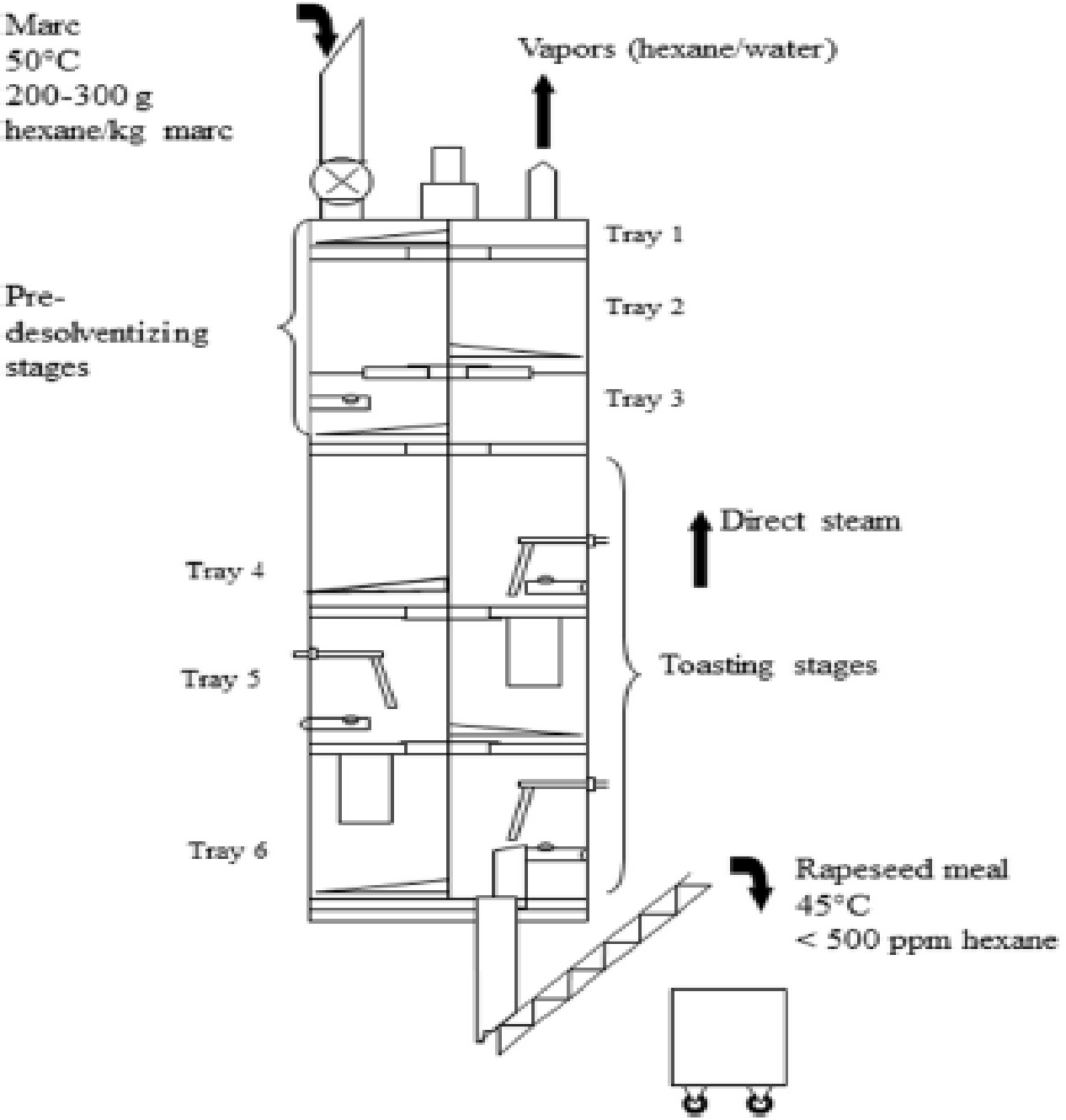
- DTs are vertical, cylindrical vessels with a multitude of horizontal trays.
- The extracted material enters at the top and is supported by the tray. The material is mixed above each tray, and conveyed downward from tray to tray, by agitating sweeps anchored to a central rotating shaft.
- The heat for increasing meal temperature and evaporating the solvent is supplied by steam, introduced directly and indirectly into the meal via the trays.
- The trays of the DT are designed with an upper plate, lower plate, and structural members between designed to hold pressurized steam

- The prepared seed flakes or cakes are transported on a perforated belt through the horizontal body of extractor.
- Fresh solvent is introduced at the discharge end of the extractor and is sprayed over the bed of the product.
- The solvents percolates through the product and extracted oil to be collected in a hopper and pumped to a sprayer located next to the hopper, towards the extractor inlet.
- This process is repeated several times via a series of pumps, thus solvent becomes richer in oil.

- About 75% of oil is extracted in the first 25 minutes out of 60-75 min residence time.
- After that, a prolonged time is required to extract the leftover oil as it becomes less accessible to solvent.
- Extraction speed depends on percolation, or the liquids' flow through the seeds.
- Hexane and miscella spray distributors are designed to avoid channeling ,contamination and dead zones.

DESOLVENTIZING-TOASTING





Factors affecting process of solvent extraction

1. Extraction speed

2. Permeability of oilseeds

3. Height of the bed and fines

4. Operating temperature

5. Viscosity of oil

•Extraction speed is the time required for the poor miscella to the particles) and the rich miscella to reach a state of equilibrium.

•The operating temperature must be below the vapourizing temperature of liquids.

Example:

- The permeability of soybean flakes is 17m3/h and that of soybean pellets is > 45m3/h.
- A mixture of 60% pellets and 40% flakes gives a permeability of 30m3/h.
- So a deeper bed and longer contact time is a better option.
- Expanded pellets have higher permeability than flakes.
- Both extraction and drainage become faster.
- This increases capacity by 20% without sending more solvent to desolventizer-toaster.
- Extractor mainly produce fines, concentrated in the last miscella.
- Solvent filters and hydrocyclones are used to remove fines.

Vegetable oil extraction process