

WHITE FLAKE DESOLVENTISING TECHNOLOGY

Flash Desolventising (FDS)
'V'
Down Draft Desolventising (DDD)

9th, October 2022



SOPA
INTERNATIONAL
SOY CONCLAVE
SOY CONCLAVE 2022




CROWN
EST. 1876

Crown Iron Works – A CPM Company

HISTORY – WHITE FLAKE DESOLVENTIZATION

- **1967** - Ex Technik sells first FDS in Italy for various press cakes including sun, rape, & sesame
- **1974** - First FDS for Soy, 1st unit for Hexane, 2nd unit for Hydrous Alcohol for SPC
- **1981** - First FDS for full extraction plant production at Sojaprotein in former Yugoslavia
- **1996** - DDD Technology Developed and first introduce to Market
- To **1999** - FDS Installations sold in India, South Africa, China, Brasil, USA, Netherlands
- ~**2000** - Ex Technik sold to Krupp, now Harburg-Freudenberg
- **2000 to Present** - White Flake Plants (FDS & DDD Technology) plants sold to ADM, Bunge, Cargill, Soja Protein, Wilmar. **+32 installed units since 1967**
- 7 plants producing 3,000+ TPD of White Flake manufactured using Crown technology in the USA.
- **2010** - Crown Iron Works purchases extraction division of Harburg-Freudenberg. August 2010 Crown sells first White Flake Plant.



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Typical White Flake Applications

TYPICAL SPECIFICATIONS

Moisture (Max)	8%
Particle Size	95% Less, 149 Microns
Flavour	Pleasant to Nutty
Odour	Neutral to Nutty

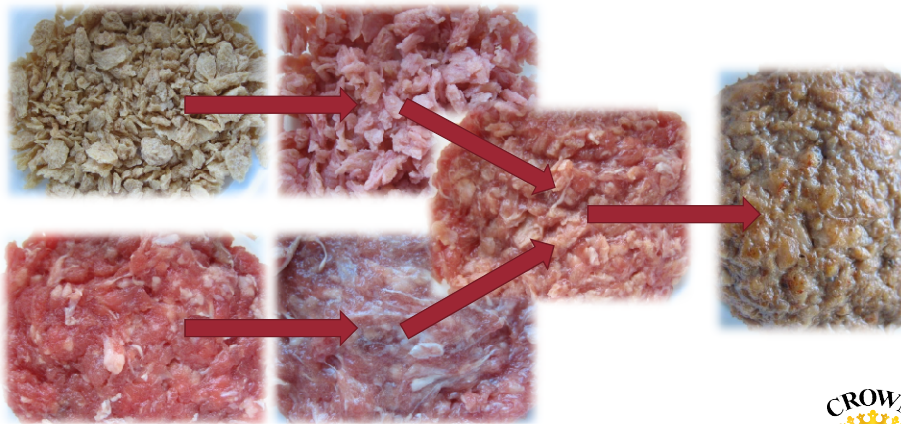
PROTEIN DISPERSIBILITY INDEX (PDI)

90	70	20
Enzyme Active	Enzyme Active	Fully Toasted
Soy Protein Isolates	Soy Protein Concentrate	Milk Replacer
Fermentation	Texturized Vegetable Protein	Meat Products
White Bread Bleaching	Bakery Mixes	Protein Beverages
Adhesives	Doughnut Mixes	Hydrated Vegetable Products
	Pasta	Flavour Carrier
	Breakfast Cereals	Hard Biscuits



Texturized Vegetable Protein Food Uses (White Flake)

TVP as Meat Extender & Replacer



Vegetable Protein Before & After Texturization



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TWO ALTERNATIVE APPROACHES

1. **Down Draft Desolventizer** Heat Exchange is INDIRECT at low temperatures and takes 15-20 minutes. Solvent boils off at 69°C, well below protein denaturation temp so PDI is preserved. Conveying is en-masse so Flake integrity is maintained.
2. **Flash Desolventizer** Heat Exchange is DIRECT to desolventize as quickly as possible at temperatures ranging from 150°C to 100°C, then discharge to lower temperature area. White Flakes are conveyed pneumatically in superheated hexane vapour to the Cyclone Collector. Turbulence in the Pneumatic Conveyor breaks the flakes.

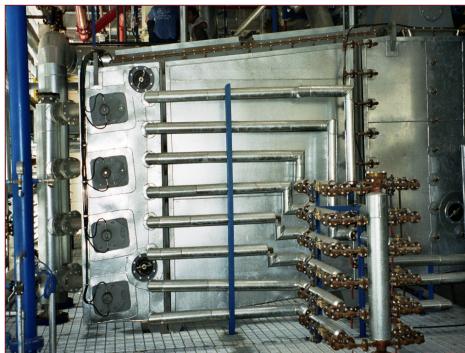
In both cases the final stripping takes place under vacuum and at low temperature in a **Vacuum Stripper** to minimize Protein Denaturation

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ALTERNATE FIRST STEPS IN WHITE FLAKE DESOLVENTIZATION

DOWN DRAFT DESOLVENTISER – Up to 300 TPD in Operation

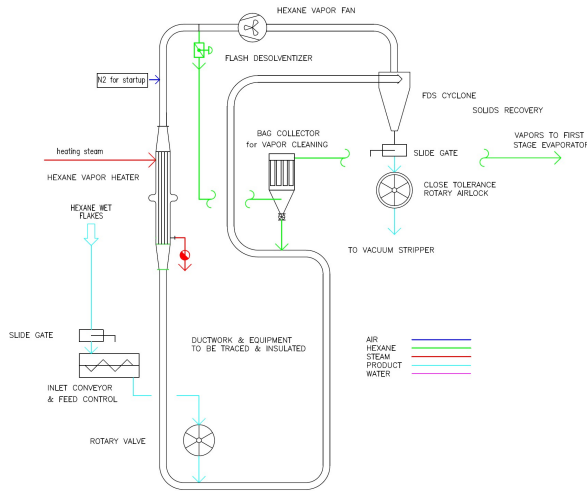


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FLASH DESOLVENTISER – Up to 1000 TPD in Operation



FLASH DESOLVENTISER (FDS)

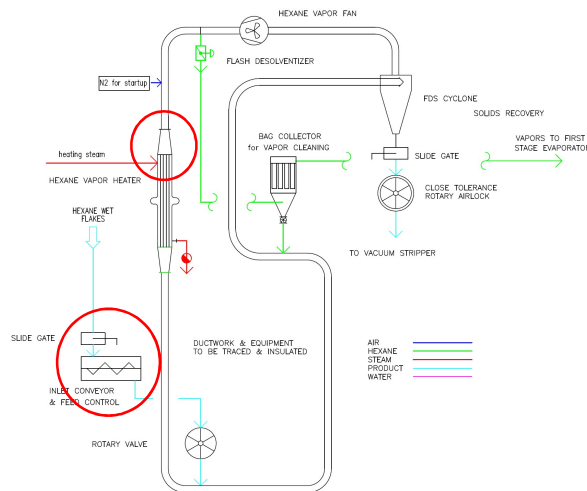


- Flexible layout & design eliminates needs for mechanical conveyors
- Short residence time ensures low protein denaturation
- Pneumatic co current conveyor with Direct Heat Transfer
- High heat with short residence time
- High turbulence to ensure good heat transfer and uniform product treatment



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FLASH DESOLVENTISING SYSTEM

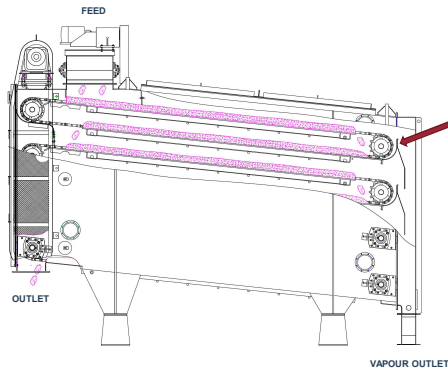


- Even product supply
- Buffer tank with variable speed discharge conveyor
- Critical: Pressure amount of gaseous hexane in the system
- Geometry of inlet section of hexane gas heater
- To avoid turbulences with dust accumulation
- Stabilization of flow after bends, elbows
- Solids Conveying Elbows have Inspection Ports (Crown Design)



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DOWN DRAFT DESOLVENTIZER Essentials of Operation



- Indirect Heating
- Solvent maintains low temp at the heat transfer surface
- Vapor outlet at bottom of machine
- Operates at atmospheric pressure

- Gentle turnover of the bed keeps solvent wetted flakes in contact with the heat transfer surfaces
- Ability to control heat on each tray

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VACUUM STRIPPER/COOLER FOR WHITE FLAKES

DESIGN ESSENTIALS

- Vacuum Stripping maintains product temperatures below the protein denaturation point, even while adding stripping steam.
- Vacuum Stripping must provide controlled residence time at conditions to fully desolventize the flakes or press cakes
- Operation under Vacuum required to obtain both
 - ❖ Minimal reduction in PDI (less than 5 points)
 - ❖ Low ppms residual hexane for storage & transport (<350ppm)
- Design must minimize in leakage of non-condensables to minimize load on the Mineral Oil System
- Must provide cooling when White Flake will be stored. If not processed in short order White Flakes must be cooled before storage. Options are : Takeaway Pneumatic Cooling Conveyor (preferred) or a in line Cooler (similar to DC).
- Ability to vary operating conditions (e.g. Pressure, temperature, stripping steam addition) to adjust PDI of White Flakes when desired.
- Pneumatic Cooling Conveyor (negative pressure) is a cleaner arrangement compared to in line Cooler

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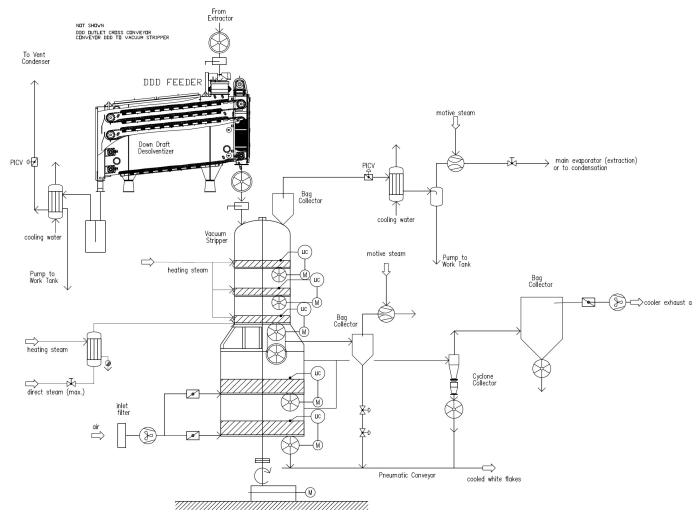
VACUUM STRIPPER/COOLER FOR WHITE FLAKES

VACUUM STRIPPER/COOLER for White Flakes – Brazil (700 TPD Capacity)

Cooling Section available with Vacuum Stripper or Alternatively a Pneumatic Cooling Conveyor can be supplied to suit existing Site Layouts



DDD SYSTEM



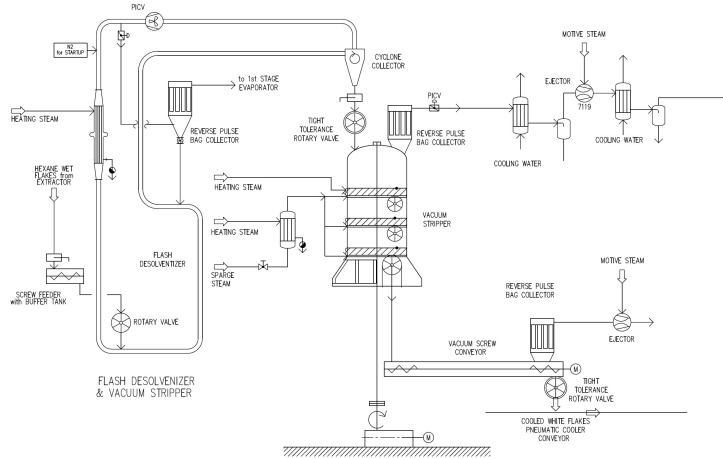
DDD provides high heat transfer area to volume ratio.

DDD provides plug flow (FIFO) yielding strict control over residence time

Connected HP requirements are orders of magnitude lower than other White Flake Desolventization methods



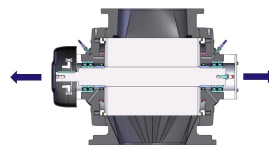
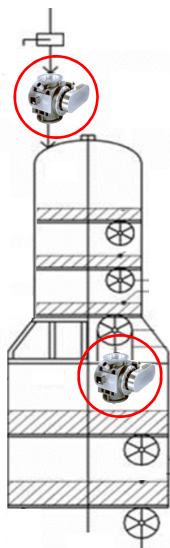
FDS SYSTEM



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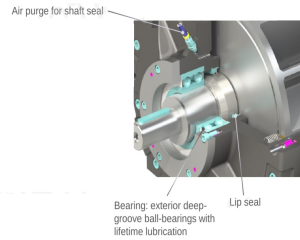
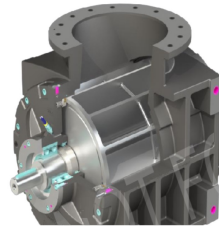


VACUUM STRIPPER/COOLER FOR WHITE FLAKES



- High-precision vacuum-tight rotary locks
- To limit the amount of non-condensables in the vapors

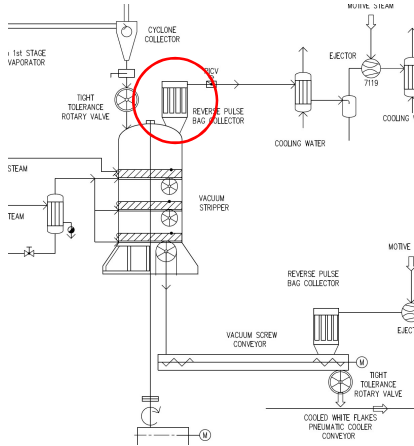
Long-lasting, radial sealing system with low generation of wear (USP)



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VACUUM STRIPPER/COOLER FOR WHITE FLAKES



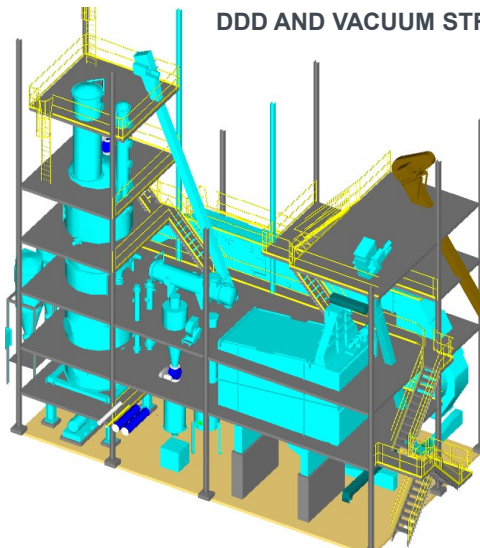
- Improved : Filter in lieu of Scrubber
- No waste water, clean vapors
- Trouble-Free Operation
- Filter directly on top of Vacuum Stripper
- Dust Discharge into the Stripper
- Trace Heating at Stripper Top Section

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TYPICAL PLANT LAYOUT

DDD AND VACUUM STRIPPER PLANT LAYOUT



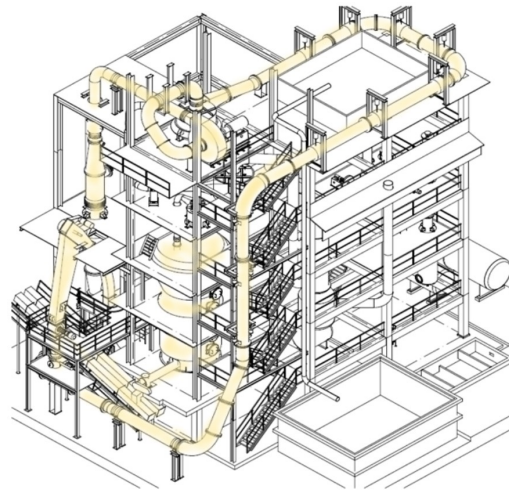
- 59' Height (Vacuum Stripper)
- 50' Height (DDD)
- 21' Width
- 64' Length

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TYPICAL PLANT LAYOUT

FDS AND VACUUM STRIPPER PLANT LAYOUT



75' Height (Vacuum Stripper)
26' Width
48' Length

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COMPARISON OF WHITE FLAKE DESOLVENTISING TECHNOLOGIES

BOTH APPLICATIONS SIZED FOR 785 MTPD WHOLE BEANS AT PREPARATION PLANT INTAKE

FEATURE	DOWN DRAFT DESOLVENTISER (DDD) WITH VACUUM STRIPPER	FLASH DESOLVENTISER (FDS) WITH VACUUM STRIPPER
Method of Conveyance	En-masse conveyors over steam heated plates, vapor tight design	Pneumatic conveying in Superheated Hexane with a High Pressure Fan
Residence Time	Less than 20 minutes, minutes in the Vacuum Stripper	Seconds, minutes in the Vacuum Stripper
Product Temperatures	~80°C for the majority of the Desolventizing process	FDS outlet temperature of 100°C, product temp ~85°C
Flake Integrity	5% breakage	Up to 50% breakage
Residual Hexane	<350 ppm,	<350 ppm
PDI Drop	Less than 7 points	Less than 5 points
Ability to Vary PDI	Vacuum Stripper can be adjusted to vary PDI from 60-90	Vacuum Stripper can be adjusted to vary PDI 60-90
Utility Consumption (Whole Beans at Plant Intake)	Power : 3.11 kW/Tonne Steam : 180 Kg/Tonne	Power : + 7.69 kW/Tonne (+247%) Steam : + 45 Kg/Tonne (+25%)
White Flake Capacity	545 MTPD	545 MTPD
Operational Considerations	Ease of Operation and Slow moving Process.	High Temperature, Working with Super heated Solvent Vapours. Low Maintenance.

