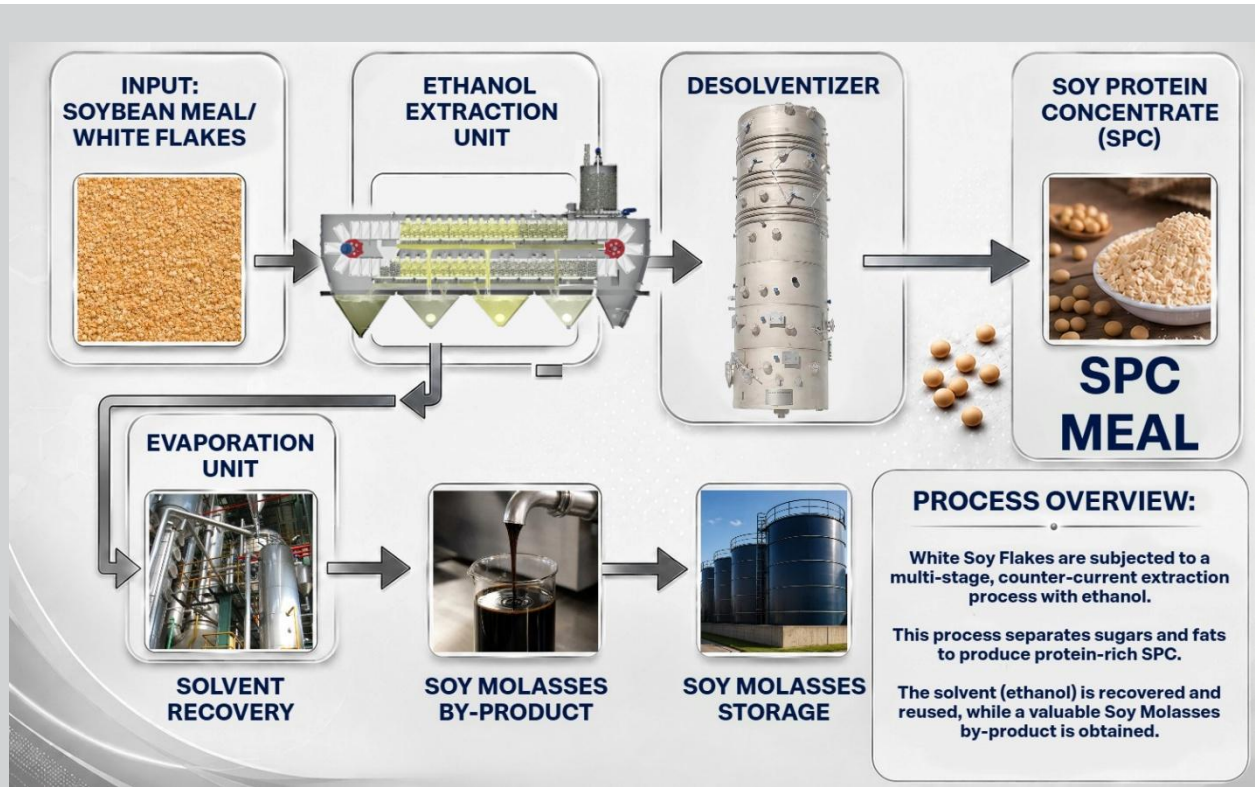


# ETHANOL EXTRACTION

PROTEIN CONCENTRATE PRODUCTION



At HUM, we combine our deep expertise in the vegetable oil industry with advanced protein enrichment technologies. We proudly introduce our Ethanol Extraction system, designed to transform soy meal (white flakes) from conventional Hexane Extraction into high-value Soy Protein Concentrate (SPC).

## WHY ETHANOL EXTRACTION AND SPC?

Soybean white flakes are a premium intermediate product obtained after solvent extraction and gentle, low-temperature desolventizing. Unlike conventional meal production, the process is specifically designed to:

- **Maximum Protein Concentration:** By removing soluble carbohydrates (sugars) that limit nutritional value, it increases the protein (phenolic compounds) content to 65-70% on a dry matter basis.
- **Elimination of Anti-Nutritional Factors:** Completely removes oligosaccharides, saponins, and bitter-tasting compounds in soybeans that may hinder digestion.
- **Superior Digestibility:** The protein structure is preserved, ensuring the highest bioavailability—ideal for aquafeed, calf starters, poultry, and the food industry (higher protein solubility PDI reaches up to 90%).
- **Food-Grade Production:** Our systems are engineered with hygienic design standards, offering the flexibility to serve both the feed and human food sectors.
- **Zero-Waste Approach:** The sugary by-product recovered after extraction (Soy Molasses) is a valuable high-energy feed additive. The recovered soy molasses, with a high metabolizable energy value (ME, kcal/kg), serves as a valuable ingredient in aquafeed and ruminant feed formulations, creating an additional revenue stream and enhancing the overall economic efficiency of the process.

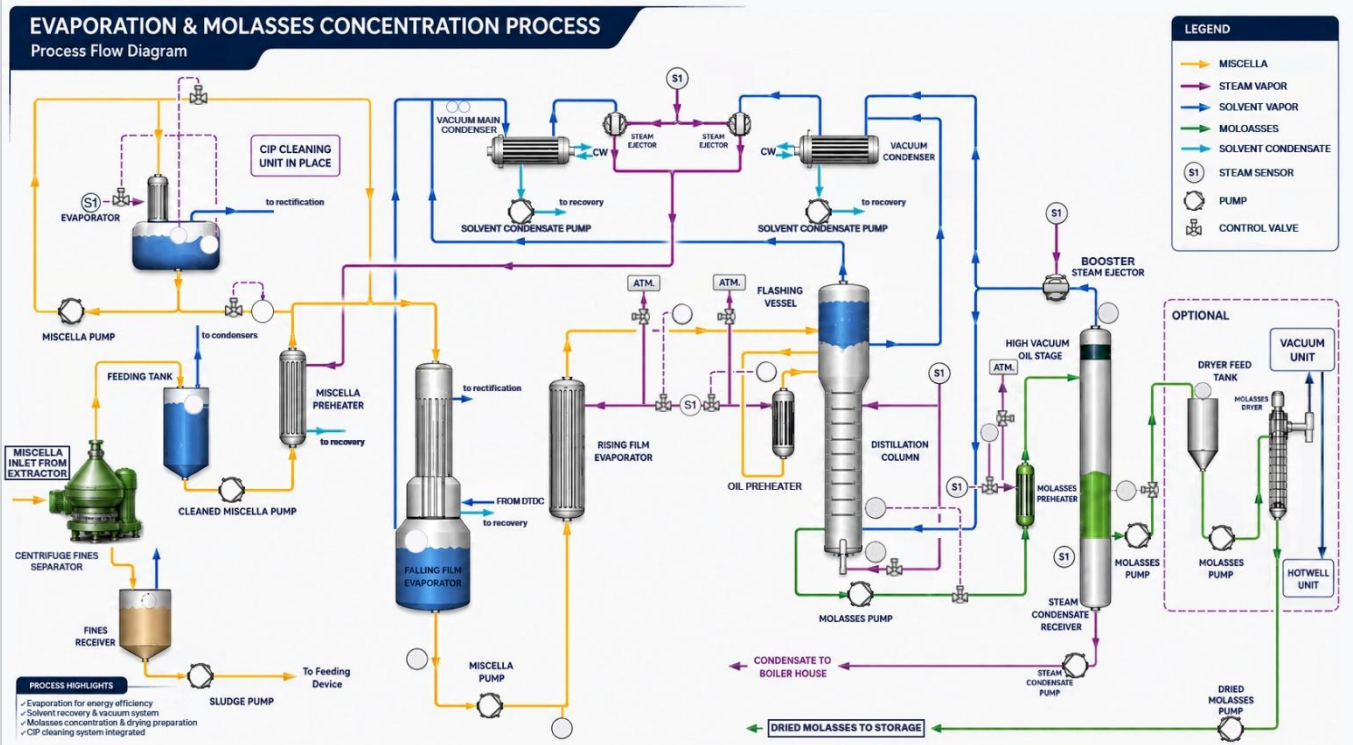
## IMPORTANT STAGES OF THE PROCESS

- Preparation and Sizing: White flakes or meal from hexane extraction are conditioned and milled to the optimal micron size to ensure maximum ethanol penetration.
- Multi-Stage Counter-Current Extraction: The material is washed with ethanol at specific temperatures and concentrations. While proteins are preserved, unwanted sugars and residual oils pass into the solvent.
- Low-fouling distillation system with integrated CIP (Cleaning-in-Place)
- Clean miscella distillation for stable operation
- Maximum heat recovery to minimize steam and energy consumption
- Reduced downtime and maintenance requirements
- Optional thin film dryer for molasses concentration (>65% if required)
- Optimized system design ensures low OPEX



- Desolventization (DTC): Ethanol is removed from the meal under low temperature and vacuum to prevent protein denaturation. This stage ensures the control of the NSI (Nitrogen Solubility Index) value.
- Solvent Recovery (Distillation): Ethanol used in the system is recovered with 95%+ efficiency in closed-circuit distillation columns, minimizing operational costs.
- Drying and Cooling: The solvent-free SPC is dried and cooled according to the end-use requirements.

# ETHANOL EXTRACTION



## HEXANE vs ETHANOL SPC

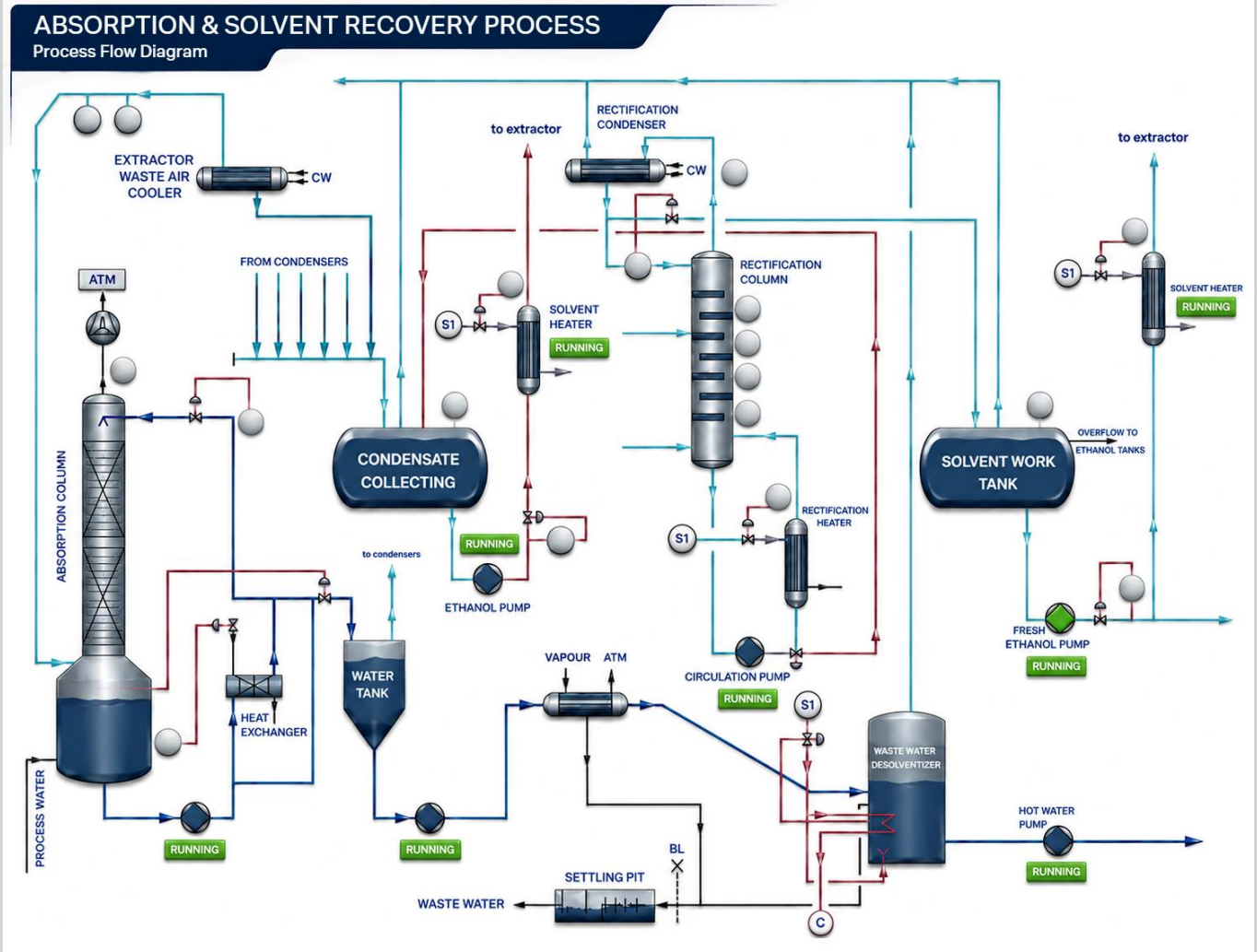
Parameter	Standard Soy Meal (Hexane)	SPC (Ethanol)
Protein	~48%	65-70%
Sugars	High	Very Low
Digestibility	Medium	High
Market Value	Low	High

## APPLICATION AREAS

Aquafeed (Fish Feed)	Ruminant Feed
Pet Food	Speciality Protein Ingredients

## VALUE PROPOSITION

This process enables producers to transform standard soybean meal or white flakes into high-value SPC, creating a strong additional revenue stream while maintaining a zero-waste and energy-optimized production approach.



## HUM ADVANTAGES

At HUM, we don't just supply equipment; we provide turn-key engineering solutions. With our PLC/SCADA controlled automation, we guarantee minimum energy consumption and maximum solvent recovery.

65+ years of process know-how	Recipe-based operation
Customized plant design (not standard package)	Remote monitoring / troubleshooting
Integration with existing hexane plants	Commissioning & training support
Low OPEX design (energy + solvent savings)	Performance guarantees
Advanced automation	After Sales Service



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