

Soymilk production process DOs and DONTs

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SUIDER-AFRIKAANSE SOJAVOEDSELVERENIGING

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Different roads to a same product

- ◆ Traditional process
- ◆ Soybean ultramilling and extraction
- ◆ Formulation based on soy protein isolates
- ◆ Soybean extraction – variations on an old traditional process



Soaking for 20 h;
room temperature



Grinding into
a slush



Cooking for 30 min
in pressure cooker



Extraction

Traditional Asiatic soymilk process



Tonyu (soy milk)



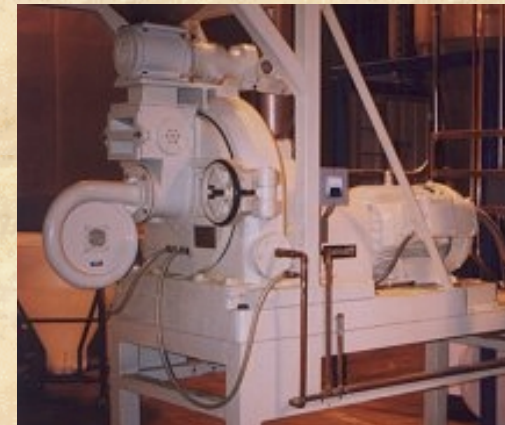
Okara (soy fiber)

Traditional, Asiatic soymilk process

- ◆ Exists since thousands of years
- ◆ Product preferably with strong beany taste
 - not adapted to Western taste pattern
- ◆ Starting product for tofu (bean curd)
- ◆ Perishable okara byproduct; can be used in other food products

Soybean ultramilling and extraction

- ◆ Buhler; FSP; ...
- ◆ Ultramilling to $<10\ \mu\text{m}$ (1000 mesh) or $<30\ \mu\text{m}$ (400 mesh)
- ◆ Readily dispersible products, or extra need for high pressure homogenisation
- ◆ No or limited fiber separation
- ◆ Risk for off flavor formation (full fat flour highly sensitive to oxidation)



Reconstituted soymilk

- ◆ ISP Isolated soy protein (>90% protein)
- ◆ Vegetable oil
- ◆ Emulsifier
- ◆ Sugar
- ◆ Salt
- ◆ Flavors; minerals; ...
- ◆ Water

So Good soy milk composition:

- ◆ Filtered water, soy protein, maltodextrin, grape extract, sunflower oil, acidity regulators (potassium citrate, potassium and diglycerides of fatty acids), stabiliser (carrageenan), salt, zinc gluconate, niacin, vitamin E, riboflavin, vitamin A, thiamin, vitamin D, folic acid, vitamin B12

- ◆ Product easily formulated
- ◆ Proper emulsifier and protein source yield stable product
- ◆ Eliminates the need for soybean extraction
- ◆ No byproducts

Soy base Extraction Technology

Objectives

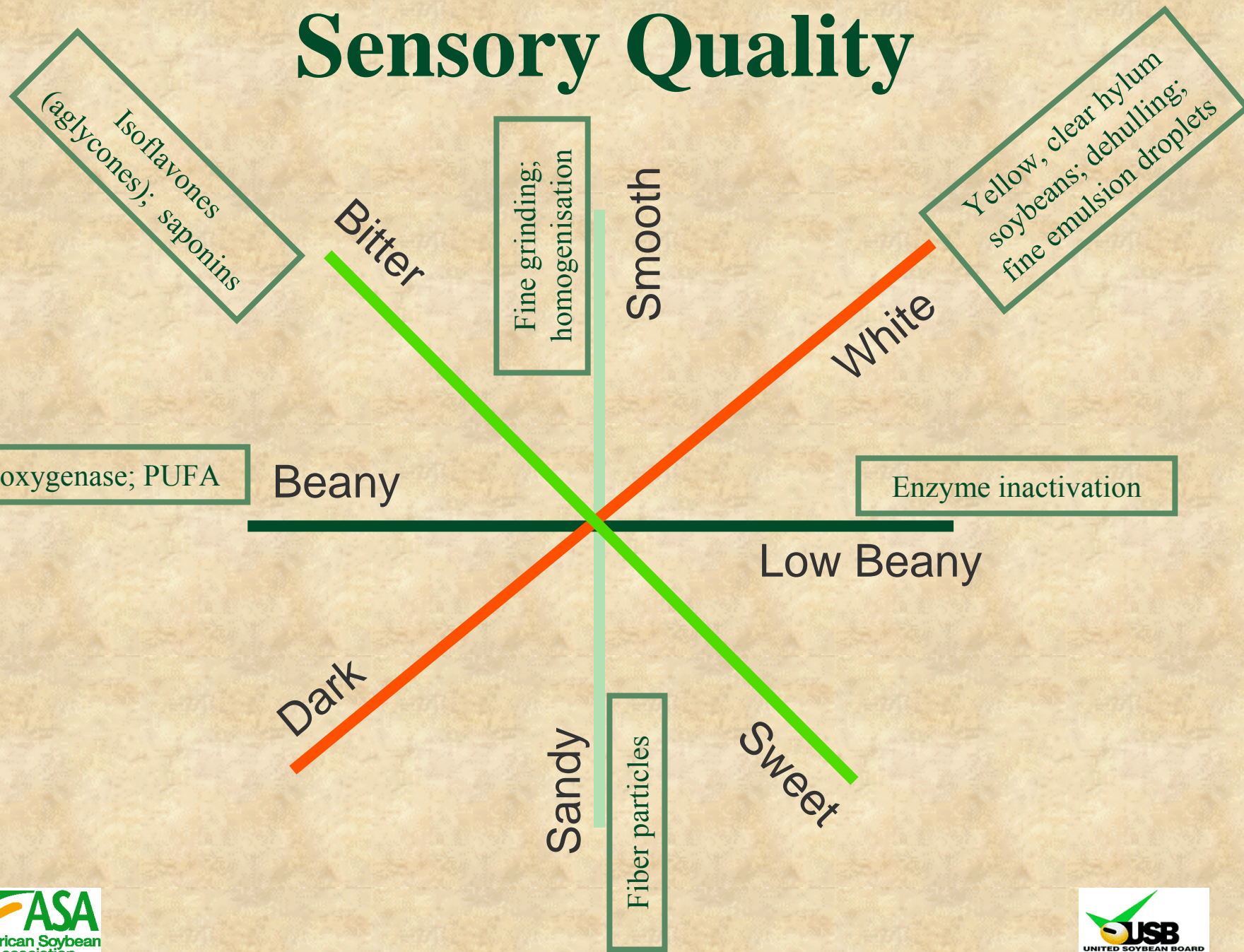
- ◆ To extract the soluble protein as much as possible
- ◆ To achieve desired flavor, taste and texture
- ◆ To inactivate the enzymes
- ◆ To stabilize the product for long shelf-life
- ◆ Taste is Number One Consideration
- ◆ Nutrition is Increasingly Important
- ◆ Pricing is a Significant Factor

**SUPERIOR TASTING
SOYFOODS & DRINKS
FOR EVERYONE**

Quality Parameters

- ◆ Sensory characteristics
- ◆ Nutritional properties
- ◆ Physico-chemical properties
- ◆ Microbiological stability
- ◆ Functional characteristics

Sensory Quality



Basic processing steps

WHOLE SOYBEANS

Water → Soaking

Water → Rinsing

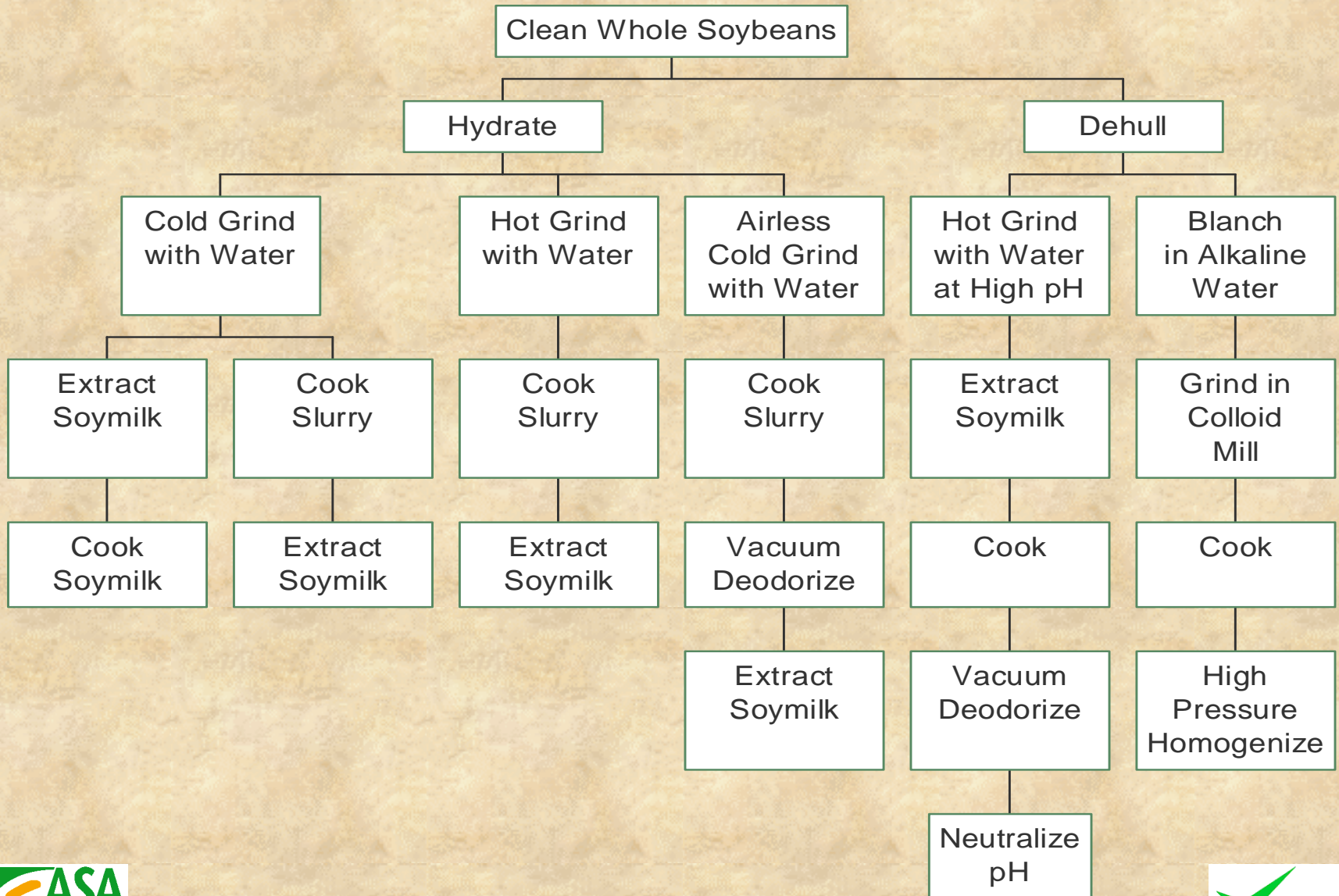
Water → Grinding

Filtering → OKARA

Heating

SOYMILK

Soy milk Production Methods



Dehulling: Yes or No?

◆ No Dehulling

- Saves additional equipment, cost and time
- Damaged soybean leads to active Lipoxygenase and a beany taste
- Soy base made from dehulled bean may have chalky taste
- Hulls aid in filtration
- Hot dehulling insolubilizes protein
- Hot dehulling gives a moist bean surface sensitive to mould infection
- Nothing harmful in the hulls

◆ Dehulling

- HOT or COLD Dehulling?
- Hot dehulling eliminates lipoxygenase
- Splits and damaged beans easy to remove
- Hulls absorb lots of water and clog blanching equipment
- Wet hulls increase okara mass and moisture
- May improve emulsion stability
- Possibility to remove germs (rich in isoflavones)

Lipoxygenase reaction and how to prevent it

Lipoxygenase can

- be denatured thermally (low stability) or chemically (acid/base)
- be kept inactive by reducing access to substrates



- ◆ Heat denaturation denatures protein: proteins attach to fiber
 - compromised taste
 - reduced yield
 - higher formulation cost & calories loading
- ◆ Native soluble proteins easily dissolve in water
 - better taste
 - better nutrition
 - better yield
 - lower formulation cost and calories

Presoaking: Yes or No?

◆ No Soaking

- Less risk for the development of beany taste
- Dry soybeans more difficult to grind
- More wear and tear in milling and grinding equipment

◆ Soaking

- Improves protein extraction yield
- Makes the soybeans soft and easy to grind
- Risk for lipoxygenase and other enzyme activity, unless in absence of oxygen, or at elevated temperature



Blanching: Yes or No?

◆ No blanching

- No loss of insoluble protein, as heat treatment is after separation
- Cooking could reduce protein solubility and extraction yield
- More wear and tear in grinding equipment (soy is very abrasive)

◆ Blanching

- Eliminates lipoxygenase and other enzymes (lipases, phospholipases, proteases, TI, urease)
- Improves taste by reducing the flavor deterioration in long shelf-life product
- Facilitates grinding, milling and/or homogenisation

Addition of sodium bicarbonate?

- ◆ Softens the beans
- ◆ Solubilizes soy protein
 - Really?
 - Through pH increase?
- ◆ Helps reducing beany taste and improves flavor
- ◆ Will require pH adjustment afterwards to suitable value for further process (acid addition) to obtain good taste
- ◆ Why add chemicals?

Hot grinding: Yes or No?

◆ Cold grinding

- No protein denaturation, which could reduce solubility and extraction yield
- Higher abrasiveness of soybeans

◆ Hot grinding (>80°C)

- Eliminates lipoxygenase and other enzymes
- Improves taste
- Faster size reduction and easier grinding

◆ Airless grinding

◆ Colloid mill

◆ High pressure homogenisation

Fiber separation process

With a decanter, centrifuge or by
course filtration

Capacity dependent:

- Filtration: small scale
- Centrifuge: large scale; semi-continuous okara discharge
- Decanter: large scale, continuous okara discharge

Deodorization: Yes or No?

◆ Deodorization:

- Removes volatile off-flavors
- Removes air
- Steam injection gives a pasteurization effect

◆ No deodorization

- Extra processing step
- Direct UHT already contains deodorization

Stability

- ◆ Sedimentation of particles
- ◆ Creaming of lipid globules
- ◆ Factors affecting the stability
 - pH
 - Emulsion stability (emulsifier; salt)
 - Homogenization
 - Clarification efficiency
 - Soaking
 - Heat treatment severity
 - Particle size/Grinding
 - Addition of stabilizer

Shelf-life

- ◆ Depends on
- ◆ The quality of the raw materials
- ◆ The stabilization process (pasteurization, sterilization or UHT)
- ◆ Storage and distribution temperature
- ◆ Quality of the packaging
- ◆ Formulation of the soy drink (effect of salt; stabilizer)

Turnkey plants vs. modular units

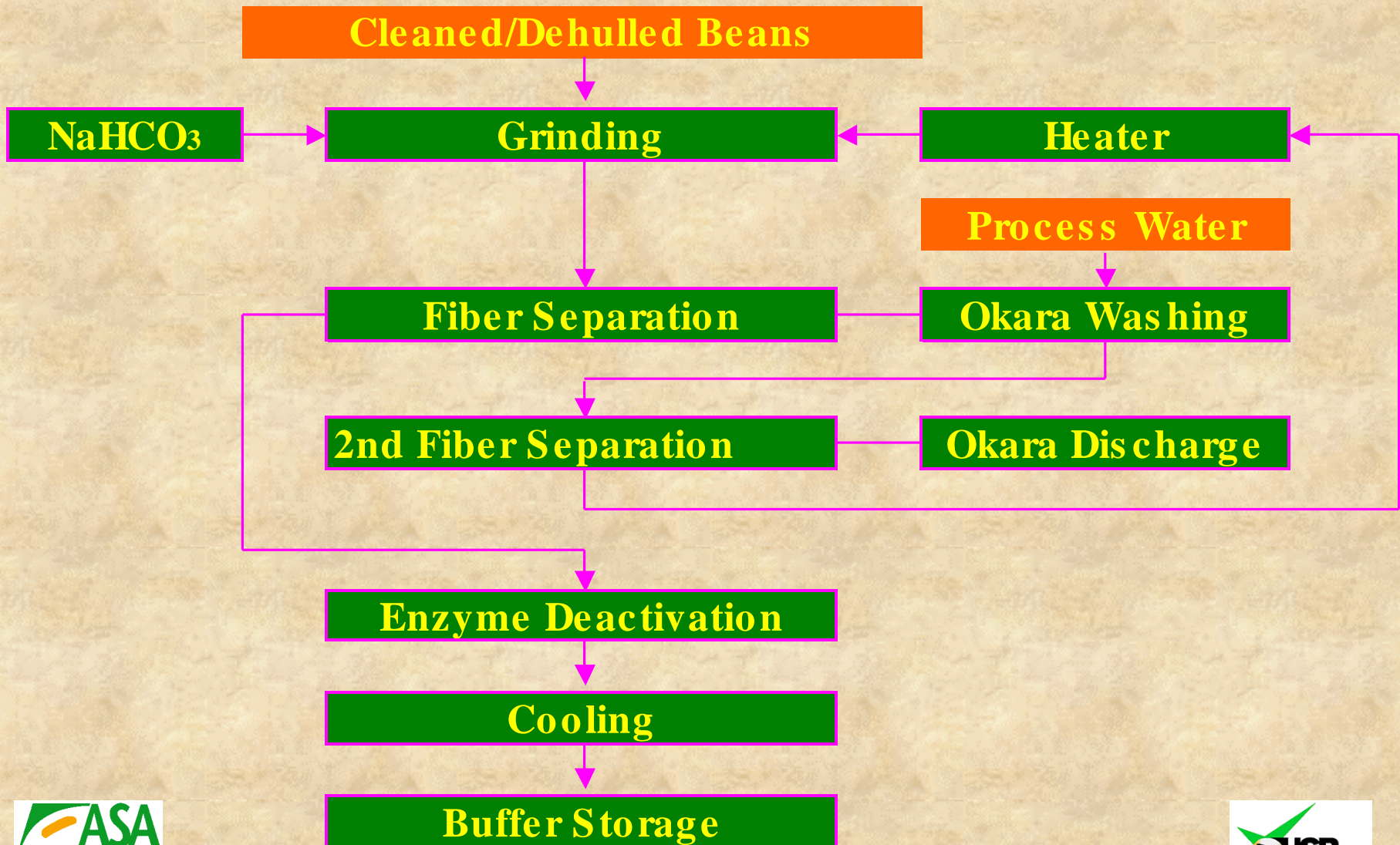
Turnkey plant gives a full integration of

- ◆ Soybean receiving & storage
- ◆ Soymilk base production
- ◆ Steam supply and use
- ◆ Water cooling
- ◆ Chillers
- ◆ Compressed air
- ◆ Effluent treatment plant
- ◆ CIP
- ◆ Soymilk base storage

Modular plant

- ◆ Need for and investment in own process technology development and engineering
- ◆ Finding process equipment that properly fits together into an integrated process

Tetra Pak Alwin™ Soymilk process

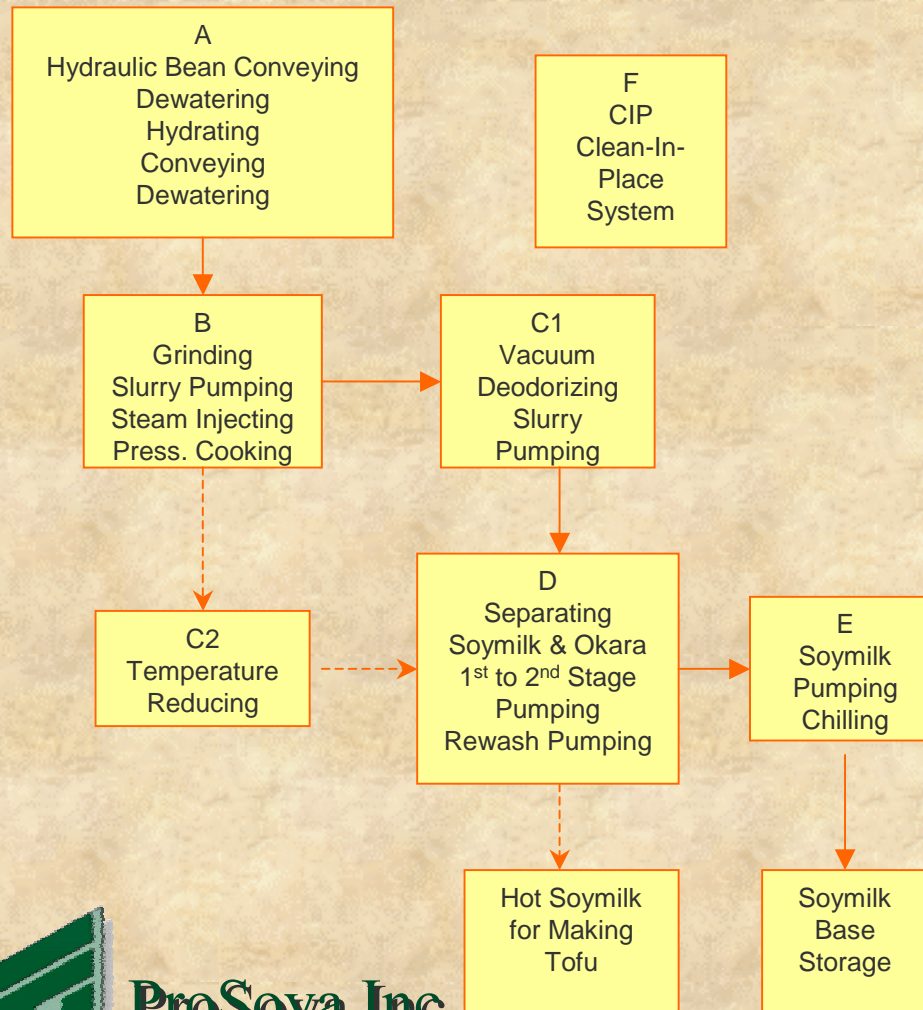


Soy base Quality and Extraction Efficiency

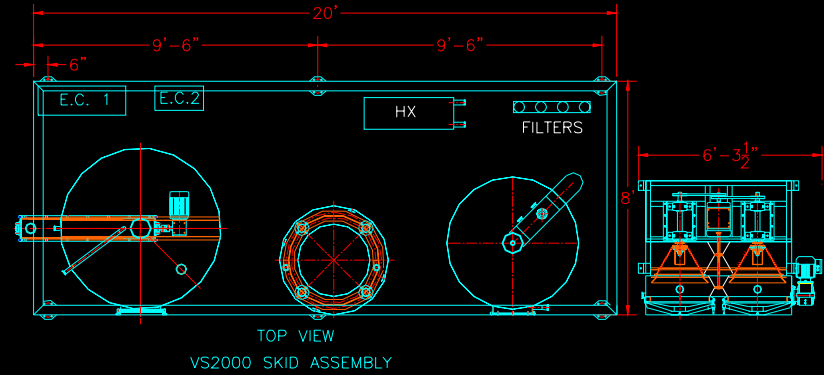
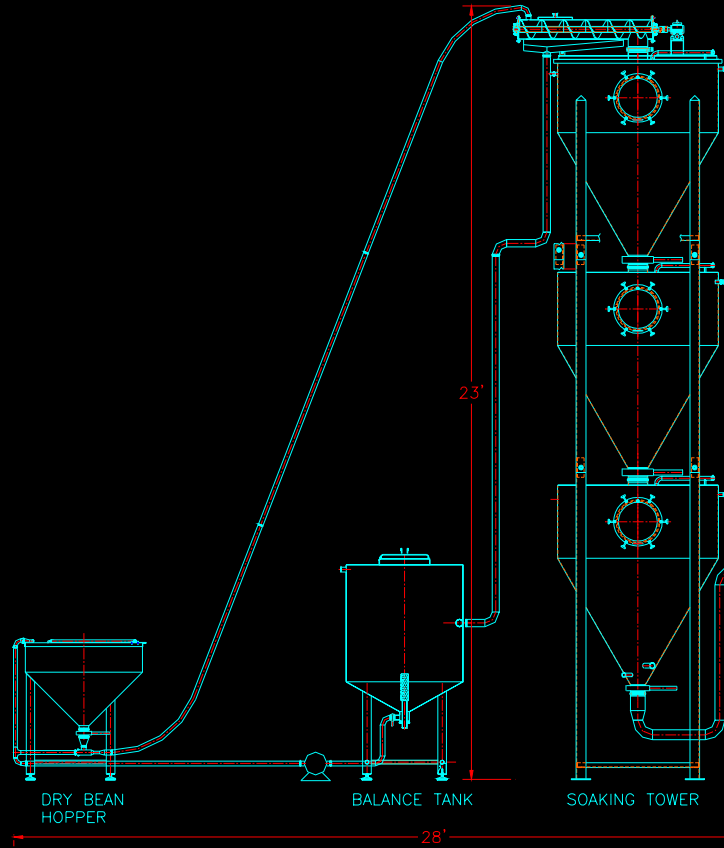
Composition of the Soy base

| Substance | One-Decanter (% wet basis) | Two-Decanter (% wet basis) |
|----------------|-------------------------------|-------------------------------|
| Total solids | 8.7 | 10.9 |
| Protein | 4.0 | 5.0 |
| Fat | 2.0 | 2.5 |
| Soluble Sugars | 1.4 | 2.0 |
| Other | 1.3 | 1.4 |

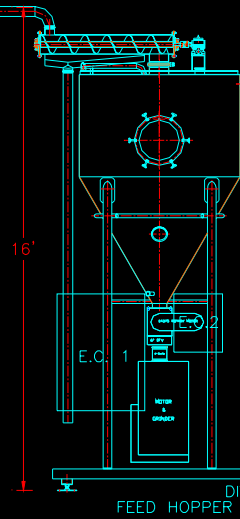
ProSoya™ Process Flow



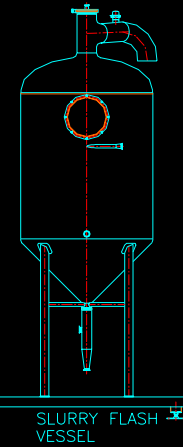
Soaking tower



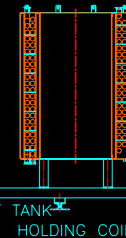
Grinding



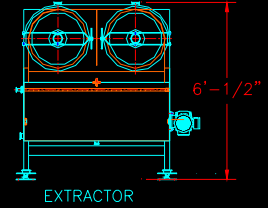
Deodorizing



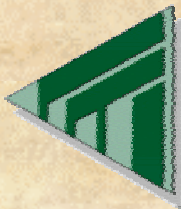
Cooking



Okara Separation



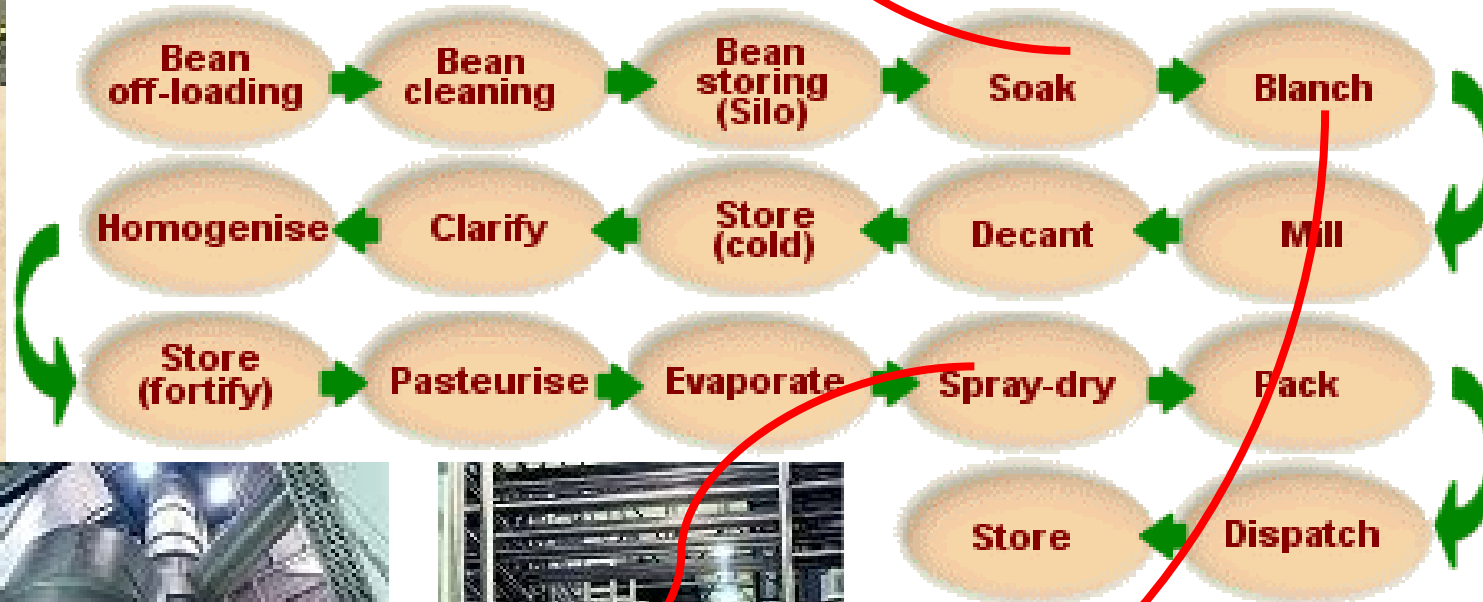
FRONT VIEW
VS2000 SKID ASSEMBLY



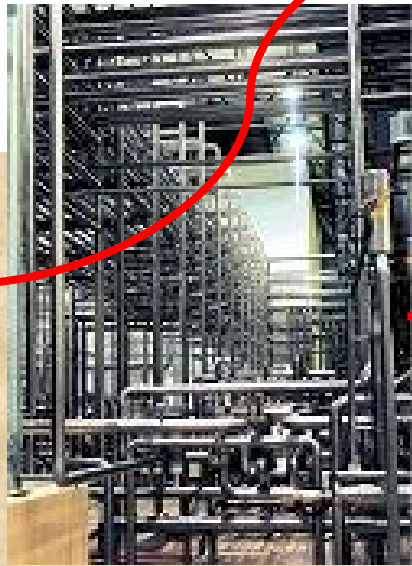
SPP process



Batch soaking

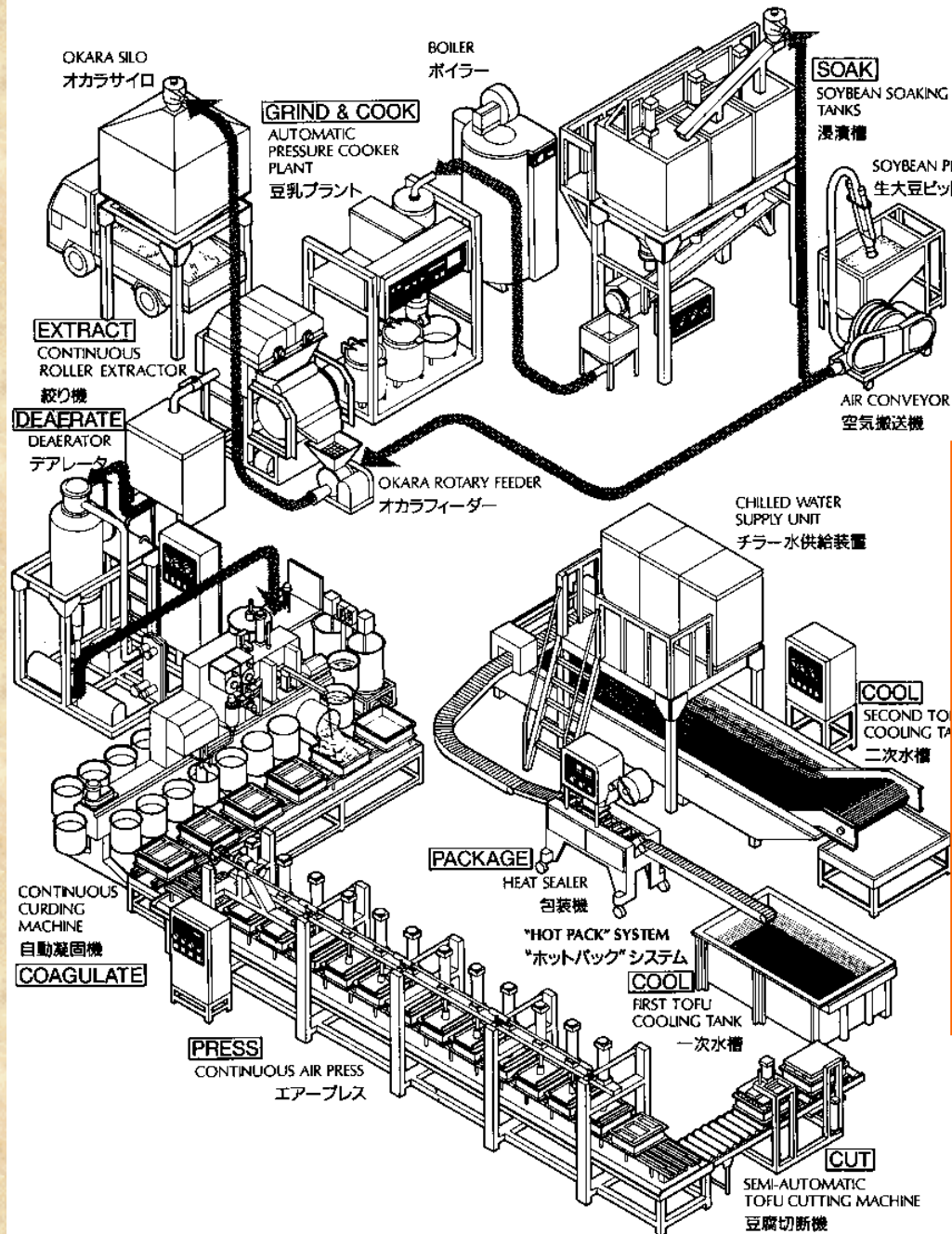


Spray drying



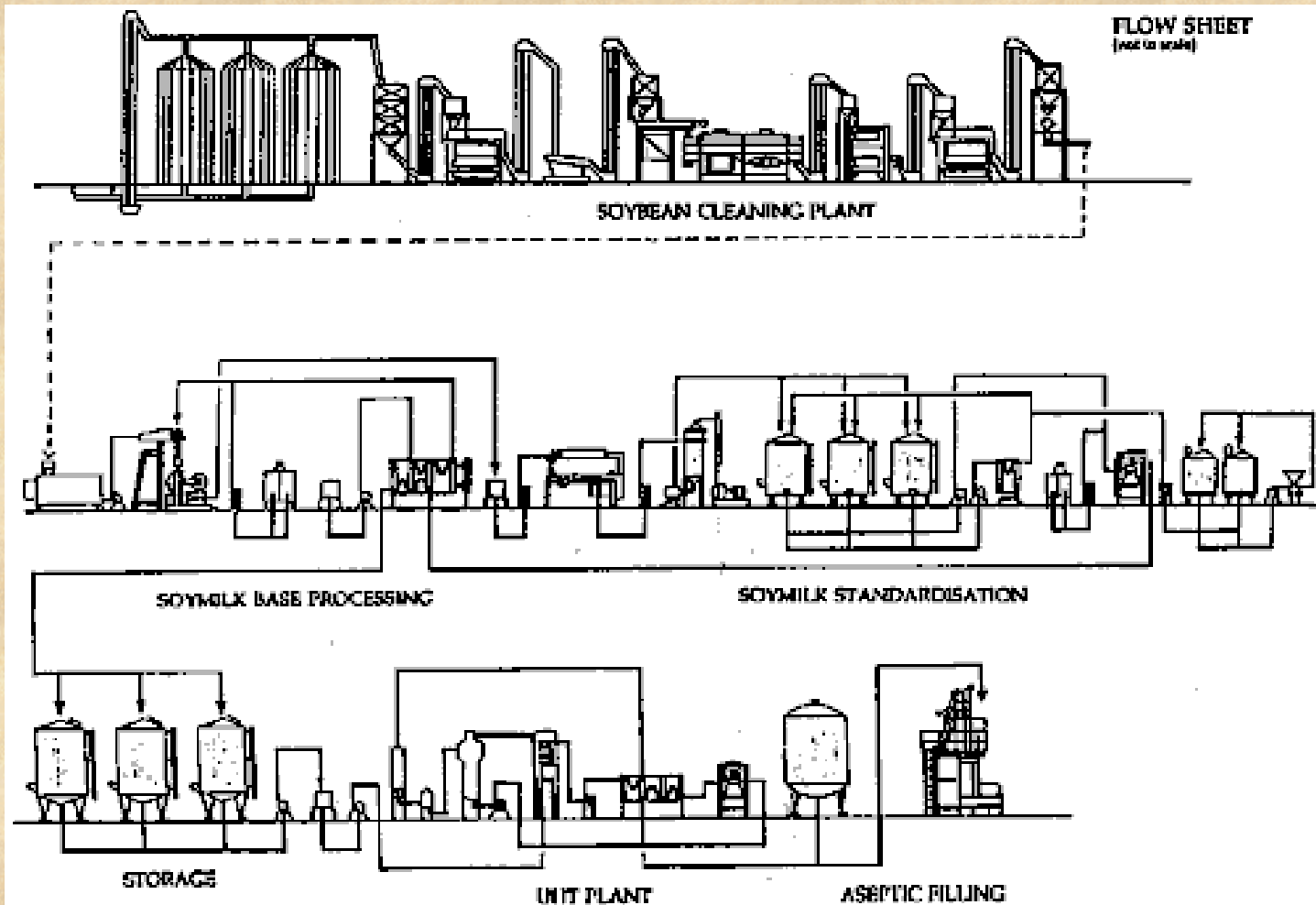
Pipe cooking

Takai soymilk process



- ◆ Chinese-style traditional soymilk
- ◆ Japanese-style good tasting soymilk
- ◆ Western-style good tasting soymilk

The STS process



Agrolactor by Nutritech



Broyage

Dosage



Double filtration



With special thanks to:

- ***Tetra Pak***
- ***ProSoya***
- ***SPP***
- ***APV***
- ***Takai***
- ***Nutritech***



<http://www.asa-europe.org>