

Ready-to-use Therapeutic Formula production in Ethiopia

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Objective:

To establish a Ready-to-use Therapeutic Formula (RUTF) plant in Adama, Ethiopia that will utilize local ingredients in order to boost the economy and fight against the development of severe acute malnutrition (SAM).

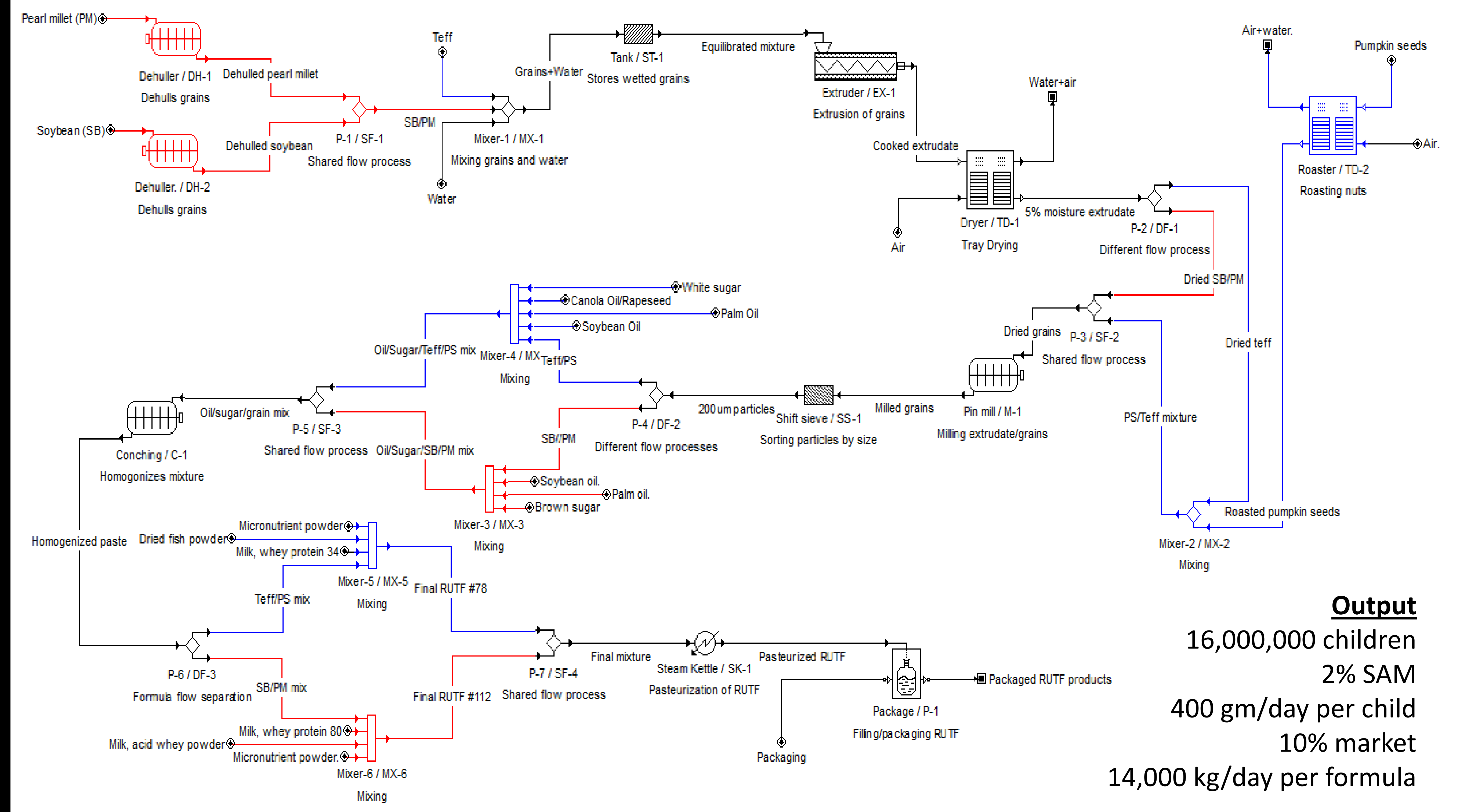
RUTF Formulations:

Formula 78		Formula 112	
Ingredient	Percent Composition	Ingredient	Percent Composition
Teff	3.60	Pearl millet	17.8
Dried fish	4.90	Soybeans	12.7
Pumpkin seeds	13.6	Milk, acid whey powder	8.90
Canola oil	2.90	Palm oil	25.3
Palm oil	22.8	Soybean oil	4.40
Soybean oil	1.00	Brown sugar	18.4
White sugar	23.8	Milk, whey protein conc. 80	6.90
Milk, whey protein conc. 34	22.3	Dimodan HSKA	2.00
Dimodan HSKA	2.00	MNP	3.60
MNP	3.10	Cost/100g	\$0.128
Cost/100g	\$0.137		

Experimental Design:

- *De-Hulling:* Removal of fibrous hulls through grinding.
- *Mixing:* Blending multiple ingredients together into a well-mixed solution.
- *Extrusion:* The cooking of grains through pressure and shearing.
- *Drying:* Removal of water through heating.
- *Pasteurization:* the heating of product to a temperature for a time in order to eliminate unwanted microorganisms and increase shelf life.
- *Milling:* The grinding of product into small particles.
- *Homogenization:* The process of breaking down large particles in a solution to create a stable emulsion.
- *Screening:* Process of separating particles based on their size.

Process Flow Diagram:



Economic Analysis:

Equipment	\$ 1,158,600
Installation	\$ 289,650
Instrumentation and controls	\$ 92,688
Electrical, installed	\$ 347,580
Other Capital	\$ 1,991,788
Fixed Capital Investment	\$ 3,862,000
Working Capital	\$ 681,529
Total Capital Investment	\$ 4,543,529
Raw Materials	\$ 11,920,000
Operating Labor	\$ 2,432,653
Direct Supervisory and Clerical Labor	\$ 243,265
Utilities	\$ 2,432,653
Maintenance and Repairs	\$ 79,710
Other Product Cost	\$ 7,223,783.35
Total Product Cost	\$ 24,326,531

Equipment Costs:

Equipment	Quantity	Unit Price	Total Cost
De-huller	14	16900	\$ 236,600
Extruder	10	20000	\$ 200,000
Tray Dryer	8	10000	\$ 80,000
Mixers	12	19000	\$ 228,000
Rotary Screen	4	5000	\$ 20,000
Steam Kettle	4	2000	\$ 8,000
Mill	12	30000	\$ 360,000
Homogenizer	2	13000	\$ 26,000
Total			\$ 1,158,600

Return of Investment

- Assume 5 year payback period
- ROI: 20%
- Selling Price: \$0.279/100g

Alternative Design:

- *Impingement dryers replace tray dryers:* Have a quicker drying time, but cost more and take up more space.
- *Cook soybeans in dryer:* Inconsistent cooking in soybean extrude
- *Utilize irradiation for food safety:* In addition to steam kettle pasteurization
- *Decrease pieces of equipment:* Perform deep clean on equipment and use for both formulas.

Sustainability:

- *Rotary screen recycle:* Send large particles that did not make it through rotary screen separator back through mill in order to decrease particle size.
- *Byproduct for animal feed:* The hulls from certain grains and the uncooked extrudate can be sold as animal feed to local farmers in Ethiopia.
- *Condense water vapor:* The extruder and the tray dryer both have moist air coming off, and this can be recycled and used for grain soaking prior to extrusion.
- *Recycle containers:* Containers initially holding ingredients from shipping can be recycled a number of ways.

Societal Impact:

- Boost local economy
- Reduce cases of severe acute malnutrition
- Develop & enhance local sustainability practices

Sponsors:

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