

Organic Plant-Based Protein & Sustainable Fuel Production for Clean Cooking Stoves



How it Started

- This project started as a fuel project October 2021, when we had noticed the steep price increase of Fossil Coal.
- We decided very early that grass was the only sensible feed stock.
- Started looking at Miscanthus and Napier grass but after continued research we found a grass developed in Thailand in the early 2000 called Super Napier or Pakchong 1. This grass is a cross hybrid between ordinary Napier grass (*Pennisetum purpureum*) and Pearl millet (*Pennisetum glaucum*).
- In January 2023 we found out that exactly the same hybrid was developed in South Africa in the 1950's, It is called Bana Grass; The name Bana is derived from the acronym "ba" in Babala (Pearl Millet) and "na" from Napier. Bana grass has spread to most parts of the sub-tropical climate areas of the world.

Protein from Grass

- In September 2022 we ran across a presentation from Aarhus University describing how the agriculture sector decided to replace the importation of organic soya protein with protein extracted from Lucerne and Clover grass farmed in Denmark.
- We looked for chemical analysis of the Bana Grass and found it contains between 16-19% of crude protein, depending on time of harvest – 45-60 days after last cutting. However when the Danish can do maximum 2 t/ha and year we can do >10!
- There are several very large scale grass to fuel projects in the world but, sofar, we are the only ones first extracting the liquid and separating the protein from the liquid in a centrifuge.

Microwave Assisted Liquid Extraction

- Pressing out liquid from Bana grass is quite difficult. If you use a batch press you are lucky if you can take out 50% of the liquid. Hence, we have introduced a technology we call: Microwave Assisted Liquid Extraction (MALE) – A revolutionising plant extraction with unmatched efficiency.
- Superior Extraction Efficiency: Our MALE process uses advanced microwave technology to rupture all cell membranes, significantly increasing the liquid extraction rate from around 50% to over 90%.

Pellets & Biochar

- One issue with fuel from grass is the corrosivity and high levels of ash content. However, those issues are eliminated when you take out the liquid before producing the fuel from the press cake. What is left in our press cake is only Cellulose, Hemi-cellulose and Lignin
- If you do not need fuel you can produce Biochar mix it into the soil. Not only is this a Carbon Sink (Carbon Credits) but also offers both fertilizer and water retention.

The Market for Plant-Based Protein

- The present price for Soya Bean Protein in Africa is USD 4-600/t
- Our Protein will be Organically farmed with a much higher value. However, the market for Organic Protein in Africa is very limited or non existing, so we will ship some to OECD countries.
- However, we are committed to supply the African feed industry to replace imported Soya Bean Protein, which they are busy doing in Denmark
- And tonnage wise, the market for protein is endless...

Propagation

- Bana grass is propagated by way of cuttings. 30 000 cuttings per ha@ USD 10 cents/cutting and, under subtropical condition, the acreage will 10 double every 3-4 months
- Moringa is propagated by way of seed. Nursery takes 500 seed per ha and produce 2 x 3 tonnes/ha/y, or 20 million seed. Seed price per kg is USD 10. Farming @ 500 000 per ha. A 20 ha nursery produces seed for 400 ha per year.

Farming

- With drip irrigation Bana grass should produce 400 t of wet matter and 75t of dry matter. At a 16% crude protein content each ha should produce 7+t/year
- With drip irrigation Moringa should produce 400 t of wet matter and 75t of dry matter. At a 28% crude protein content each ha should produce 15+t/year
- See enclosed Propagation and Farming guidelines.

Mechanical Fractionation – Chaff Cutter

- After plants are harvested at 45-60 days of age, the stems need to be shredded by a Chaff Cutter



Processing

- First the liquid is extracted in the following steps:
 - Mechanical Fractionation
 - Microwave Assisted Liquid Extraction
 - Liquid Extraction
- Secondly the protein is separated from the liquid – Precipitation and Protein Separation
- Thirdly the Press Cake is used to make pellets or Biochar.

Microwave Assisted Liquid Extraction



Benefits:

Increased Yield: From around 50% to over 90% extraction rate.

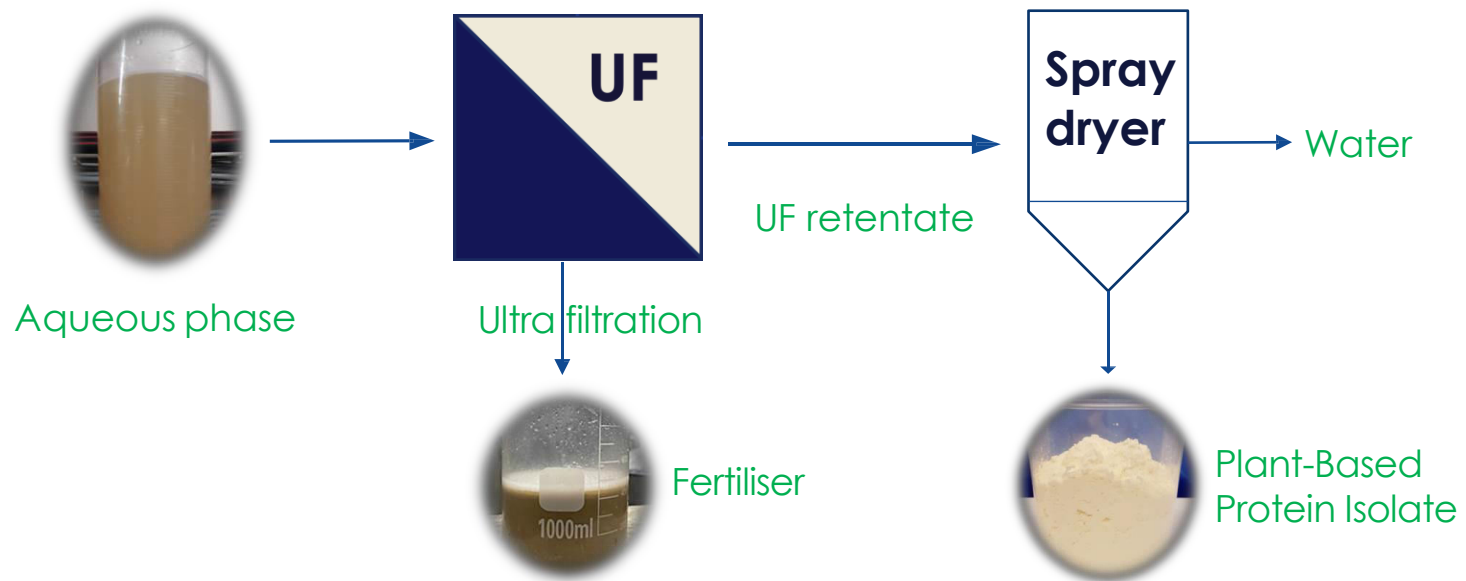
Nutritional Value: Efficient extraction of vital amino acids, supporting the global shift towards plant-based diets.

Liquid Extraction

- The Belt press typically has more capacity per CAPEX but less extraction rate (%) than a batch press
- However, applying Microwave treatment gives the Belt press higher extraction rate and higher production rate.



Ultra Filtration Protein Separation

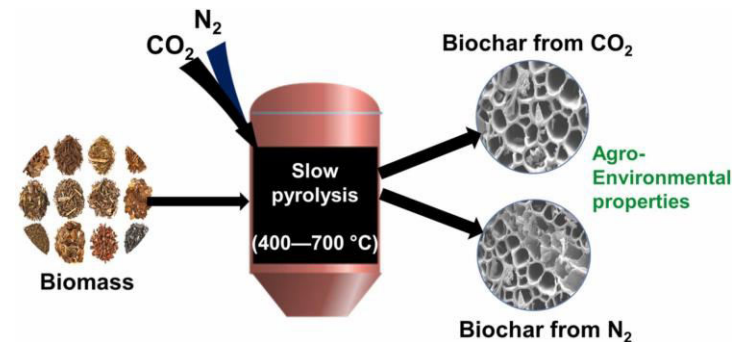


A decanter centrifuge based technology typically delivers a protein concentration of <50%, and using chemicals and heat 70-80%, which disturbs the stability and structure of the amino acids – Denaturation.

Our technology – using no chemicals nor heat – delivers a concentration of > 98% Crude Protein.

Fuel from Press Cake

- The press cake is very suitable for making pellets or biochar. As we first extract almost all liquid, the press cake almost only contains Cellulose, Hemicellulose and Lignin
- Almost all Nutrients and Salts have left with the liquid which reduces the corrosivity in the burning process to a minimum and what ever smoke coming out much cleaner.



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