

Cassava Growth Markets

Processing Technologies

Workpackage WP3

Activities undertaken

Technical assessment of existing bin and flash dryers

The assessment of a Chinese make flash dryer and bin dryer was carried out at Caltech. Bin dryers used at Majestic Company Limited, Hohoe and Praise Export Company Limited were also assessed.

Other artificial drying equipment was also assessed including;

1. Cabinet dryer at F.R.I. Pokuase
2. Solar dryer at F.R.I. Pokuase
3. Patio sun drying at FRI Pokuase and
4. Cassacoxa Co. Ltd. at Sunyani, Chiraa

Deliverables

1. Flash dryer at Caltech CO. Ltd.

The heat generator of this Chinese make flash dryer, is operated by using an indirect heating system which uses wood as its source of fuel. The design rated capacity of this dryer is 8tons/day of dried product (cassava flour).

Currently the operating capacity is 1.0-1.5 tons of dried product per day depending on the type of wood used in firing the heat generator. Wood of high calorific value (hard wood) such as teak, rose wood and mahogany enable the drier achieve 1.5tons/day, while wood with low calorific value (soft wood) attains 1.0ton/day.

The dryer is a part of a processing line of machines which includes mechanical washing and grating and centrifuging presses which enables dewatered mash of 40% moisture content to be achieved before drying. The initial temperature developed by the dryer is 300-400 °C.

Challenges associated with the flash dryer

Currently, the flash dryer is only used when there is an order with price agreement for the production of High Quality Cassava Flour (HQCF).

Challenges are as follows;

- High management cost of flash dryer.

- High fuel consumption per unit of dry grits produced.(800kg wood fuel/day)
- High electricity cost – uses 11.5kW electrical motor for the pneumatic conveying system.
- High cost of operating the centrifuge press attached to the dryer.

This dryer is suitable for high capacity processing. However, harvesting and peeling are carried out manually. These are still major problems in the production of HQCF in Ghana. Processing of HQCF is time bound (within 24hours after harvesting). Processing below 4-5 tons/day makes the flash dryer not cost effective.



Cyclone of the Flash Dryer at Caltech Ltd.



FEEDING UNIT



HEAT GENERATION UNIT

The feeding unit and heat generator unit of the Flash Dryer at CALTECH,

2. Wood-fuel bin dryer

At Caltech, wood fuel operated bin dryers are used. However, these dryers are not the totally indirect type. They have an outlet for exhaust smoke but the inlet of heat into the bin is directly inside the burning chamber of the heat generator.

The bins are each loaded 1ton of disintegrated mass and takes 8-10 hours to dry.

Each bin dryer uses 200kg of wood for 1 batch drying.

Currently Caltech uses these bin dryers to produce industrial cassava flour. These dryers have good drying capacities but are not suitable for HQCF production

Challenges associated with wood fuel bin dryer

- Uneven drying of product in bin
- Need for frequent stirring for a harmonized drying

- Product is contaminated with some level of smoke



3. Diesel fuel operated bin dryer

Majestic company limited, Hohoe, uses a bin dryer which although operates on electricity, uses diesel fuel for heat generation. The loading capacity is 1ton and requires 4 hours.

About GH¢50 worth of diesel and GH¢30 worth electricity is used to dry 1 batch.

4. Liquefied Petroleum Gas (LPG) operated bin dryers

Praise Export in Accra uses 3 LPG operated bin dryers. Praise Export produces fermented cassava dough Agbelima and Banku mix (fermented cassava and fermented maize) and occasionally HQCF.

Loading capacity of the bin dryer is 1.2 ton (disintegrated cassava dough) at 45% MC and takes about 25-27 hours to dry to 12% MC.

Initially when these bin dryers were running diesel fuel, the cost/batch drying was about GH¢300

The present cost/batch drying using gas is GH¢220

Calculated drying cost is GH¢0.22/kg of dried cassava grits

The product is free from exhaust smoke contamination and takes 2-3 days to completely dry to 10% MC (drying from 9am -5pm daily).

Challenges associated with the dryer

- Constant stirring of product to achieve uniform drying



Batch Bin Dryer



LPG fired heat generator

5. Diesel operated cabinet dryer – FRI Accra

The cabinet dryer runs on electricity but utilizes diesel fuel to generate heat for drying. It is an indirect hot air system. The dryer cabinet is constructed of baked bricks and internally lined with metal sheets. The size of the drying cabinet is 3.9m x 8.2m x 2.4m. The loading capacity is 500-800kg wet mass, about 45% MC which takes 50-60litesof diesel fuel. Movable trolleys with drying trays are provided for easy loading and off-loading.

The loading capacity can be increased by increasing the quantity of wet mass on the trays to take advantage of the full volume of drying chamber.

This type of dryer is suitable for HQCF as well as other food products and has an efficient processing capacity of 2tons fresh cassava



Interior of Cabinet and Burner Unit of FRI Diesel Fired Dryer at Pokuase

6. Solar house dryer

The solar house dryer is a fixed cement block construction with fibre glass roof .It has an inlet and outlet vents to allow for natural convection. There is a temperature build up of 50-55°C in the afternoon 12.30pm in the drying chamber on good sunny days. The produce is dried on black polyethylene sheets on the drying platforms provided. This dryer has a capacity of about 300 kg of wet mash with a drying time of 8-10 hours. The main limitation of this dryer is that its performance is weather dependent, and may not be effective on a cloudy day.



Solar house dryer

7. Sun Drying Patios

These are constructed concrete platforms with a lot of granite chipping near the surface. F.R.I. and Cassacoxa Co. Ltd employ these for sun drying. Different sizes of patios are at F.R.I. and Cassacoxa.

Disintergrated cassava mash is spread on polyether sheet on these patios for drying. The patios are very effective on good sunny days, but not suitable for cloudy and rainy days.

150kg mash of 45% moisture content (MC) on patio surface area of 30.75 square metre takes 2 days to fully dry. However first day drying is enough to prevent fermentation of the product.

Problems Identified

Apart from the listed challenges associated with the various technologies and drying equipments there were no major problems encountered save that there were no moisture meters to cross check MC values and instruments to check the heat distribution of in the various dryers.

Work plan for the next 6 months

Testing and modification of flash and bin dryers. Testing and modification of other dryers listed will also be considered.