

**‘SUSTAINABLE INDUSTRIAL MARKETS FOR CASSAVA’  
PROJECT**

**FINAL REPORT ON PROJECT OUTPUTS 1.6.1 AND 3.4.2**

**FACTORY VISITS AND PARTICIPATORY TRIALS**

**ON THE**

**PRODUCTION OF HIGH QUALITY CASSAVA FLOUR (HQCF), RICE MALTS  
AND GLUCOSE SYRUPS.**

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## **EXECUTIVE SUMMARY**

A search was conducted to locate interested local processing companies that could take up the raw or semi-processed cassava products to turn them out to finished industrial goods. Four companies were identified and visited. Fifteen (15) technical visits were made in all to the four industries. Discussions were held with management of the companies as well as inspection of existing processing equipment and factory premises during the visits. Technical advice and suggestions of modifying some unit operations and equipment was provided after discussions. Four trials for glucose syrup production and one trial for rice malt production were run after the modifications were carried out. Some of the trials were characterised with problems but the FRI team and management of the companies provided technical advice to solve them. One company, Afrimart Global Enterprises, has started producing rice malt and glucose syrup in commercial quantity. Amassa Agro Foods has increased its production of High Quality Cassava Flour (HQCF). Fruit and Flavours is preparing to start production of glucose syrup in 2004. Feed and Flour Ghana Ltd is yet to put the full complement of its equipment in order but has carried out two test productions.

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## **1.0 INTRODUCTION**

Food Research Institute (FRI)-CSIR had developed a number of technologies that add value to cassava to make it a dependable industrial raw material. These technologies include technologies for producing High Quality Cassava Flour (HQCF) as raw material for production of bakery products and technologies for the development of cassava flour based glucose syrups. To sustain the uptake of cassava as an industrial commodity in Ghana, these technologies needed to be transferred to interested industries that will in turn make use of the technologies to enhance and promote the use of cassava in Ghana. A search was launched to locate interested food companies to take up the processing of cassava into the products mentioned above as well as end-user companies. The objective of the search was to introduce to the companies the principles and production practices underlying the production of the products above, the equipment requirements and the profitability of the process. A report on the in-factory participatory trials and technical visits is presented in this document.

For those partners that are partners under the ‘Sustainable uptake of cassava as an industrial commodity’ project (SUCICP) and are somehow already in production it was necessary to make frequent technical visits to ensure conformity to good manufacturing practices and solve any technical problems militating against the turning out of good quality products. For those yet to start production there was the need to conduct some in0factory participatory trials to build the confidence of the management staff in the efficacy of the technology an sharpen the skills of the production staff in the production processes to ensure high quality of final products.

## **2.0 FACTORY VISITS FOR MONITORING PROBLEMS AND SUCCESSES WITH PRODUCTION OF GLUCOSE SYRUP, HQCF AND RICE MALTS**

### **2.1 VISITS TO FRUIT AND FLAVOURS COMPANY.**

#### **2.1.1 Preliminary Preparations and Dates of Visits**

Two visits were made to Fruit and Flavours Company (F&F), Cape Coast, in quarter two of project year two. The first visit was made on the 6<sup>th</sup> of May, 2003. The Food Research Institute (FRI) project team leader contacted the Manager of Fruit and Flavours Company on phone and discussed briefly FRI's intention of their Company taking up the glucose syrup production technology it had developed. The date was fixed for the visit after the discussions. The date was communicated to other members of the FRI team. The second visit came off on the 16<sup>th</sup> of July, 2003. The FRI team arranged and took along 800Kg of cassava starch, 200kg of malted rice and other logistics to carry out a training for the staff of F&F and subsequently run a trial on glucose syrup production. Fruit and Flavours Company on the other hand fixed boiling coils and motor driven stirrer in the boiler/reaction tank and prepared the production area for the trial.

#### **2.1.2 Purpose of Visit**

The first visit was aimed at finding out if the factory could adjust its concentrated lime juice production line to produce glucose syrup. The second visit was a follow-up of the first and the main aim was to introduce the staff of F&F on production of glucose syrup and subsequently run a trial of the glucose syrup production using the modified equipment of Fruit and Flavours.

#### **2.1.3 Activities and Outcome of Visit**

Discussions were held during the first visit between FRI team and F&F management in the premise of F&F. The FRI team briefed management of Fruit and Flavours Company on the technology of glucose syrup production using cassava starch and cassava flour. F&F on the other hand briefed FRI team on the company's operations. The team was later conducted round the factory premises by management of F&F. During the second visit, technical advise and assistance as well as training was provided to Fruit and Flavours staff on how to produce glucose syrup. A trial was run after which a meeting was held with management to discuss how best to solve the problems encountered during the trial.

On touring the factory premises and familiarising with the equipment available after initial discussions during the first visit, it was clear that the production line of the factory could be adjusted for glucose syrup production in commercial quantities. The FRI team suggested to management of F&F to fix boiling coils and a motor driven stirrer to a stainless steel tank which should serve as the reaction tank. A date was fixed for the training and trial of the glucose syrup production. The FRI team was to provide cassava starch, malted rice and other logistics needed for the training and trials. Staff of F&F were trained on how to produce glucose syrup with cassava starch during the second visit. During the trial production however, some problems were encountered. Some of the problems included:

- the blowing up of two motors, some fermentation of the hydrolysate,
- slow filtration process of the saccharified hydrolysate and
- insufficient volume of hydrolysate for the evaporator.

Some amount of glucose syrup was however produced after the trial.

The FRI team, after meeting with management, provided some of the solutions and recommendations for a successful production the next time round. The following were some of the solutions and recommendations which the team hoped will lead to a successful trial the next time.

1. Provision of two large PVC tanks by FRI team to hold cassava flour hydrolysate prior to evaporation to adequately feed the evaporator.
2. Identification and provision of local filter cloth (less expensive) for the filter press.
3. The use of cassava flour as filter bed for better flow and effective filtering process.
4. Recommendation of the use of high horse power motors for the stirrer and as pumps for the slurry.
5. The use of metabisulphite to arrest fermentation in filtered samples prior to evaporation.

## **2.2 VISITS TO FEED & FLOUR GHANA LTD.**

### **2.2.1 Preliminary preparations and Dates of Visits**

Two visits were made to Feed and Flour Ghana Ltd (FFGL), a cassava processing plant at Amanfrom-Akwapim, in the second quarter of year two. The first visit was made on the

23<sup>rd</sup> of April 2003. Before the visit, FRI project leader contacted the Manager of FFGL on phone and told him about the intention of the team. A brief discussion was held on the phone after which the date above was fixed for further discussions. The second visit came off on the 23<sup>rd</sup> of June 2003. FFGL prepared its premises and equipment for assessment by the FRI team before the visit date. FRI team on the other hand gathered the necessary tools for the assessment of the equipment and carried them along on the visit date.

### **2.2.2 Purpose of Visits**

The first visit was to enable the FRI team to familiarise with the processing operations of FFGL and hold discussions on how best FFGL can modify its equipment to take up the technology of processing High Quality Cassava Flour (HQCF). The second visit was to assess the existing equipment to enable FFGL to start the production of HQCF.

### **2.2.3 Activities During Visit**

Discussions were held between management of FFGL and the FRI team during the first visit. The FRI team was conducted round the factory premises of FFGL by the management after which suggestions regarding modification of the entire processing plant to ensure smooth flow of processing and enhance efficiency were made to the management. The suggestions were tailored to bring the plant to production levels of two tons of HQCF per day. During the second visit, the FRI team carried out assessment of processing equipment in FFGL processing plant.

### **2.2.4 Outcome of Visits**

After discussions and inspection of processing equipment and factory premises during the first visit, some suggestions were made by the FRI team to management of FFGL. These included the following:

1. Creating a separate peeling and washing shed beside the processing plant.
2. Modifying the forecourt (the open space between the office and the storeroom) to serve as the pressing area and the area for loading and off-loading of products into and out of the dryer.
3. Modifying and converting the current storage room into a drying room for the dryer.
4. Modifying and converting the current office into a storage room for dried and milled products.
5. Creating an office on the corridor in front of the grating and milling room.



6. Assess and repair, maintain, correct, or change the processing machines and power units as necessary.

The assessment conducted on the processing equipment during the second visit revealed the following:

***A. Cassava Grater.***

The cassava grating machine was badly rusted and worn-out. The machine was out of use.

- Hopper badly rusted and broken off.
- Body of grating machine not in place
- Grating surface rusted and torn
- Machine base- board broken
- Mechanism for actuating the pressure block was not in place

***B. Plate Attrition Mill***

Plate attrition mill was badly worn, rusted and out of use.

- Plates badly worn out
- Mechanism for adjusting movable plate badly worn out.
- Many parts of the mill not in place.

***C. Diesel Engine***

Engine was badly worn out, hardly starts, lacks power and rattles when started.

- Engine was weak and lacked compression
- Weak, faulty and poor delivery from injector pump.
- Faulty spray delivery from injector.

The following recommendations were made after the assessment.

1. The grating machine should be replaced.
2. The plate attrition mill should be replaced.
3. The diesel engine should be replaced..

## **2.3 VISITS TO AFRIMART GLOBAL ENTERPRISES.**

### **2.3.1 Preliminary Preparations and Dates of Visits**

Eight (8) visits were made to Afrimart, formerly Farmindus, a weaning food company that is located at Fise on the Accra-Kumasi highway during the second quarter of year two. The visits were made between 7<sup>th</sup> of July 2003 and 26<sup>th</sup> September 2003. Before the first visit was made, the FRI team called on the Manager of farmindus and had a brief discussion with him about taking up the technology of producing rice malt and glucose syrup from cassava flour. The first meeting date was fixed after the brief discussion.

### **2.3.2 Purpose of Visit**

The first visit aimed at familiarizing the technical team with the operations and equipment of Afrimart and discussions with management of Afrimart on how best their production methods could be modified to take up the production of glucose syrup and rice malt. Subsequent visits were made with the objective of training and monitoring how best the production was moving on.

### **2.3.3 Activities Undertaken During visit and Outcome of Visit**

During the first visit, the FRI team was conducted round the factory premises by the supervisor and the manager of the company, Mr. Baffour Asare Bediako. Discussions were held later and the team saw that the factory with the present facilities was capable of carrying out malting and production of glucose syrup in commercial quantities. A member of the team was therefore tasked to provide training for the staff during the next visit for work to resume on malting.

The training was provided as planned but it was found out during the training that there were not adequate containers for soaking the grains. Trays for spreading the soaked grains for germination were also not available. The team however located a suitable dark room in the factory premises for germinating the grains. The team provided suitable containers for soaking the grains as well as aluminium trays for spreading the grains for germination. The staff was also advised to keep the malting room shut always to avoid the rays of the sun.

The next visit was meant to monitor how the staff was faring with the malting process after the training. The staff of Afrimart were making good progress with the malting of

rice, however it was found out that too much water was being left in the trays during the malting because of insufficient draining of the water. This was making some of the grains to get rotten and mouldy. Also, watering of the malt was not uniformly done. This led to more growth in some portions of the malt than others. Some of the grains were also spread on jute sacs during the visit. The team advised the staff to soak the exact amount of grains that the trays can contain to avoid the spreading of the extra grains on jute sacs. This is because the roots of the grains are not easily removed from the sacs when they penetrate it during germination. The FRI team also suggested the construction of slanting wooden platforms to serve as the stands of the trays during malting to allow easy draining off of excess water.

After the staff of Afrimart had successfully carried out the malting, the next problem was with the drying and milling of the malt. It was found out that the diesel-operated dryer of the company needed to be modified for drying the malted rice. An electrical technician was contacted in FRI to inspect the dryer. He advised that the Atomiser of the engine needed to be serviced and the wiring system of the equipment should be checked before the engine is started. Major repair works were later carried out on the engine and the drying equipment as a whole to make it functional. As an interim measure the drying and milling of the malt produced at Afrimart was undertaken at FRI until the company repaired its dryers.

Another training was carried out at Afrimart to teach the staff how to produce glucose syrup. This took a week to execute. Logistics and technical advise was provided by the FRI team. Two other monitoring visits were made the following week to check how the production was going. The staff was conforming to the training provided and was turning out twenty kilograms (20Kg) of glucose syrup per day. Further trials involved sampling of products for analysis. No problems were recorded.

## **2.4 VISITS TO AMASSA AGRO-PROCESSING COMPANY**

### **2.4.1 Preliminary Preparations and Dates of Visits**

Two visits were made to Amassa Agro-Processing Company (AAPC) during the second quarter of year two. The first visit came off on the 9<sup>th</sup> of April, 2003. Before this visit, the project leader of FRI team contacted the General Manager of AAFC on phone and

discussed briefly with him the intentions of his team. The date above was fixed for the visit. The second visit to AAFC came off on the 27<sup>th</sup> of May 2003.

#### **2.4.2 Purpose of Visits**

The main aim of the first visit by the FRI team was to familiarise itself with the factory premises, equipment and operations of the company. The team was also there to hold discussions with management of AAPC on how best to modify their operations to increase the production of HQCF. The second and subsequent visits were carried out to monitor production processes and to collect samples for analysis.

#### **2.4.3 Activities Undertaken During Visits and Outcome of Visits**

During the first visit, the Quality Control Manager, Mr Kofi Abura, and the General Manager of the company, Mr Kwasi Oware conducted the team round the premises of the company. The premises of the company was considered satisfactory for the production of HQCF. All the equipment needed for the production of the flour was in place and in good order. The second visit was to find out further details about the problem with the sifting machine. This was necessary because of a fineness problem the FRI team had with flour supplied to her earlier by Amassa Agro-Processing Company. The particle size of the flour was above the required particle size. The team therefore decided to visit AAPC to find out what was going wrong.

After inspection of the sifting machine by the FRI engineer during the second visit, it was found out that the sieve of the sifter got torn during the process of sifting. The FRI team acquired the right sieve and provided it to Amassa Agro Foods Company. During the subsequent visits work was progressing normally. Product samples were taken each time for analysis.

### **2.5 VISIT TO KOKOFU GLUCOSE SYRUP PRODUCTION PLANT**

#### **2.5.1 Preliminary Preparations and Dates of Visits**

Visits were made on the following dates:

- Jan 15, 2004
- Feb 6, 2004

### **2.5.2 Purpose of Visits**

The purpose of the first visit was for the project team to acquaint itself with the progress of the production process, assess the quality of products and discuss any problems being encountered in the course of production, and to train the processors in cassava starch production. The second visit was to introduce to the processors the use of a new sieve that would improve the clarity of the filtered hydrolysate, train the processors in the utilization of cassava starch in glucose syrup production.

### **2.5.3 Activities Undertaken During Visit and Outcome of Visit.**

On the first visit the group was found to have made significant progress in the glucose syrup production. A total of 20kg of syrup had been produced. However the clarity of the syrup was not very good and the product was a little bit too dark. The problem with the clarity was attributed to the lack of good filtration facilities whilst the colour was a result of inadequate amounts of metabisulphite being used. Arrangements were made for the group to benefit from a set of filter clothes being ordered from the Netherlands by Afrimart Global Enterprise. The training in cassava starch production went on as planned. About 15 members of the Association participated.

During the second visit the filter clothes of 25u, 50u and 100u mesh sizes were presented to the group. The 100u sieve was to be used for starch production whilst the 25 and 50u sieves were to be used for the glucose syrup production. The processors were taught how to use the 50u and 25u sieves consecutively to filter the hydrolysate in a 2-stage filtration process. A participatory trial production was then undertaken using cassava starch as substrate and employing the use of the filter clothes. The application of the correct amount and stage of addition of sodium metabisulphite during evaporation was also demonstrated. Processors were made aware of the fact that some amount of colour in the product must be put up with since that is unavoidable when open pan evaporation is done. All the glucose syrup produced at the Kokofu Production unit was delivered to Afrimart for sale to end-users. The processors were very delighted to have earned the first income from their production activities.

## **2.6 VISITS TO WATRO HQCF PRODUCTION UNIT**

### **2.6.1 Preliminary Preparations and Dates of Visits**

The visits to Watro were made on the following dates:

- Jan 16, 2004
- Feb. 5, 2004

### **2.6.2 Purpose of Visits**

To assess the progress of production activities

To assess the operational condition of processing equipment especially the grater

To discuss problems facing the unit

### **2.6.3 Activities Undertaken During Visit and Outcome of Visit**

The project team had a meeting with the executive members of the Association at which progress of processing activities were discussed. Processing of dried grits was going on vigorously and even though the grater broke down often efforts were made to fix it promptly so that processing activities were not hindered. At the time of the team's visit it was realized that the cassava grater had a problem with one of the bearings which had tehn stopped functioning. The bearing could not be obtained locally so the technical team had to make arrangements to have it purchased from Accra. This was done and the grater was fixed. Other problems discussed were:

- The need for a building to house the processing equipment permanently
- The need for bigger drying space.
- Strengthening of the linkage between the Unit and AAPC for marketing purposes.

The resolution of the first two issues required sourcing for funds. The processors were informed that even though definite promise could be made efforts would be made to secure funds for the purpose as soon as practicable.

A meeting was to be arranged between AAPC and the processors within the shortest possible time. Until then products would be delivered by the MOFA team to AAPC using the project vehicle and payments made to them through MOFA.

### **3.0 FACTORY PARTICIPATORY TRIALS FOR PRODUCTION OF RICE MALT AND GLUCOSE SYRUP.**

#### **3.1 GLUCOSE SYRUP PRODUCTION TRIAL AT FRUIT AND FLAVOURS (ASEBU – CAPE COAST)**

##### **3.1.1 Preliminary Preparations and Trial Dates**

Three (3) trials were held in all at Fruit and Flavours in quarter two of year two. The team from FRI and the production staff of Fruit and Flavours carried out the trials. The first trial was held on the 27<sup>th</sup> July – 2<sup>nd</sup> Aug., 2003. The second and third trials were held on the 21<sup>st</sup> -22<sup>nd</sup> August, 2003 and 10<sup>th</sup> -11<sup>th</sup> September, 2003 respectively.

##### **3.1.2 Purpose of Trials**

The first trial was carried out to test if the modifications made to the production line could lead to successful production of glucose syrup from cassava starch. HQCF was used for the second trial instead of cassava starch to test the filtration process after saccharification and to compare the yield of glucose syrup to that made from cassava starch. The running of the third trial became necessary to verify the cause of reduced sweetness of the hydrolysate during the second trial.

##### **3.1.3 Activities Undertaken During Trials and Outcome of Trials**

Seven hundred kilograms (700Kg) of cassava starch was used for the first trial. On the first day of the trial, the boiler was filled with 2500 litres of cold water and the motor of the stirrer switched on. The cassava starch was then introduced (one bag of 50Kg at a time) and stirred. 56Kg of rice malt was added to the cassava starch mixture and stirred before the last bag of starch was introduced. Just after the last bag of the starch was added, the motor started smoking so it was quickly switched off. The team tried to solve the problem of thorough mixing of the slurry while the heating was going on by pumping the slurry from the bottom of the boiler with a pump to the top of the boiler.

This process led to the blowing up of another motor. The team resorted to fetching off about 3700 litres of the slurry from the reaction tank and the rest heated to gelatinise after which the slurry that was fetched off was added bit by bit (with manual stirring with a long wooden paddle) until the entire sample gelatinised. The gelatinised sample was later cooled to the desired temperature after which another 56Kg of rice malt was added. The sample was manually stirred again to ensure thorough mixing of the malt and left to saccharify for 8 hours. The saccharified sample was filtered using a twenty-plate filter press. The filtration took about 23 hours with occasional changing of the filter paper. The filtered sample was treated with metabisulphite prior to evaporation to prevent fermentation from occurring. The sample was concentrated with a multiple effect vacuum evaporator.

Two hundred kilograms (200Kg) of HQCF was used for the second trial instead of starch. Three hundred (300) litres of cold water was introduced into the boiler after which the stirrer was switched on. The cassava flour was added (one bag of 50Kg) one after the other with continuous stirring. Sixteen (16Kg) of rice malt was also added to the mixture before the last bag of cassava flour was introduced. Steam was introduced into the mixture until the entire sample got gelatinised. The sample was cooled to a desired temperature by pouring cold water on top of the tank to drain to the bottom. Another 16Kg of rice malt was added to the mixture, stirred well and left to saccharify for 6 hours. The sample was then strained to get rid of the chaff from the rice malt and subsequently filtered through a filter press.

Two hundred kilograms (200Kg) of HQCF was used to carry out the third trial. This was processed in the same way as the second trial above.

Three hundred and fifty kilograms (350Kg) of glucose syrup was obtained (with a brix of 74%) after concentration of the hydrolysate in the first trial. This trial was therefore considered successful despite the frustrations during the production. The desired initial sweetness (brix of about 25%) of the hydrolysate from the second trial was not obtained. It was later found (after some laboratory tests) that there was some level of contamination of lime in the reaction tank during the trial. The sample was therefore discarded. The filtration process of the second trial was also very slow and the filtration cloth had to be



changed so often with much accumulated chaff. It was later detected (after some laboratory work) that the flour was not sieved to the required particle size. The hydrolysate of the third trial produced the desired initial brix and the filtration process was very effective in terms of the rate. The hydrolysate could not however be evaporated in time because it was not enough for the vacuum evaporator so it got fermented but it was distilled to produce alcohol.

At the end of all three trials, it became very clear that the modifications made to the production line at Fruit and Flavours could be used to produce glucose syrup in commercial quantities. However, the capacity of the vacuum evaporator at Fruit and Flavours is very high and it needs about 10,000 litres of hydrolysate for effective concentration. This means that, the hydrolysate has to be produced in three batches to feed the evaporator because the capacity of the reaction tank is about 4,000 litres of liquid. The hydrolysate must also be treated with metabisulphite to prevent fermentation prior to concentration. Finally the flour to be used for glucose syrup production must always be sieved with a sieve size of about 500 $\mu$  to allow for easy filtration process.

## **3.2 RICE MALT PRODUCTION TRIAL AT AFRIMART GLOBAL ENTERPRISES**

### **3.2.1 Preliminary Preparations and Trial Dates**

The trial was held between the 1<sup>st</sup> – 5<sup>th</sup> Sept., 2003. One member of the FRI team was delegated to take the staff of Afrimart through the rice malt production process.

### **3.2.2 Purpose of Trials**

The trial was carried out to test the modifications made to the production facilities at Afrimart to produce rice malt. It also served as training for the staff of Afrimart to take up the production of the glucose syrup production technology on a commercial scale.

### **3.2.3 Activities Undertaken During Trials and Outcome of Trials**

A bag of paddy rice (50Kg) was acquired, cleaned, washed thoroughly and soaked on the first day of the trial. The grains were left to soak for 24 hours after which it was drained and held in the soaking container (a plastic drum) for 48 hours with once a day watering.

The grains were then spread (about 3cm thick) on aluminium trays, covered with polythene sheets and kept on slanting platforms in a dark room to germinate. The grains were watered once a day for five days after which it was held for two extra days with no watering. The grains were collected, shredded, bagged and transported to FRI pilot plant for drying. A mechanical dryer was used to dry the wet malt (thinly spread on aluminium trays) at 45°C for 21 hours. The dried malt was then milled with a hammer mill at FRI pilot plant and packaged in polypropylene sacks.

Forty kilograms (40Kg) of milled rice malt was obtained after the trial. This represented 80% yield. The trial was therefore considered very successful. It was also concluded that the modifications made to the production facilities could be used to produce rice malt in commercial quantities at Afrimart.

### **3.3 GLUCOSE SYRUP PRODUCTION TRIAL AT AFRIMART**

#### **3.3.1 Preliminary Preparation and Outcome of Trials**

The trial was carried out from Monday, the 22<sup>nd</sup> of September to Friday, the 26<sup>th</sup> of September 2003. A four member staff from Afrimart together with a member of the FRI team participated in the trial. The factory premise was prepared on the first day of the trial with movement of some items needed for the production from FRI to Afrimart.

#### **3.3.2 Purpose of Trials**

The trial was meant to test the modifications and additions made to the production facilities at Afrimart to produce glucose syrup. It also served as training for the staff of Afrimart to take up the production of the glucose syrup production technology on a medium scale.

#### **3.3.3 Activities Undertaken During Trial and Outcome of Trials**

Actual production of the syrup started on Tuesday (23<sup>rd</sup> Sept.) morning. A batch of 8Kg HQCF and 320g rice malt sample was mixed with cold water and gelatinised with boiling water. The sample was cooled to the desired temperature and stored in an ice chest for 5hours to saccharify. Just before the straining and filtration of the saccharified sample, another batch with the same 8Kg cassava flour was prepared and kept overnight in the ice chest for saccharification. Straining and filtration of the first batch sample was carried out

(using a screw press) and the filtered sample was concentrated halfway and kept overnight.

On Wednesday, two batches of 8Kg of HQCF was prepared in the morning and stored in the ice chest for saccharification. The sample kept for saccharification overnight was also strained, filtered and concentrated. This gave a final product of 6.7Kg. The sample which was concentrated halfway the previous day was fully concentrated to a brix of 78% and a mass of 6.5Kg. Just before the straining and filtration of the two batches of the sample prepared in the morning, another batch of 8Kg flour was prepared and kept in the ice chest overnight for saccharification. The filtered sample from the two batches produced earlier in the day was concentrated halfway and kept overnight.

Three batches each of 8Kg flour was prepared on Thursday morning and stored in the ice chest for saccharification. The sample which was concentrated halfway the previous day was concentrated fully. The sample which was kept for saccharification overnight was also strained, filtered and concentrated. The three batches produced earlier in the day were strained, filtered, halfway concentrated and kept overnight. On Friday, the halfway concentrated sample kept overnight was fully concentrated.

In all, 64kg of cassava flour was used to produce 56Kg of glucose syrup with brix of 76%. This showed that the trial was very successful. The staff was made to do most of the work after the third days production which they carried out very well. The production could however be increased with the use of large size containers for the saccharification process.

#### **4.0 CONCLUSION**

The technical visits conducted and factory trials undertaken have brought to the fore some problems which would never have been realised if these visits and trials were not to have been undertaken, e.g. the lack of sweetness in the glucose syrup produced at Fruit and Flavours. These have been very educative to both the technical team of the FRI and the production staff of the various production units and have challenged and improved their skills at problem identification and solution.

The problem encountered with the quality of flour from AAPC has emphasized the urgent need for regular quality monitoring of the products at the production points and for end-users to also carry out brief quality checks before putting raw materials through the production process. It also highlighted the need for regular inspection of processing equipment to detect defects that could affect product quality.

The confidence of Afrimart Global Enterprises in taking up the production and marketing of glucose syrup and the increase in production levels of FFGL are enough evidence to the achievement of the objectives of the monitoring visits and factory trials.