DECLARATION

clare that this project work is solely the result of my work and has never been itted any where for any degree. All the literature cited have been duly owledged in the reference.

Adedigba Sunday

29/11/07

Date

CERTIFICATION

This project work titled Bread formulation using Dextrin from Cassava by Adedigba Sunday meets the regulations governing the award of degree of Bachelor of Engineering, (Chemical Engineering) of Federal University of Technology, Minna and is approved for it contribution to knowledge and literary presentation.

Dr. M. O. Edoga
Head of Department
And Supervisor

28 - 11 - 07
Date

External Examiner

Date

DEDICATION

o my friend ,partner, and my love ,Oluwafunmike Aina lawal who has been a source of y ,strength and courage during the course of this programme .To you I say I cannot ıank myself for your love, patience and endurance.

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ery accomplishment in life is a result of the contribution of many individuals who th directly and indirectly shared their gift, talent, wisdom with us all. This project is no ception .I Appreciate the effort of my supervisor Dr. M.O.Edoga for his support and derstanding during the course of this project.

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ABSTRACT

his project work was aimed at producing cyanide-free dextrin from cassava tuber via ermentation as well as formulate bread from the dextrin using ten different ormulations, in which the percentage ratio of dextrin, wheat flour, and milk were varied nd the percentage ratio of other bread ingredients were fixed.

he white dextrin produced has cyanide concentration of 0.019 mg/dm^3.

he results obtained revealed that formulation which has very higher ratio of dextrin did ot give quality bread rather a very hard, bread-like material which has poor visual uality. This shows that formulation which has high percentage ratio of dextrin cannot be sed for bread baking.

ormulation 10 gave the best quality dextrin bread, which was baked at temperature of 45°C for 8minutes. It has carbohydrate nutritional–value of 44/100g, shelf–life of 7days nder room condition, ash nutritional-value of 2.1/100g.

BREAD FORMULATION USING DEXTRIN FROM CASSAVA

A PROJECT

BY

ADEDIDGBA ADESHINA SUNDAY

2004/20847EH

EING IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF ENGINEERING (B.ENG) DEGREE IN CHEMICAL ENGINEERING,

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CHAPTER ONE

NTRODUCTION

ıd, in one form or another, has been one of the principal forms of food for man from earliest s. Cassabe is a type of bread prepared from cassava. It is common to South America. Similar ucts are made in other cassava-growing regions. It is the staple diet of the Amazonian ans.

Background

e are two different methods for making cassabe, depending upon whether the roots are ed and fermented or if they are just peeled and grated.

variety of cassava and the level of cyanide containing compounds within the tuber will rmine whether fermentation is required. Bitter cassava is preferred as it has a higher starch ent which makes the product less brittle and better to store. Dextrin obtain from starch is in bread production.

ange (1804) made dextrins by roasting starch; he was attempting to find a substitute for gum ic, which was then largely used in industries.

sh gum was however a coincidental discovery which originated as a result of fire in a starch ge building at a textile plant near Dublin Ireland in September 1921. Part of the factory was oyed by fire and the stored starch, which had been exposed to heat roasted to a brownish w colour. When this was mixed in cold water it no longer had the characteristic of a starch dissolved to a viscous gummy liquid. The result was duplicated by heating starch in a ing pot over fire and its result was henceforth known to be British gum.

rins was made by moistening dried starch with dilute mixture of acid (HCl) and nitric acids O_3), the mixture was spread in a corrugated iron sheets and exposed to the heat of a bakers until they were thoroughly dried and slightly yellow.

rins exist in various forms but their characteristics and mechanical properties depend on the ls of manufacture i.e. time of roasting, use or non-use of converting agent, character of ering agents, raw materials, concentration of acid used or mixtures of different starches.

major raw materials for dextrins are the starches such as corn, potato, tapioca (cassava) with ller uses of starches from other sources. However, since cassava is abundant in Nigeria, there need to carryout this present project work

Aims and Objectives

project work was aimed at demonstrating the importance and advantages of using dextrin n cassava) in bread formulation, and the objective is to produce an economical source of d flour.

Approach

hieving the above stated objective the following procedure were followed

i) procurement and pretreatment of cassava tuber

ii) fermentation of cassava tuber.

iii) production of starch from cassava tuber.

iv) dextrinization of starch and bread formulation.

Justification

will serve as the most economic source of flour for bread baking, if this project work is essful, considering the abundant availability of cassava in Nigeria .it will also provide an omic source of dextrin for adhesive production.

CHAPTER TWO

2.0 LITERATURE REVIEW

istorical Development of bread

nportance of cassava in the agricultural economy of many tropical countries has grown kably in recent years. Governments, institutions and are seriously interested in studying ms concerning the production, processing and marketing of cassava and cassava products. aked products for which cassava flour is the basic ingredient are known commercially as as or tapioca fancies. In Malaysia and some other areas these products are commonly n in the industry as sago products. The term probably originated with the Chinese iction of sago-palm starch products. The manufacture of tapioca fancies is a logical follow- the production of the flour itself in the countries of origin. Separation of the processing of lour and of the derivatives would be illogical. Many medium-size and larger factories are equipped for the manufacture of such baked products as flakes, seeds, pearls, and grist. Still nd mostly on imported wheat or wheat flour while they grow various staples such as starchy s like cassava or cereals other than wheat. Recent experiments show the possibility of al replacement of wheat flour in bread-making by other flours (e.g., cassava and Soya).

ough people have been making bread for thousands of years, its exact origins are unknown. ng the late Stone Age, probably Bread consumption is constantly increasing in many loping countries, which made a thick gruel from wild grain and baked it into flat cakes on stones in their campfires. About 10,000 years ago nomadic tribes settled and began ivating grains, among them einkorn and emmer, the ancestors of modern domestic wheat. und 6000 BC Swiss lake dwellers improved on the wild grain-gruel recipe by crushing grains nake a flatbread. Archaeological evidence suggests that yeast-risen wheat breads were eloped in Egypt around 4000 years ago. The Egyptians are also believed to be the first to d wheat flour in a process analogous to modern milling.

hnical advances continued to improve bread-making techniques, among them the use of the st-containing residue of the brewing process as a leavening agent. Bread bakers no longer had y on wild airborne yeast or sourdough starters, and by the 3rd century BC, yeast was factured commercially in Egypt.

s who colonized the Mediterranean between about 700 and 130 BC were avid bakers. They d flours to eliminate the impurities; seasoned their breads and cakes with honey, sesame, ruits; and invented a stone oven for baking bread. By the 2nd century AD Roman bakeries ced several different kinds of bread, and the Romans introduced their bread to all the lands conquered.

g the early half of the Middle Ages, around the 5th century to the 10th century, political tions caused trade between countries to decline. Wheat crops, grown in warm, dry climates, ne less available to bakers in the cool, damp countries of northern Europe. Northern bakers cted rye, oat, and barley breads, and a tradition of dark, hearty bread making persists in e regions of northern Europe today.

nial Americans made bread from cornmeal at home, baking it in the fireplace hearth. Wheat bread became available as American settlers migrated westward to the plains-regions with ates suitable for wheat farming—and established cooperative mills for grinding grain. roads made grain and flour distribution efficient and cost-effective. Bread makers had to e their own yeast or rely on old dough starters for leavening until 1868, when prepared kaged yeast was made available for sale to the public.

he 20th century, industrial and technological improvements made the time-consuming flour-ning process less expensive. White flour, once considered a delicacy for the upper classes, aced whole wheat flour as the cheapest, most widely produced flour. Until the early 20th tury, white flour was not fortified with the vitamins and minerals lost during the refining cess, and conditions caused by vitamin deficiencies became more prevalent as white bread laced whole wheat bread in popularity. Cases of beriberi, a condition resulting from a lack of amine, and pellagra, caused by dietary niacin deficiencies, increased dramatically. Many vernments, including the United States, began enforcing mandatory vitamin and mineral tification requirements. These programs have been quite successful, and cases of beriberi and llagra are now very rare in industrialized countries.

ompetitive Position of Cassava

ing back on the many uses of cassava, it may be asked: what are the reasons for its rapid luction and permanent use in some starch-using industries, while in others it has not gained ce of importance? One explanation is found in the unique properties of this kind of starch.

e full treatment of the colloidal behaviour of cassava is outside the scope of the research , the more essential of these properties may be summarized as follows. The product is ily gelatinized by cooking with water, and the solution after cooling remains comparatively l; jellies or puddings cannot be prepared with it. The solutions, moreover, are relatively le in that they do not readily separate again into an insoluble form, as is the case with corn ize) starch and potato starch ("retro-gradation").

ious factors of lesser importance have also influenced the position of cassava on the market, nly in a negative sense. Being produced mostly in developing regions with an unstable nomic position, it is not available with the same regularity and predictability as, for instance, n (maize) starch; it is available in many grades and qualities, which are highly variable, and price, especially in recent years, fluctuates considerably.

s possible to distinguish three sectors of the starch-using industries, in each of which cassava cupies a fundamentally different position:

) Where irreplaceable by other starches.

the manufacture of remoistening gums cassava has no competitors for the time being. tention should be called, however, to the continuous efforts to adapt other starches to the ecial demands of these industries, both by chemical means as well as by the selection of arch-bearing plants. Mention should be made of the so-called waxy-maize starch, which pproaches cassava in many respects.

) Where other starches are preferable despite the cost factor.

ome of the more desirable characteristics of other starches may be the result of further rocessing, as, for instance, in the corn (maize) starch industry. Examples are the thin-boiling, hlorinated and other special starches. Cassava furnishes only a crude starch with a wide range of uality and characteristics.

here interchangeable with other starches.

s case, price and marketing conditions are the only controlling factors. Because of severe etition from other kinds of starch, in this field cassava has lost much ground of late.

safely be concluded that a market for cassava of all grades will be found for many years to ; however, the possibility of an expansion of its use will depend to a great extent on ved techniques in processing as well as on more efficient methods of marketing the flour.

uality Control Of Cassava Products

e processing of cassava, questions naturally arise regarding efficiency and output; moreover, lling the product the determination of quality becomes important. These problems can only solved by qualitative and quantitative study of the composition of the raw materials and the erties of the finished products. The financial return, especially in large factories, will depend certain degree on such control analyses, which in a way are actually part of the processing f.

Analysis of Basic Materials

two important basic materials requiring analysis are the cassava roots and the water used in essing. The best practical qualitative test of these materials consists in reproducing the whole ess on a small scale and judging the resulting flour by comparing it with a standard sample y analysing it according to the methods described farther on. In fact, for judging the ability of the water available, small-scale processing is the only test of practical value.

rt from this, since starch is the substance to be isolated, a determination of the starch content oth the fresh roots and the pulp remaining after rasping and wet-screening is necessary for trol of the efficiency of the process and in particular for determination of the rasping effect.

ally, tests for the presence of hydrocyanic acid are necessary owing to the important food uses cassava.

Criteria for Quality of flour and Starch

r a product like starch, which is used as a basic material in many quite different branches of lustry, the value of a certain brand greatly depends on the purpose for which it is intended.

y in cassava can therefore only be defined with reference to the end use. In each industry the starch, the starting material will be subjected to certain tests in order to determine er it is suitable for the process concerned. In some cases, a mere superficial test of purity uffice (when, for instance, it is used as filler); in others, more elaborate determinations will cessary. The value of the product in question will thus vary from case to case, and quality ll as price will emerge as a result of these investigations.

neral it can be said that the more careful and clean the manufacture of cassava flour, the r will be its value for most purposes and thus its quality. There are, however, some otions to this rule, as where a flour of medium purity is preferred to one of prime quality. medium- and off-quality flours have a market comparable in volume to that of the prime-ty flours.

analysis of cassava flour consists of a group of selected tests, which together provide the possible general insight into the usefulness of the material. The analysis comprises chemical rminations, such as those of water, pulp and ash, as well as physiochemical tests for the surement of viscosity and acidity. On the basis of the results of these tests, quality is usually gnated in the form of a grade, that is, a cipher expressing the quality in general or, more cifically, in relation to a certain property. The letters A, B and C thus often denote first, dium and poor quality, each classification being bound to specified limits of the properties estigated.

ssava producers and industrial users have long understood that a universally accepted system specifications with concomitant grading based on the results of a number of accurately defined ts would do much to stabilize marketing. The first attempt to draw up such a system of ecifications was made in Indonesia between 1930 and 1940; it was based upon a series of alitative and semi quantitative tests which had long been used in commercial circles. rtificates stating the results of analysis of the flour according to this system, notwithstanding shortcomings, gave buyers in most countries an adequate idea of the quality of the product.

chnical developments in the countries where most of the end-use industries are centred, rticularly the United States, led to much more specific and stringent demands regarding certain operties of the flour. Existing specifications soon ceased to cover satisfactorily the relevant features of the various brands of flour. To correct the situation and to adapt the grading of the product more closely to its various applications, a new system of specifications and grading was drawn up in 1943 by the Tapioca Institute of America (TIA) in close cooperation with most end-use industries.

The tests to determine the quality of cassava starch include those for mesh size, colour, odour, cleanliness, pulp or fibre content, moisture content, ash, acidity and viscosity of cold flour slurry as well as cooked starch paste. All these tests help establish the grade and therefore the commercial value of the product. The discussion of these quality features will bring out more clearly the significance of the properties involved. For several of these properties alternative methods of determination sometimes give valuable complementary information on the quality of the flour.

2.6 Mesh Size

This test measures efficiency of bolting. Fine pulp, however, obtained from bolting with disintegrators will pass the screens. In judging the purity of flour, neither this test nor the determination of pulp under the TIA system is sufficiently precise; it is supplemented in a way by the cleanliness test, and an additional determination of pulp content by hydrolysis would seem advisable.

2.6.1 Dry Appearance

In this test the brightness or whiteness of the flour is visually compared with that of a "standard," which is a prime-grade flour produced by certain first class factories. The result cannot be clearly expressed by enumeration. Besides, the difficulty of procuring flour of standard whiteness which will keep for a sufficiently long time is an important drawback. With the many excellent modern of spectrophotometric apparatus available, however, it would not be hard to devise an objective and accurate quantitative expression for the whiteness of the flour as measured by its reflectivity relative to that of a sufficiently durable standard of whiteness (e.g., barium sulfate). In fact, this method has been adopted in Indonesia. Remarkably enough, comparative experiments in which the same flours were judged by the direct visual method and by the objective reflectivity method have shown that the former test is about as accurate as the latter, provided the observer has enough experience with the visual method and has accustomed himself to the standard of whiteness adopted. As an independent measure of the purity of the flour, dry appearance has lost much of its significance, but it is still a commercial criterion. It is customary in commerce to estimate the number of specks occurring on a flattened surface of the dry flour as an indication of clean processing.

2.6.2 Cleanliness

The degree of whiteness and clearness depends on the quantity of pigment, dirt and protein present in the starch.

2.6.3 Pulp

The amount of pulp, or fibre, present in the finished product is of foremost importance in deciding the usefulness of flour in various applications. The presence of insoluble cellulose is a serious hindrance in almost any industry where solutions of gelatinized starch are needed. Exceptions are the manufacture of corrugated cardboard and of plywood where the fibre is useful to a certain extent as a binder. In the form given in the specification system under consideration, the test makes possible the determination of small amounts of fibre with comparative ease. The sediment volume measured is somewhat dependent on the fineness of the fibre. The presence of a slight trace of fibre, pulp or other impurity can be detected by microscopic examination of the size and shape of the starch granules. The actual amount of cellulosic fibre in the flour and of foreign insoluble material can be determined by weighing the residue after a mild acid hydrolysis of the sample.

A rough estimate of the amount of pulp may be based on the "crunch" of the flour - that is, the sound emitted when a sample, packed tightly in a small bag, is pinched between the fingers. "Crunch" is strong in pure flours, but above certain pulp content it is lost.

2.6.4 Viscosity

Raw starch suspended in water gives rise to more or less viscous slurries. While in some applications the viscosity of these suspensions may be of some technical importance, the term "viscosity of flour" is generally used for the viscosity of a solution of flour after gelatinization, because it is in that form that flour is used in most industries. Numerous methods are used to determine this property. They differ in the instrument applied in the actual measurement of the rate of flow of starch solutions, and in the method of preparing the starch solutions to be tested.

2.4.5 Ash

The amount of inorganic constituents present, as measured by the ash content, can be considered an indication of clean processing and, in conjunction with the acid factor, conveys an impression of the quantity of metal ions bound to the raw starch. The colour of the ash is also of interest, as an off-colour indicates the presence of objectionable elements (e.g., brown-red from iron).

2.6.6 Moisture

Determination of moisture by the oven method, though simple to perform, requires many weighings and is otherwise rather lengthy. Moreover, the results tend to be low in a highly humid surrounding atmosphere such as is likely to occur in tropical regions. A more rapid method, free from these objections, consists in boiling a sample with xylene (boiling point 135°C) and collecting the water driven out in the form of vapour, which separates from the xylene after condensation in a graduated tube.

2.6.7. Acidity

This test is of considerable interest to manufacturers of dextrin from cassava. The titration required in the determination of the acid factor is a measure of the acid-binding capacity of the flour. As most dextrins are prepared with the addition of acid, it is understandable that the acid factor should be of prime importance in the conversion of starch to dextrin. It has been found that a smooth course of dextrinization requires an acid factor of between 2.0 and 2.5. The initial pH, apart from its role as a starting point in the determination of the acid factor' may be used as an indication of the presence of moulds or other impurities in the flour: low pH values indicate deterioration. The amount of acid present is often determined by separate titration of a sample suspended in alcohol with dilute alkali solutions.

2.7. Specifications for particular uses

Specifications of starch are being developed rapidly and analysis of commercial starches is becoming more and more necessary for both the producer and the consumer. The general specification system just reviewed does not cover all the properties which may be of interest for particular end uses. An instructive example is to be found in the specifications for dextrin from cassava as used in remoistening gum. Though much depends on the performance of the dextrinization, it may be assumed that only certain varieties of the basic material will meet these requirements. Cassava dextrin is preferred in remoistening gums for stamps, envelope flaps and so on because of its adhesive properties and its agreeable taste and odour requirements surpassing by far the specifications system of the Tapioca Institute of America are found also in the food industry.

Standards, grades and methods of analysis for starch and starch products have been established during the last two decades by the International Organization for Standardization. Some leading food corporations in the United States have also developed their own specifications in order to bring about some uniformity of quality in cassava products.

2.8 Improved Methods for Processing Cassava Flour

Although traditional cassava processing is simple and effective in terms of producing safe and tradable goods, the flour is generally of low quality and there are few alternative market opportunities for this product. Prices of the chips and flour are dependent upon seasonal yields and ceiling prices are generally limited by the price of maize flour, which is considered a product of higher quality. To test the potential for improved processing of root crops, IITA has developed simple, small-scale cassava processing equipment.

• Chipping equipment can produce up to 1000 kg of chips/day and during the dry season it takes 2–3 days to sun-dry the chips.

• Grating equipment can produce up to 500 kg of fine, white, odorless cassava flour/day.

The processing techniques, therefore, offer farmers the prospects of premium prices at the local marketplace and also access to secondary processing markets. This potential to engage in more vertical integration, from farmer to primary and secondary processors, will lead to increased farm-gate prices, and the ability to diversify the product range is a critical factor in expanding the market sales points for a commodity and therefore in stimulating demand.

2.9. Stages in processing high quality flour from cassava

1. Roots manually harvested and peeled.

2. Peeled roots are grated, using a power grate.

3. The grated cassava paste is dewatered using a press.

4. The drained mash is removed from the gunny bags and regrated. The regrated cassava flour is then spread out to dry, To avoid contamination by dust, the cassava flour can be dried on plastic sheets, concrete beds, or on raised racks.

2.10. Manual Processing

One of the obvious disadvantages of power processing is the cost of the equipment for resource-poor farmers who have great difficulties in getting access to credit. The manual chipper was designed to offer a lower cost processing alternative and this equipment can be used for cassava and sweet potato processing. The reason why manual processing has not been analyzed economically is that demand for this technology has been low.

2.11. Cassava-Starch and its Uses.

The flour produced from the cassava plant, which on account of its low content of non-carbohydrate constituents might well be called a starch, is known in world trade as tapioca flour. It is used directly, made into a group of baked or gelatinized products or manufactured into glucose, dextrins and other products.

Dextrins were accidentally discovered in 1821 when during a fire in a Dublin (Ireland) textile mill one of the workmen noticed that some of the starch had turned brown with the heat and dissolved easily in water to form a thick adhesive paste.

Three primary groups of dextrins are now known: British gums, white dextrins and yellow dextrins.

British gums are formed by heating the starch alone or in the presence of small amounts of alkaline buffer salts to a temperature range of about 180°220°C. The final products range in colour from light to very dark brown. They give aqueous solutions with lower viscosities than starch.

White dextrins are prepared by mild heating of the starch with a relatively large amount of added catalyst, such as hydrochloric acid, at a low temperature of 80°-120°C for short periods of time. The final product is almost white, has very limited solubility in water and retains to varying degrees the set-back tendency of the original starch paste.

Yellow dextrins are formed when lower acid or catalyst levels are used with higher temperatures of conversion (150°-220°C) for longer conversion times. They are soluble in water, form solutions of low viscosity and are light yellow to brown in colour.

The following are some of the major uses of dextrins in nonfood industries:

- ***Corrugated cardboard manufacture.***

One of the large users of dextrins is the corrugated cardboard industry for the manufacture of cartons. Boxes and other packing materials. The layers of board are glued together with a suspension of raw starch in a solution of the gelatinized form. The board is pressed between hot rollers, which effects a gelatinization of the raw starch and results in a very strong bonding. Medium-quality flours are suitable for this purpose provided the pulp content is not too high.

- ***Remoistening gums.***

These adhesives are coated and dried on surfaces, such as postage stamps and **envelope** flaps, for moistening by the user before application to another surface. Cassava dextrins in aqueous solution are well suited for this purpose as they give a high solids solution with clean machining properties.

- ***Wallpaper and other home uses.***

Various types of starch-based products are used as adhesives for wallpaper and other domestic uses.

- ***Foundry***

Starch is used as an adhesive for coating the sand grains and binding them together in making cores which are placed in moulds in the manufacture of castings for metals.

- ***Well drilling.***

Starches and modified starches mixed with clay are used to give the correct viscosity and water-holding capacity in bores for the exploratory drilling of oil wells or water wells. These starch products are replacing other commercial products for making the muddy materials which are indispensable for drilling wells. For this purpose a coldwater-soluble pregelatinized starch which can be made up to a paste of the required concentration on the spot is desired.

- ***Paper industry.***

In the paper and board industries, starch is used in large quantities at three points during the process:

(I) at the end of the wet treatment, when the basic cellulose fibre is beaten to the desired pulp in order to increase the strength of the finished paper and to impart body and resistance to scuffing and folding;

(ii) at the size press, when the paper sheet or board has been formed and partially dried, starch (generally oxidized or modified) is usually added to one or both sides of the paper sheet or board to improve the finish, appearance, strength and printing properties;

(iii) In the coating operation, when a pigment coating is required for the paper, starch acts as a coating agent and as an adhesive.

Cassava starch has been widely used as a tub size and beater size in the manufacture of paper, in the past mainly on account of its low price. A high colour (whiteness), low dirt and fibre content, and, above all, uniformity of lots are needed in this instance.

An important new application of starch is in the machine-coating of magazine paper, formerly done exclusively with caseins. There are indications that cassava is particularly well suited to the purpose; however, definite specifications for the starch still have to be worked out.

- ***Textile industry.***

In the textile industry, starches occupy an important place in such operations as warp sizing, cloth finishing and printing. Warp sizing is the application of a protective coating to prevent the single yarns from disintegrating during weaving. The size consists of an adhesive and a lubricant and is generally removed after weaving. Cloth finishing alters the "feel" of the fabric by making it firmer, stiffer and heavier. Cassava starch is also used for cloth printing or producing certain designs in various colours on the smooth surface of a finished fabric. While cassava accounted for about 20 percent of all starch for these purposes in 1937, it has been largely replaced by other starches after the Second World War.

An exception is the manufacture of felt, where cassava continues to be used exclusively in the finishing process.

- ***Wood furniture.***

Before the Second World War the manufacture of plywood and veneer relied mainly on cassava as a glue. The basic material in this case is gelatinized at room temperature with about double the amount of a solution of sodium hydroxide. After prolonged kneading of the very stiff paste in order to give it the required stringy consistency, the glue is applied to the wood with rollers. As the presence of a certain amount of the pulp is useful, medium- to low-quality flours are acceptable or even preferable, although the presence of sand is objectionable.

Since 1945, however, the use of cassava as glue has declined to second place owing to the increasing success of water-resistant plastics.

2.12. Prussic (Hydrocyanic) Acid Analysis

2 .12.1.Qualitative test (Quignard's test)

Prepare sodium picrate paper by dipping strips into 1 percent picric acid solution and then, after drying, dipping them into 10 percent sodium carbonate solution, thereafter drying them again. Preserve these strips of paper in a stopper bottle. Chop finely a small amount of the roots to be tested and put the chopping into a test tube. Insert a piece of moist sodium picrate paper, taking care that it does not come into contact with the root pulp. Add a few drops of chloroform and stopper the tube tightly. The sodium picrate paper gradually turns orange if the root material releases hydrocyanic acid. The test is a delicate one, and the rapidity of the colour change depends on the quantity of free hydrocyanic acid present.

2.12.2 Quantitative determination (alkaline titration method)

Put 10 to 20 g of the crushed root material in a distillation flask, add about 200 ml of water and allow to stand two to four hours, in order to set free all the bound hydrocyanic acid, meanwhile keeping the flask connected with an apparatus for distillation. Distil with steam and collect 150-200 ml of distillate in a solution of 0.5 g of sodium hydroxide in 20 ml of water. To 100 ml of distillate (it is preferable to dilute to a volume of 250 ml and titrate an aliquot of 100 ml) add 8 ml of 5 percent potassium iodide solution and titrate with 0.02 N silver nitrate (I ml of 0.02 N silver nitrate corresponds to 1.08 mg of hydrocyanic acid) using a micro-burette. The end point is indicated by a faint but permanent turbidity which may be easily recognized, especially against a black background.

CHAPTER THREE

3.0. METHODOLOGY

3.1 Material And Equipment Used

Table 3.1: Material and Equipment Used

Material And Equipment
Cassava
Dextrin
Water
Sugar
Wheat flour
Butter
Yeast
Salt
Vegetable oil
Baking palm
Bucket
Electrical oven

3.2 Cassava Fermentation

Fermentation is an important process in the preparation of many cassava products in Africa, although a limited number of techniques are used. Fermentation has been reported to be responsible for product stability, flavor development, and cyanide elimination. Bitter cassava is traditionally processed to a safe, nontoxic product, using wet fermentation.

Wet fermentation/detoxification involves soaking peeled cassava roots in water for 10 days in a bucket. When the roots have softened sufficiently, they are removed from the water and similarly pounded into pulp. In soaked roots, microbial growth is essential for efficient cyanogen reduction. Although there is some reduction in cyanogens in the absence of microbial growth, efficient cyanogen reduction only occurs when microbial growth takes place and the roots soften (or ret).

3.3 Extraction of Starch From Cassava

Cassava varieties fall into two main categories, "bitter" and "sweet" cassava, depending on the cyanohydrin content of the roots. In general, bitter cassava has higher cyanohydrin content than sweet cassava and requires some form of processing before it can be eaten safely. For processing purposes, bitter varieties are most frequently used whereas sweet cassava is preferred for the boil-and-eat market.

Extraction of starch from the cassava roots can be divided into 5 main stages:

Preparation, rasping/pulping, purification, dewatering and drying, and finishing. For cassava, the process of starch extraction is relatively simple as there are only small amounts of secondary substances, such as protein, in the roots. When roots are selected for starch extraction, age and root quality are critical factors. Cassava roots need to be processed almost immediately after harvest as the roots are highly perishable and enzymatic processes accelerate deterioration within 1–2 days. A first-rate starch can be obtained using only water, and this makes the processing of cassava flour and starch particularly suitable for developing countries and rural industries.

3.3.1 Peeling and Washing.

In small-scale processing, the peel (skin and cortex) is removed and only the soft central part of the root is processed. When the roots are fresh, it is relatively simple to cut them with a knife to the depth of the skin and then cut or peel away the outer cortex. This leaves clean smooth tubers for processing. The roots are either heaped or stored in water and can be washed by hand to remove any remaining dirt before rasping. At the medium- to large-scale levels, a number of mechanical devices can be used For the processes of peeling and washing roots. The most common type is a mesh coated cylinder that is partially immersed in water. As the cylinder is rotated, the roots inside the mesh drum wash against brushes and against each other; abrasion and washing remove skin and debris. Alternatively, roots can be cleaned and peeled within a large rotating screw fitted with paddles. As the screw slowly rotates, the roots are moved along a 15 m axis and the action of abrasion the Papery skin. As the roots move along the axis, water is sprayed at high onto the roots to remove any dirt.

3.3.2. Rasping and pulping.

To maximize the efficiency of starch extraction it is necessary to rupture all the cells to release the starch granules. This is important stage as it affects the quantity of starch released from the cassava. Typically, after one or more gratings, between 70 and 90% of the starch is liberated from the cells. Rasping can be done by hand but this process is usually power-driven and the scale of throughput determines the quality and effectiveness of the rasping machinery.

3.3.3 Screening.

It's carried out by hand. The pressed through the muslin/nylon screen by hand, using a washing action. This batch system is relatively slow and the extraction rate can be as low as 10–15% of fresh weight (Kolijn et al. 1998). In small-scale production, waste pulp contains significant amounts of starch and this can either be used as animal feed, or simply remixed into flour for food.

3.3.4 Settling and purification.

At the rural level, starch is settled in tanks. After Rasping and washing, settling takes approximately 6 hours and when the starch has settled, supernatant water is removed by opening stoppers on the sides of the tank. Starch is washed by adding clean water and agitating the mixture, before allowing it to resettle. Processors add sulphuric acid to improve starch whiteness and alum to increase the rate of sedimentation.

3.3.5 Drying.

Sun-drying is the cheapest form of water removal; solar dryers are used in all small-scale operations and by many medium-scale mills. After settling, the wet starch is either spread out into baskets or directly on to cement floors or floors covered with a plastic sheet. The starch is generally crumbled before or during drying to break up the cake. An important advantage of sun-drying is the bleaching effect but there are problems associated with dust and bacterial contamination.

3.3.6 Finishing and packaging

Crude starch often consists of large lumps and these need to pulverized and dry screened in a process known as bolting. Larger mills have bolting whereas smaller starch manufactures use rollers. After rolling, starch is usually refiltered through dry screens to remove any remaining fibers. The starch is then stored in nylon bags, preferably with a plastic liner to prevent rewetting.

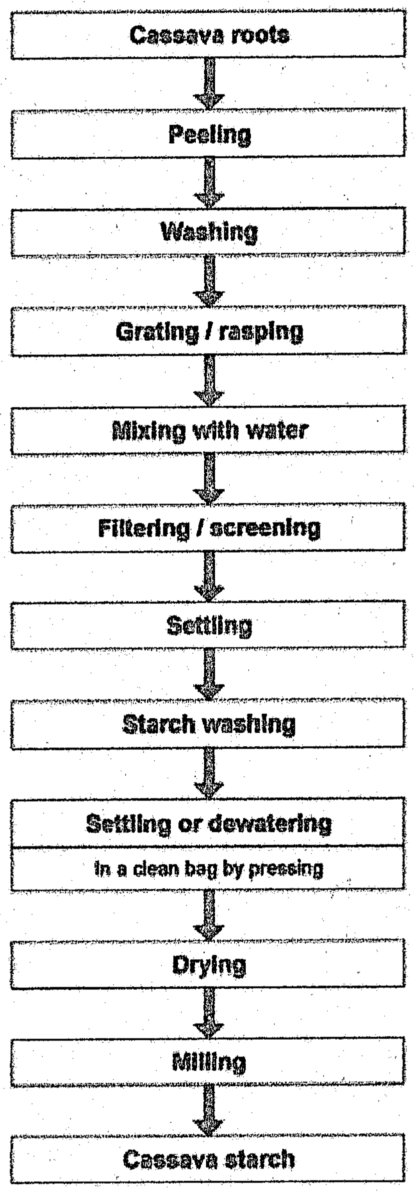

Figure 3.1. Simple process for cassava starch production.

3.4. Determination of Cyanide Content Of Starch Using Alkaline Picrate.

Principle

This method is based on the fact that a reaction between hydrogen cyanide and alkaline picrate produces a characteristic orange colour whose absorbance can be measured in colorimeter at 490nm.The cyanide concentration is then extrapolated from the standard curve already constructed.

3.4.1 Procedure

Different volume of standard KCN from 0.5 to 0.9um were measured into five different 50cm3 volumetric flasks and were labeled .1cm3 sample filtrates was also pipetted into 50cm3 volumetric flask and labeled sample solution .To each of the flasks was then added 4cn^ of alkaline picrate and then the flasks were incubated in water bath at 95°c for five minutes .There was colour developments. The flasks and the contents were cooled and later made up to the mark with distilled water. The absorbance of the resulting coloured solution were read at 490nm in a colorimeter using 1cm3 cells and distilled water was used as blank .The cyanide concentration was then extrapolated from the standard curve already constructed.

3.5 Gelatinization

In gelatinizing, starch undergoes a radical alteration in molecular arrangement, with a concomitant change in properties. From a practically insoluble product of semi crystalline structure it becomes an amorphous substance, miscible with water in any proportions at sufficiently high temperatures, giving viscous solutions which after cooling set to a semisolid elastic mass: a jelly, or gel.

This process may be brought about by the action of chemicals or by heating in an aqueous medium; only the latter case is of interest here. The onset of gelatinization is characterized by a loss of granular, structure which also promotes swelling; both processes can easily be followed under a microscope. With cassava starch, gelatinization sets in at about 60°C, and the process is completed at about 80°C. The point of gelatinization depends to a certain extent on granule size, the smaller granules being more resistant to swelling.

3.6 Dextrinization

Dextrinization is a reaction using heat and water to increase the solubility and stickiness of starch. Edible Dextrins was made by moistening dried starch water, the mixture was spread in a corrugated iron sheets and exposed to the heat of a bakers oven at a temperature of 60°C for 60 minutes until they were thoroughly dried and slightly yellow.

xtrins exist in various forms but their characteristics and mechanical properties depend on the tails of manufacture i.e. time of roasting, use or non-use of converting agent, character of vering agents, raw materials, or mixtures of different starches.

e colours of dextrins ranges from a pure white to a dark brown, some grades are highly hesive and dry quickly.

e major raw materials for dextrins are the starches such as corn, potato, tapioca (cassava) with aller uses of starches from other sources. However, for this research work cassava roots also own as tapioca is the source of starch used.

.7 Bread Formulation And Baking

he ten run breads formulation was carried out by varying the percentage composition of Dextrin, wheat flour and milk, while the composition of other ingredients were fixed.

.8. Baking Process

The ingredients were mixed together according to the desire percentage composition of ingredients to form a sticky paste and a rise time of one hour was allowed.

The sticky paste was then milled and molded in to the baking pan. The baking Process began by placing the baking pan in an electrical oven .The table below shows the different percentage compositions of ingredients, temperature of baking, time of baking for ten different runs.

Table 3.2: Various Dextrin formulations for bread production

Formulation number	1	2	3	4	5	6	7	8	9	10
Dextrin	1.0	0.0	0.98	0.92	0.93	0.89	0.97	0.80	0.82	0.69
Flour	0.0	1.0	0.0	0.05	0.05	0.09	0.0	0.16	0.06	0.28
Milk	0.0	0.0	0.02	0.03	0.02	0.02	0.03	0.04	0.02	0.03
Temp (°C)	250	245	250	245	250	245	250	245	245	245
Time(mins)	7	8	7	8	7	8	7	8	7	8

CHAPTER FOUR

4.0 RESULT AND DISCUSSION

he following basic tests are carried out on the runs of bread produced.

- Taste
- Carbohydrate
- Self –life
- Ash.

he experimental results of this project are as tabulated below.

able 4.1: carbohydrate nutritional value

ORMULATION NUMBER	NUTRITIONAL VALUE /100g
2	46
8	41
10	44

Table 4.2.: Table of experimental shelf –life test

FORMULATION NUMBER	NUMBERS OF DAYS
2	8
8	6
10	7

Table 4.3: Table of experimental ash test

FORMULATION NUMBER	NUTRITIONAL VALUE/100g
2	1.8
8	2.4
10	2.1

1. DISCUSSION OF RESULT

he dextrin produced from cassava contains 0.019mg/dm^3 of cyanide and the acceptable reshold-limit of cyanide by standard organization of Nigeria (SON) is 0.35mg/dm^3.This show at cassava can be detoxified of cyanide below the acceptable level via fermentation.

he baking process was carried out, using ten different bread formulations in which the ercentage composition of dextrin, wheat –flour, and milk was varied and that of other ngredients were fixed. The result obtained revealed that formulation which has very higher ercentage composition of dextrin did not produce good bread. The bread formed has poor hysical look, harder and consequently poor market value.

This means that bread formulation cannot be carried out with high proportion of dextrin in the omposition of the formulation.

However, formulation 2, 8, and 10 produced good breads upon baking. The bread produced were ubjected to taste, carbohydrate, shelf –life, and ash test respectively.

The three formulations (2, 8 and 10) have a very good taste like that of normal bread. Formulation number 2 has the best nutritional value in term of carbohydrate content, followed by that of formulation 10 and lastly formulation 8.

All these carbohydrate nutritional value fall within the accepted carbohydrate nutritional value, which is within 40-50g/100g. Formulation 2 has the highest shelf–life of 8days, followed by formulation 10 which has 7 days and lastly formulation 8 which has 6 days. This revealed that higher; proportion of dextrin in the formulation reduces the shelf-life of the bread. Formulation 2 has the lowest value of ash nutritional value, followed by formulation 10 and lastly formulation 8.This means that formulation 2 is richer in nutrients than formulation 10 and 2.Also formulation 10 is richer in nutrient than formulation 10. This is because the lower the ash value the richer the nutrient of the bread.

CHAPTER FIVE

0 CONCLUSION AND RECOMMENDATIONS

1 Conclusion

eyond experimental error, it has been fully practicalised that bread formulation with dextrin is ossible and its carbohydrate and ash nutritional values fall within the generally accepted andard.

.2 Recommendations

1. A total cyanide-free dextrin from cassava should be provided.
2. A method should be devised to accommodate very higher proportion of dextrin in the formulation.

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