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Rheological properties and fatty acid of seedless bread fruit *(Artocarpus altilis)*

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ABSTARCT

The starch powdered sample was analyzed for the Rheological properties using Rapid ViscoAnalyzer and the oil was methylated and then analyzed for fatty acids using Gas chromatography. From the graph of RVU versus Time, it was discovered that in breadfruit as the temperature is increased, the starch granules swell and increase the viscosity of the starch paste until the peak viscosity is reached (117.83). A high peak viscosity corresponds with a high thickening power of starch. The pasting time for was (85.75). Also the breakdown was (13.42). The set back (retro gradation) for Breadfruit was (60.92), the peak time was(7.00). The trough1 value was also(56.92).The result of fatty acid indicates that breadfruit contain myristic acid(MA) (16.52%), stearic acid (SA) (4.50%), and Oleic acid (OA) (78.98%). The starches of breadfruit can be use in pharmaceutical industries as binding tablet, stabilizer and as or thickening agent when modified and the breadfruit can be eaten as it contains essential fatty acid(Oleic acid) which the body can not synthesize on its own.

Keywords: Rheological, fatty acid, viscosity, setback, break down, MA, OA, SA.

INTRODUCTION

Breadfruit*(artocarpus altilis*) is a handsome and fast growing, tree reaching 85ft in height, often with a clear trunk to 20ft becoming 2 to 6ft in width and often buttressed at the base.[1].In the green stage, the fruit is hard and the interior is white, starchy and fibrous. When fully ripe, the fruit is soft; the interior is creamy coloured and pasty, also sweetlyfragrant. The seeds are irregularly oval, rounded at one end, pointed at the other about ¾ inches long. In Nigeria, it is predominantly found in some parts of the country which include Ibadan, Ogbomosho, Akure, Ikire. Breadfruit classification is in two categories namely, 'the wide type' with seeds and little pulp and the 'cultivated seedless type'. The seedless varieties are much consumed by people of

African origin. The dried fruit has been made into flour and improved methods have been explored in Brazil with a viewto substituting it in part for wheat flour in bread making. The combination of it has been found more nutritious than wheat flour alone.

Many research works has been done on Breadfruit, but the starch of it has not been analyzed for potential uses in pharmaceutical industries and also the oil has not beenanalyzed for the essential fatty acids that body may need but can not be synthesized by the body system.

The goal of the research paper is to analyze the Rheological properties of the starch sample using rapid viscoanalyzer and also using the Gas chromatography for the fatty acid profile.

MATERIALS AND METHODS

Matured breadfruit (*Artocarpusaltilis*) were obtained on the farm at Ile- Oluji, Ondo State, Nigeria. The fruits were peeled opened, sliced, sun dried and powdered.

Starch isolation

The method of [2] was used for the isolation of starch from the sample flours. Each sample flour was extracted using soxhlet extractor with a mixture of Hexane, Trichloromethane and Methanol(1:2:1v/v/v) at reflux temperature. The crude starch was recovered when the defatted four was steeped in water containing $HgCl^2$ (100ppm) for 16 hours at room temperature and macerated in a blender. The crude starch granules were separated by filtration through 150-200mm mesh sieves and centrifuged at 5000rpm for 10 minutes.

The crude starch granules were purified by treating with dilute NaOH (0.1ml at room temperature) and 0.1MNacl-toluene, after each treatment the granules were sedimented by centrifugation and the sediment were washed thoroughly with water. The final sediment was further washed twice with methanol and air dried.

Rheological Analysis:

Pasting characteristics were determined with a Rapid Visco Analyzer (RVA).(Model RVA 3D+,Network Scientific, Australia)[3] This method was used as an alternative to Bra bender Amylograph which was confirmed by [4].The flour (2.5g) samples were weighed into a dried empty canister; 25ml of distilled water was dispensed into the canister containing the sample.The solution was mixed and the canister was well fitted into the RVA, as recommended. The slurry was heated from 50oc with 2 minutes holding time. The rate of heating and cooling were at a constant rate of 11.25oc/minutes. Peak viscosity, trough, breakdown, final viscosity, set back, peak time and pasting temperature were read from the pasting profile with the aid of thermocline for windows software connected to a computer.

Oil Extraction and GC Analysis

The oil of the sample was extracted using soxhlet extractor and petroleum ether as solvent.The composition of the fatty acids was determined using gas chromatography of the purified methylated sample(methylation was done using BF_3 methanol), 1µl was injected into a HP 5890 series II gas chromatograph fitted with a FID and an HP-FFAP capillary column(30m×0.25mm×0.25µm). The helium carrier gas flow was 8ml/min.The detector

temperature was 280^{oc}. The injector split 1:50 at 220^{oc}. A temperature programmer was used with an initial temperature of 160^{oc} held for 5min, raised from 200to 220^{oc} at a rate of 2^{oc}/ min and 220^{oc} held for 30min.

The fatty acid methyl esters were identified by comparison with the retention times of the standards: GLC-68D and GLC-69A, NU-chek-prep and Qualimix fish 89-5540, Larodan fine chemicals. The individual fatty acids were expressed as the percentage of total fatty acids(relative amount). Integrating the area under the peak and dividing the results by the total area of all the fatty acids quantified the relative amounts.

RESULTS AND DISCUSSION

From the table of rheological properties, it was discovered that breadfruit has high peak viscosity (117.83Rvu). The pasting time was (85.75minutes). Also the breakdown was (13.42).The high breakdown seen in breadfruit shows that the starch is highly stable and amylose has been removed. The set back (retro gradation) was (60.92). The peak time was (7.00).The trough1 was 56.92 and the peak1 was 70.33.

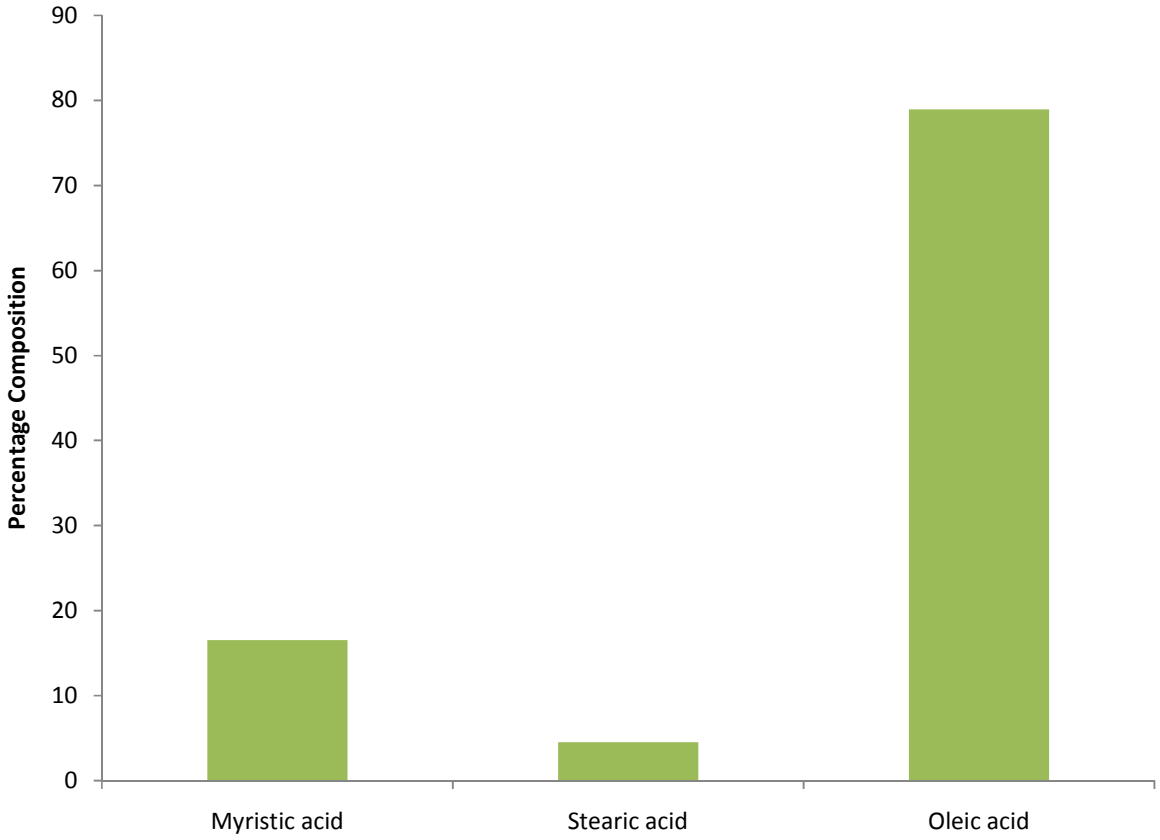

Figure 1: percentage composition of fatty acids

From the graph of viscosity(RVU) versus time, it was discovered that in breadfruit (*Artocarpusaltilis*) graph, as the temperature is increased, the starch granules swell and increase the viscosity of the starch paste until the peak viscosity is reached.(117.83RVU). A high peak

viscosity corresponds with a high thickening power of starch. An interesting feature of starch is that it does not give sharp maxima(peak viscosity), which indicates that cooking time is required for complete gelatinization.[5]

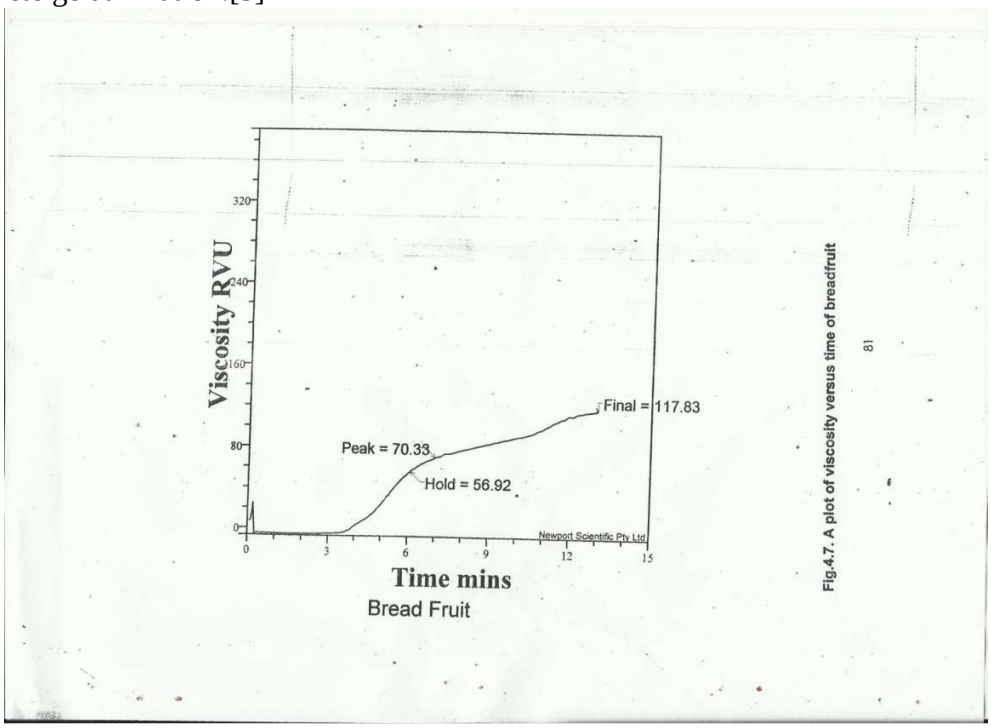

Figure 2: Rheological graph of seedless breadfruit*(artocarpusaltilis)*

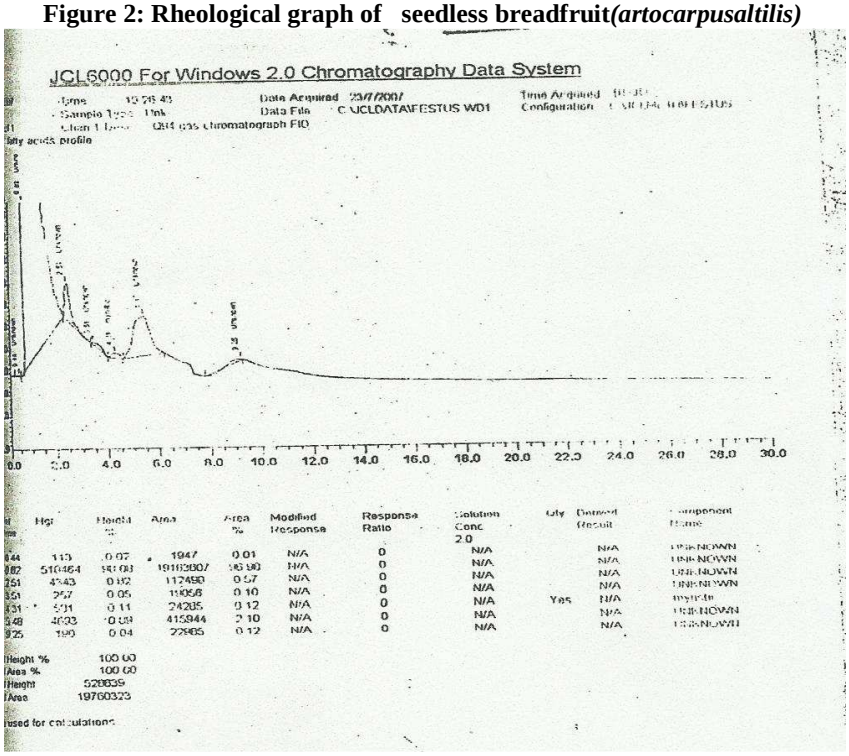

Figure 3: fatty acid profile of breadfruit *(artocarpusaltilis)*

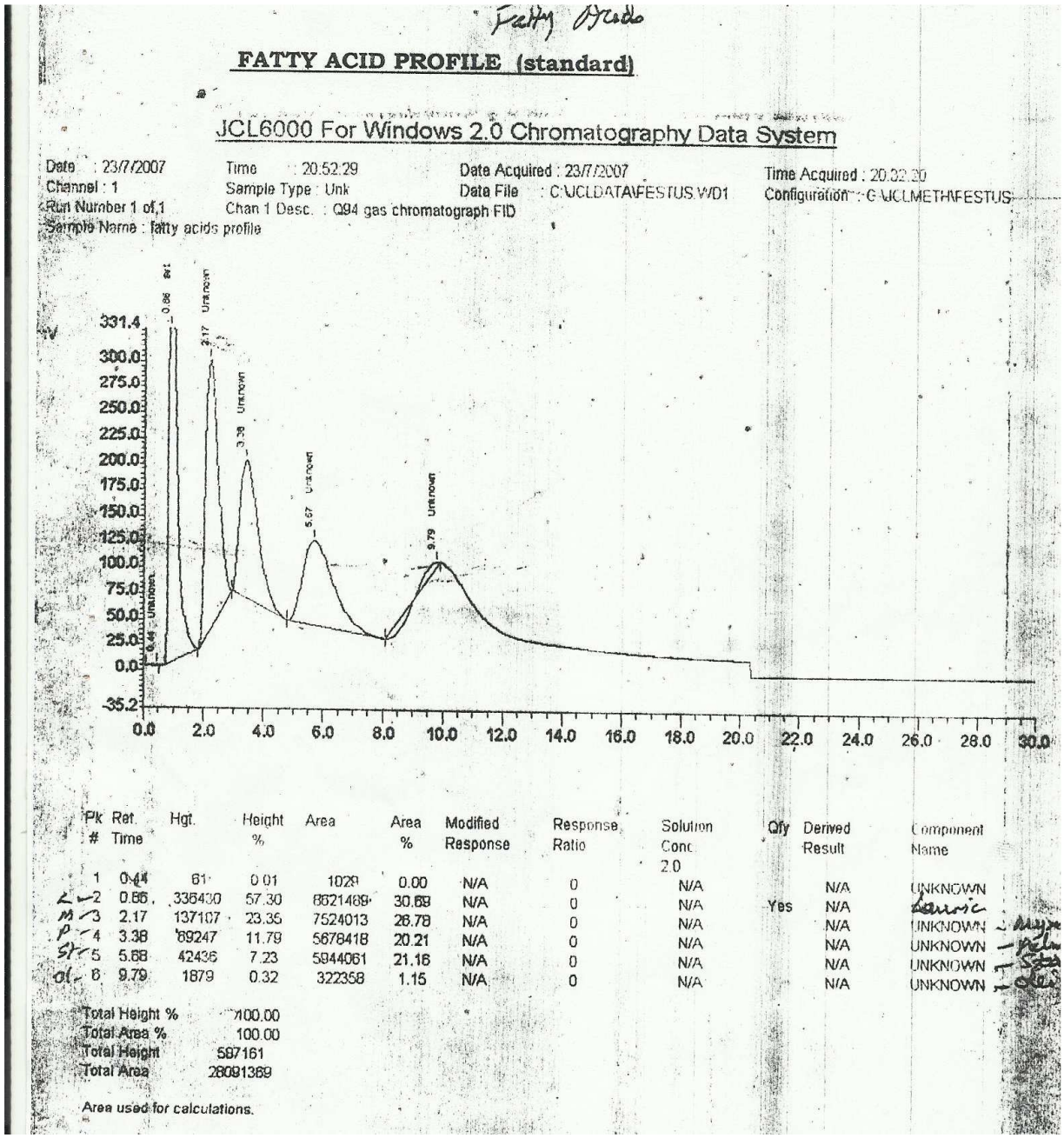

Figure 4: Standard graph of fatty Acid profile

[6-7] have reported the use of starches with high viscosity value in pharmaceutical companies especially, as tablet binders. A starch of breadfruit was(117.83Rvu) can be found applicable in pharmaceutical industries. Solutions of higher viscosity havehigh paste stability, because of the solution yield value, which is defined as the sheer stress or applied force, below which the solution will not flow.[8] (Sandersan,1981

According to [9] staling of bread is a function of retro gradation (set back), that is, association of the linear amylase molecule. Breadfruit, when modified can be used as a thickening agent or as a

stabilizer [8].[10]) had shown the importance of viscosity, in characterizing and selecting starch for food uses, which includes the functions of viscosity as an index of consistency, as a quality control tool on the raw products, as a measure of a constitution of polymer. Furthermore, lower values of pasting time in breadfruit (85.75minutes) showed that the starch granules were easily leached out of the solutions [11].

From the table of fatty acid composition, it was found that seedless breadfruit oil contains myristic acid(16.52%), stearic acid(4.50%) and oleic acid(78.98%). Myristic acid functions in the body to stabilize the cell proteins used in the immune system and to fight tumour [12-13]. The presence of myristic acid with 16.52% is a good indication that when taken or if its oil can be processed industrially for cooking, it will function in the body to stabilize the cell proteins. Also, the high value obtained in Oleic acid showed that it can be taken, being essential fatty acid which the body cannot synthesize [12-13].

CONCLUSION

Starches from seedless breadfruit can be highly useful in pharmaceutical industries as tablet binder, thickening agent and when modified can be used as stabilizer, it can be incorporated into food component if well purified and modified, also, the high presence of oleic acid, being one of highly essential acids, which the body needs for its metabolism, in the oil of seedless breadfruit showed that it can useful industrially in the formulation of various food component**.**

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