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Rheological properties of Wild yam(*Discorea villosa*) and Aerial yam(*Discorea bulbifera)*

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ABSTARCT

The starch powdered samples were analyzed for their Rheological properties using Rapid Visco Analyser. From the graph of RVU versus Time, it was discovered that in aerial yam as the temperature is increased, the starch granules swell and increase the viscosity of the starch paste until the peak viscosity is reached(390.92). A highpeakviscosity corresponds with a high thickening power of starch, this peak is higher than that of wild yam (-2.92). The pasting time for aerial yam (86.50) was the same with that of wild yam(86.35). Also the breakdown for aerial yam (20.50) was higher than that of wild yam(0.50).The set back(retrogradation) for aerial yam(128.83) was higher than that of wild yam(0.50). The peak time for aerial yam(5.60) was lower than that of wild yam(7.00).The trough1 for aerial yam (262.08) was higher than that of wild yam(-3.50. The peak value for aerial yam(282.58) was higher than that of wild yam(-3.00). The starches of aerial yam can be use in pharmaceutical industries as binding tablet, stabilizer and as or thickening agent.

Keywords: Rheological, wildyam, aerial yam, viscosity, setback, pasting time, peak, trough1.

INTRODUCTION

Aerial yam *(Discoreabulbifera) belongs to Discoreae species*, in Nigeria the aerial yam plants are predominantly noticed in some parts of the country which include Ibadan, oyo, Ogbomosho, Ile Ife, Ile Oluji, Ikire and Akure.It grows in a wide range of soils and most varieties require long rainy seasons. The Planting procedure include planting the bulbils or tubers either whole or small pieces, the tubers produced by the plants grown from bulbils are usually very small in the first year and often used as sets for planting the following year to produce edible tubers of a reasonable size.[1]

The tubers are occasionally used for the production of flour, they are also used has food in times of scarcity, but detoxification is necessary and this is done by soaking in water or prolong boiling before they are safe to consume.[1-2] and are very useful medicinally [3].

Wild yam*(Discoreavillosa)* is a plant native to North America, Mexico and Asia.In Nigeria the wild yam plants are predominantly seen in western part of the country like Owo, Oyo, Ogbomosho, Ikire Ile -Ife.It is believed to bea wonderful, natural hormone regulator. The herb contains compound that are similar to female hormones which are helpful for female disorders. It contains natural steroid called dehydro-epiandrosterone(DHEA) that is said to rejuvenate and give vigor to love making.([4] It is also considered to be a liver cleaner[5],it is has sometimes been called one of the best natural relievers of jaundice, and nausea[4-5].

There are many species of the genus discoreaa and lot of research work has been done on them but wild yam(*Discorea villosa)* and aerial yam(*Discorea bulbifera)* have not been investigated for their Rheological properties.

The essence of the study is to carry out the rheological properties of the two varieties of the yam, wild yam(*Discoreavillosa*) and aerial yam(*Discoreabulbifera*).

MATERIALS AND METHODS

The two samples were obtained from Owo in Ondo state and Ile- Ife in Osun State, they were washed, dried, peeled and grinded into powdered samples for the extraction of their starch.

Starch Isolation:
The method of [6] was used for the isolation of starch from the sample flours.Each sample flour was extracted usingsoxhlet extractor with a mixtureof 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 hrs 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) This method was used as an alternative to Bra benderAmylograph which was confirmed by [7]; 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 50^{oc} with 2 minutes holding time. The rate of heating and cooling were at a constant rate of 11.25^{oc}/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 [8].

RESULTS

From the table of rheological properties, it was discovered that aerial yam has high peak viscosity(390.92Rvu) while that of wild yam had (-2.92Rvu). The pasting time for aerial yam (86.50 minutes) was higher than that of wild yam (86.35minutes). Also the breakdown for aerial yam (20.50) was higher than that of wild yam(0.50).The high breakdown seen in Wild yam shows that the starch is highly stable and amylose has been removed.The set back(retro gradation) for aerial yam (128.83) was higher than that of wild yam (-0.50).This is as a result of fall in viscosity(-2.92RVU) which occurs because of glucose re-alignment which is mainly amylose which has lower viscosity. The peak time for aerial yam(5.60) was lower than that of wild yam(7.00).The trough1 for aerial yam (262.08) was higher than that of wild yam(-3.50).

The peak value for aerial yam (282.58) was higher than that of wild yam(-3.00).

DISCUSSION

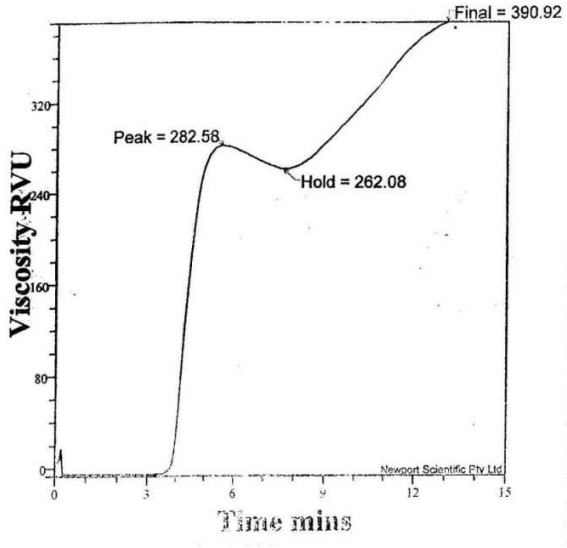
From the graph of viscosity(RVU) versus time, it was discovered that in Aerial yam(*Discorea bulbifera)* graph, as the temperature is increased, the starch granules swell and increase the viscosity of the starch paste until the peak viscosity is reached.(390.92Rvu). A high peak viscosity corresponds with a high thickening power of starch, this peak viscosity is higher than that of wild yam(-2.92Rvu).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.[9].[10] and [11] have reported the use of starches with high viscosity value in pharmaceutical companies especially, as tablet binders. Starches of aerial yam(390.92Rvu) can be found applicable in pharmaceutical industries. Solution of higher viscosity have a high 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.[12].

According to [13], staling of bread is a function of retro gradation(set back), that is, association of the linear amylase molecule.Aerial yam(*Discorea bulbifera*)(128.83), when modified can be used as a thickening agent or as a stabilizer[12].[14] 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 aerial yam (86.50minutes) and wild yam(86.35minutes) showed that the starch granules were easily leached out of the solutions.[15].

Table 1. Result of Rheological properties

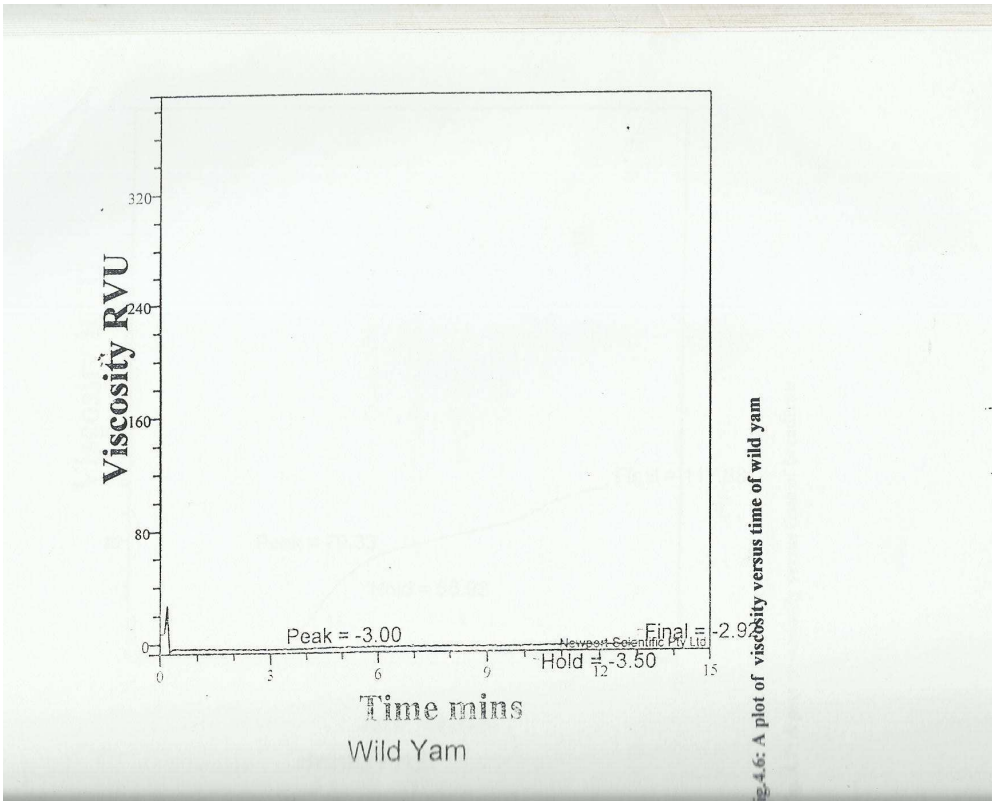
	Peak 1	Trough 1	Breakdown	Final Viscosity	Setback	Peak Time(min)	Pasting Time(min)
Aerial Yam	282.58	262.08	20.50	390.92	128.83	5.60	86.50
Wild yam	-3.00	-3.50	-0.50	-2.92	0.58	7.00	86.35

Graph of Rheological of aerial yam(*Discorea bulbifera)* and wild yam(*Discorea villosa)*



5: A plot of viscosity versus time of aerial yam

Aerial yam



4.6: A plot of viscosity versus time of wild yam

CONCLUSION

From the results so far it can be infer that the starches of aerial yam can be highly useful in pharmaceutical industries as tablet binder and also, when modified, it can be used as a thickening agent and stabilizer in industries.

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