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THE CHEMICAL COMPOSITION AND PHYSICO-CHEMICAL PROPERTIES OF *MUCUNA SLOANEI* SEED.

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ABSTRACT

The chemical composition, functional and pasting properties of *Mucuna sloanei* seed were determined. The seed has high carbohydrate (50.9%), crude protein (22.5%) and crude lipid (7.5%)content. It was also found to be rich in potassium, phosphorus and calcium but low in sodium. Phytic acid was high while the level of other toxicants analysed was low except hydrocyanic acid that was not detected. The amount of water absorbed by the sample was thirty-eight times the amount of oil absorbed. The pasting properties analysed were gelatinization temperature (73°C) and gelatinization time (30min). Other pasting properties determined were time of attainment of peak viscosity on cooking at 50°C, viscosity after 30 mins at 95°C, ease of cooking and starch stability. The work shows the starch from this seed to form a slurry with low paste viscosity. As such, it may be used in dense puddings in addition to its thickening and flavouring properties.

Keywords: chemical, composition, phsico-chemical, *Mucuna sloanei*, seed.

INTRODUCTION.

Mucuna sloanei called 'ibaba' by the Efiks of Cross River State in Nigeria is used as a soup thickener and flavouring agent. The local community claims it lowers libido in men and has sedative properties. This is the first of a series of tests being carried out in our unit to determine the chemical nature of this seed. *Mucuna sloanei* is a leguminous plant belonging to the family leguminosae. The leaves of the plant are usually alternate trifoliate and the flowers have superior ovaries containing mostly three to four seeds (Kay 1979). The fruits are usually in leguminous pods and split along the dorsal sutures when mature. The seed coat is black when mature but white to cream coloured while young. The seeds are usually without endosperm and appear white.

Some work has been done on *Mucuna* species. For instance Ene Obong and Carnovale (1992) had worked on the proximate composition, mineral and amino acid content of *Mucuna urens* and *Mucuna prusiens* (black and cream varieties) while Achinehwu (1982) had earlier worked on the proximate composition of *Mucuna sloanei*. In this work, the proximate composition, sugar content and toxicants in the seed are determined, also determined are the water binding capacities and starch pasting properties of the seed. The aim is to find out if this seed could be used for other purposes apart from its use as a soup thickener and flavouring agent.

MATERIALS AND METHODS

COLLECTION AND TREATMENT OF SAMPLES FOR ANALYSIS.

The *Mucuna sloanei* seeds used were obtained from a private farm in Usung Idim Yellow-Duke in Akpabuyo Local Government Area of Cross River State in Nigeria. The variety used has a black seed coat when mature but is white to cream colour while young. The mature black seeds were picked and used immediately the pod dried. They were brought into the laboratory and used within 48 hrs. They were separated from the seed coat and finely chopped. Fresh portions were taken for determination of moisture, ascorbic and cyanic acids. The rest were dried in a hot air circulating oven Gallenkamp (DV330) at 65°C to constant weight. The dried sample was ground using an electric blender with steel blades (Philips HR 28411) and stored in a screw-capped bottle and kept at 4-6°C.

METHODS.

Moisture content was determined by drying about 3g of the fresh sample to constant weight in a hot air circulating oven at 100°C. Proximate composition which included percentage moisture, crude lipid, crude protein, fibre and ash was determined according to AOAC (1984) method. The nitrogen free extractives (total carbohydrate) were determined according to AOAC (1984) by difference. The calorific value was the sum of multiplied value of percentage crude protein, crude lipids and nitrogen with Atwater factor of 4,9,4 kilocalories per gram

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Table 1: Proximate composition (g/100g) dry weight and calorific value (Kcals/100g) of the seed of *Mucuna sloanei* seed

	(Mean ± standard error)[a]
Moisture	12.5 ± 0.5
Crude fibre	3.6 ± 0.3
Crude lipid	7.5 ±0.05
Crude protein (Kjedahl N x 6.52)	22.5± 0.5
Total Ash	3.0 ±0.2
Carbohydrate (NFE)	50.9 ±0.7
Energy Content (Kcal)	361.1 ±3.5

a= Mean of 3 determinations.
NFE = Nitrogen Free Extractives.

respectively. Atomic absorption spectrophotometer, Pye Unicam 2900 was used in the determination of sodium, potassium, calcium, magnesium, copper, chromium and cadmium according to the procedure of AOAC (1984) from the dry sample. Phosphorus was estimated from the dry sample using the vanadomolybdate colorimetric method (AOAC, 1984). Total reducing sugar was determined by the method of Miller (1959) using dinitrosalicyclic acid reagent and the component sugars were determined by AOAC (1984) method from the dry sample. Ascorbic acid extract prepared from 30g of fresh sample was titrated with N- bromosuccinimide according to the method of Haddad (1977) to obtain ascorbic acid content. Toxicants determined were phytic acid by the titrimetric method of McCance and Widdowson (1953), hydrocyanic acid from fresh sample by AOAC, (1984) method, tanins by the titrimetric method of Burns (1971) and oxalate by the gravimetric method of Dye (1956).

Water binding capacity was determined by Beuchat (1977) volumetric method while amylase content was determined using Milton Roy's spectrophotometric (AOAC 1984) method. Fat absorption capacity was by the volumetric method of Sosulski et al (1976) while starch pasting properties, which include gelatinization temperature and time, and peak viscosities were determined using the graphical analysis: rf the Brabender Visco- amylogram curves. (Mazurs et al 1957).

Table 3: Vitamin C (Ascorbic acid) and toxic substances (mg/100g) in *Mucuna sloanei* seed.

	(Mean ± Standard Error)[a]
Vitamin C[a,b]	6.2 ±0.3
Hydrocyanic acid[b]	nd
Tanins	25.5 ± 0.2
Phytic acid[c,a]	161.4 ±0.3
Total oxalate[c]	100 ± 0.4
Soluble oxalate[c]	66.5 ± 0.3

a= Mean of 3 determinations. b=Wet sample.
c=Dry sample. nd=Not detected.

RESULTS AND DISCUSSION.

The results are shown in Tables 1-5. Table 1 shows the proximate composition and calorific value of the seed of *Mucuna sloanei* .It has a high protein value of 22.5g/100g. This is comparable to the value of 20.8g/100g obtained by Eyo et al (1985). Eneobong et al (1922) had 21.2%, 33.2% and 34.2% for *Mucuna urens* and *Mucuna prusiens* (black and cream varieties) respectively. It is our opinion that this seed has sufficient protein to be relied upon as a source of protein in meals instead of its being used as a thickener and flavouring agent only. This seed contains 7.5% of crude lipids and was classified as a Nigeria oil seed by Eyo et al (1985). The oil content of this seed is intermediate between the percentage oil (17.5%) in the seed of *Mucuna urens* and the cream variety of *Mucuna prusiens* (3.7%). The calorific value of this seed is 361.1 kcals/100g. This is close to that of the seed of *Cola rostrata,* which is 280.1kcal/100g for the yellow variety and 389.7kcal/100g for the white variety (Dosunmu and Eka 1989).

The mineral content of the sample is as shown in Table 2. The seed is rich in potassium and calcium but low in sodium. Cobalt was not detected while the percentage of iron and magnesium in the seed is low. Table3 shows the vitamin C (ascorbic acid) content as well as the level of toxicants in the seed of *Mucuna sloanei.* The toxicants determined were hydrocyanic acid, tanins, phytic acid and total and soluble oxalates. Hydrocyanic acid was not detected in this sample. The amount of phytic acid was high

Table 2: Mineral content of *Mucuna sloanei* seed (mg/100mg) of dry powder.

Na	K	Ca	Mg	Cu	Ni	F	Fe	Zn	Cd	Cr	Co
12.1	350	140	65	1.4	1.5	182	5.7	0.3	0.46	0.1	nd

nd= not detected

while that of tanin was low. The sample contains 100mg/g of total oxalate but about two-thirds of the oxalate is water soluble and would therefore be lost during preparation as the process of preparing the thickener involves several processes of boiling and washing in water. This process was not carried out in the raw seed used for this research.

Table 4 shows amylose and sugar content and some functional properties of *Mucuna sloanei* seed. The total sugar in *Mucuna sloanei* seed consists of glucose, fructose, sucrose mannose and arabinose. The water binding capacity of the seed is high. This might be due to the high protein content of the seed, as proteins are known to influence the water binding capacity of foods because hydrogen bonds can be formed between water and the polar residues of protein molecules (Pomeranz, 1991). Chau and Cheung (1998) reported that three Chinese indigenous legume seeds had increased water binding capacity as a result of increased protein. The water bound by the flour of this seed is about thirty-eight times the amount of oil absorbed. This shows that there is a more effective mechanism for water absorption than for oil. Kinsella (1976) suggests that oil absorption is the physical entrapment of oil by capillary attraction while absorption of water is a chemical process.

Table 4: Amylose, sugar (g/100g) and some functional properties of *Mucuna sloanei* seed.

	(Mean ± standard error)[a].
Amylose	12.2
Total sugar	26.03 ± 0.03
Glucose	6.03 ± 0.2
Fructose	5.00 ±0.3
Sucrose	3.41 ±0.2
Mannose	5.31 ±0.2
Water binding capacity %	96 ± 0.2
Oil absorption capacity	2.5 ±0.05

a = Mean of 3 determinations.

Table 5: Pasting properties of Mucuna sloanei seed slurry.

Gelatinization Temperature (Tg)°C	73
Gelatinization Time (Mg) mins	30
Time peak viscosity is attained (Mn) mins	35.3
Peak viscosity at 95°C(Vp)	1935
Viscosity on cooling to 50°C (Ve)	755
Viscosity after 30 mins at 95°C(Vr)	550
Ease of cooking	10.5
Starch stability (Vp-Vr)	1385 Bu

The pasting properties of the seed are found in Table 5. The pasting or gelatinization temperature of the seed is 73°C. This high gelatinization temperature suggests that the crystalline size and association within the granules are of high order of magnitude (Hoover, 1996). It has been suggested by Iwuoha and Kalu (1995) that gelatinization temperature serves as a measure of the index of the level at which the carbohydrate fraction of the food system affects its thickening power. In other words, its water binding capacity is most effective about that temperature.

The cooking time for the flour of the seed is high. This is probably due to the high crude protein in the sample. We have found that the percentage of protein tends to influence the cooking time of flours. The flour has relatively high diastatic activity and low paste viscosity hence it will produce a dense pudding -like slurry. This explains why the seed is used more as a thickener. Its flour may not be useful for bread making. It could however be used to formulate breakfast dishes that could be substituted for 'ogi'. This would be of added advantage since it contains more proteins than 'ogi'.

CONCLUSION.

The seed of *Mucuna sloanei* like majority of seeds in Nigeria is under utilized. It is believed that as more research is carried out on it, some of the myths surrounding it will be removed and its flour will be used in food and as animal feed since it contains a high percentage of crude protein, crude fat and carbohydrate and is rich in some minerals. It could also be used as a source of starch for dense pudding since its pasting properties favour such.

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