# Determination of the Pasting Properties of *Mucuna (Pruriens* and *Veracruz)* Bean Flour *Varieties* Relevant to their processing

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***Abstract***
*The edible seeds of Veracruz and Mucuna Pruriens are rich in vital elements and may be turned into flour for various uses. This study used Rapid Visco-analytical equipment to assess the pasting qualities of flour made from Mucuna bean seed species. Using the Rapid Visco Analyser (R.V.A.), it was easy to evaluate the pasting qualities of starchy goods. During the test, starch is gelatinized and becomes more viscous after being exposed to extremely high temperatures and controlled shear, revealing its stability. It is then chilled to show a setback during the gelatinization process. The Mucuna Pruriens sample flour had peak viscosity, trough viscosity, breakdown viscosity, final viscosity, and setback viscosity of 72.21 RVU, 67.84 RVU, 4.38 RVU, 125.04 RVU, and 57.21 RVU, while the Mucuna Veracruz sample flour had these same values: 72.01 RVU, 66.99 RVU, 4.28 RVU, 124.55 RVU, and 57.19 RVU. It shows that using horse-eye bean flours can enhance food quality and make them more suitable for a range of food compositions. They can thus find practical use in the production of cakes and other foods.*

**Keywords:** *Mucuna Prureins, Mucuna Veracruz, pasting properties, viscosity, and Rapid Visco analyze*

A popular annual climbing legume among the Igbo people of Eastern Nigeria is Mucuna (Pruriens and Veracruz) Agbara, which belongs to the Fabaceae family, a subfamily of the papilionaceous. It is sometimes referred to as cowage, cowitch, or velvet bean. It is one of the most often used medicinal herbs in Asia and Africa, to be found in more than 200 locally created medication combinations. [1] It is located on the Indian plains. Mucuna seeds contain the medication L3, 4-Dihydroxyl Phenyl Alamine (L-DOPA), which is used to treat Parkinson's disease (PD), which is the only reason why demand for Mucuna has skyrocketed in India and on global medical markets [2].

The Leguminosae family includes the genus Mucuna, which has over 100 species of climbing vines and shrubs. Tropical forests, particularly those in the Caribbean, tropical Africa, and tropical India, are home to the genus, which is named for the plant Mucuna. The annual twining crop Mucuna may grow up to 15 meters in length. The plant's fuzzy hair, which formerly covered it almost completely, almost completely falls off as it ages. The petioles are large and smooth, ranging in length from 6.3 to 11.3 cm, and the leaves are trifoliate, alternate, or spiraling. Membranous terminal leaflets are smaller than lateral leaflets, which vary widely in size.

The flowers droop in racemes and might be lavender, white, or dark purple. The petals are noticeably curled, and the blooms are bigger than peas. The glossy, oval-shaped, brown or black seeds measure 12 mm [3]. It has also been demonstrated to function as a male reproductive agent and to have neuroprotective, analgesic, and anti-inflammatory properties. Because of their high protein content and ease of digestion, Mucuna bean seeds are regarded as a potential source of dietary proteins. Its protein content ranges from 23 to 35%, and its nutritional characteristics are comparable to those of other pulses [4].

The primary usage of legume proteins is as an ingredient in food items that aim to improve nutritional quality and provide several beneficial qualities, including the ideal structure, texture, taste, and color. The culinary and pharmaceutical sectors have a strong need for Mucuna's many forms and accessions.

[5], rheology is the field that studies the flow and deformation of agricultural products. Rheological analysis information is required for process design, engineering data calculation, and agricultural material quality evaluation. To determine or establish the exact ranges of pump and pipe diameters and energy required during food processing, it is important to have a thorough understanding of deformation-flow characteristics and behavior.

When applied simultaneously through energy, force, and load proportions, models derived from the rheological calculations from the observed tests might be very useful in the design of the food process. Thus, it is crucial to evaluate different dietary materials and agricultural products to confirm their inherent benefits, which will enhance human existence and quality of life [6]. The pasting properties of different types of Mucuna bean flour are not well documented in the literature. To investigate the many possible applications of Mucuna (Pruriens and Veracruz) bean flour in the food system, expand their uses, and lower post-harvest losses, this study compares and evaluates the pasting qualities of two types of bean flour.

## Materials and Method

**Sample Collection:** Mucuna Pruriens ripe seeds were collected straight from a farm in Orba, Enugu State, Nigeria's Udenu Local Government Area. The coordinates of its location are east and north. In Enugu State, Nigeria, Mucuna Veracruz seeds were collected from a farm in Enugu Ezike, Igboeze North Local Government Area. The coordinates of its location are east and north. To get rid of any unwanted objects, such as chaff, immature seeds, and fragments of stone, the samples were hand-cleaned.

(A) (B)

Figure 1: Mucuna seeds varieties (a = Pruriens and b = Veracruz)

Orba in Udenu LGA

**Fig .2a**: Map of Orba GPS

Enugu Ezike in Igboeze LGA

Fig. 2b: Map of Enugu- Ezike

**Sample Preparation**

According to the methodology suggested by [7], the flour samples from Mucuna (Pruriens and Veracruz) were made. 1 kg of clean Mucuna Pruriens and Veracruz seeds were soaked in clean water at 250°C and 20°C for ten hours before being manually dehulled. Ten hours were spent drying the cotyledons at 1050C. Before being used, the dehydrated seeds were first ground in a hammer mill, sieved through a 0.50 mm mesh screen, and stored at 40 °C in an airtight container.

**Pasting properties of the Mucuna samples.**

It was easy to evaluate the pasting qualities of starchy products with the Rapid Visco Analyser (R.V.A.). After being exposed to extremely high temperatures and controlled shear throughout the test, which reveals its stability, the starch gelatinizes and becomes more viscous; this is followed by cooling, which indicates a setback during the gelatinization process. Peak time, pasting temperature, peak viscosity, temperature at peak, breakdown of hot and cold paste viscosity, setback, and final viscosity may then be evaluated for the samples.

**Peak Viscosity (PV):** This controls how easily the starch molecules will swell and shows how strong the paste that is created while cooking is. Because it takes energy to start swelling and gelatinization, products with greater peak viscosities do not swell as readily.

**Trough Viscosity (TV):** This shows how well the paste may resist breaking down when cooking (Ayo, 2000)

**Breakdown Viscosity (BV):** This assesses the starch's resistance to shear stress when cooking.

**Final Viscosity (FV):** This shows that after heating and chilling, the material may produce starch and a viscous paste or gel (Maziye et al., 2007).

**Setback Viscosity (SV):** This provides insight into the starch retrogradation found in floor samples. Dough that is cohesive or mouldable is said to have high setback viscosity values. High setback viscosity materials are more likely to retrograde when cooled, which causes the amylase and amylopectin molecules to realign and become soft and wet.

**Peak Time (PT):** This indicates how long the flour samples were cooked and how many minutes the peak viscosity occurred [1].

**Procedures for evaluating the pasting properties**

A dry canister containing 3.0g of the material was combined with 25 ml of distilled water. The Rapid Visco Analyser was filled with the mixture. After being maintained at 50°C for one minute, the suspension was heated to 95°C and held for two minutes. 11.85 per minute was maintained as the heating and cooling rate. Using a thermo-cline for Windows program that is connected to a computer, the pasting profile was used to calculate the peak viscosity, breakdown viscosity, trough viscosity, final viscosity, and setback viscosity. The Pasting properties of ***Mucuna (Pruriens and Veracruz)*** are presented in Tables 1 and 2 respectively.

**Table 1: Pasting properties of *Mucuna Pruriens.***

| TEST | SAMPLE NAME | PEAK VISCOSITY | TROUGH VISCOSITY | BREAKDOWN VISCOSITY | FINAL VISCOSITY | SETBACK VISCOSITY | PEAK TIME VISCOSITY | PASTING TEMPERATURE |
|---|---|---|---|---|---|---|---|---|
| **A** | ***MUCUNA* PRURIENS** | 70.83 | 66.50 | 4.33 | 122.58 | 56.08 | 7.00 | 87.95 |
| **B** | | 73.58 | 69.17 | 4.42 | 127.50 | 58.33 | 7.04 | 87.25 |
| **AV. VAL (x)** | | 72.21 | 67.84 | 4.38 | 125.04 | 57.21 | 7.02 | 87.60 |

**Table 2: Pasting properties of *Mucuna Veracruz***

| TEST | SAMPLE NAME | PEAK VISCOSITY | TROUGH VISCOSITY | BREAKDOWN VISCOSITY | FINAL VISCOSITY | SETBACK VISCOSITY | PEAK TIME VISCOSITY | PASTING TEMPERATURE |
|---|---|---|---|---|---|---|---|---|
| **A** | ***MUCUNA* VERACRUZ** | 71.20 | 66.10 | 4.21 | 122.62 | 56.48 | 7.50 | 87.49 |
| **B** | | 72.85 | 67.89 | 4.34 | 126.47 | 57.89 | 7.54 | 87.02 |
| **AV. VAL (x)** | | 72.01 | 66.99 | 4.28 | 124.55 | 57.19 | 7.52 | 87.26 |

## Results and Discussion

Table 1 and Figure 1 displayed the pasting properties of the flours derived from the various Mucuna bean flour samples. The flour samples' pasting qualities differed substantially ($p < 0.05$). The flour sample from Mucuna Pruriens began pasting at 87.25 °C and took 7.02 minutes to attain its maximum viscosity of 72.21 RVU. At 87.02 °C, the Mucuna Veracruz bean began to paste, and at 7.52 minutes, it had reached its maximum viscosity of 72.01. The two flour samples' pasting temperatures ranged from 87.60 °C for pruriens and 87.26 °C for Veracruz bean flour, respectively.

**The Peak Viscosity (PV):** This is the highest viscosity that can be achieved during heating procedures. It also assesses the flour's water binding capacity index and provides information on the high swelling ability caused by the granules' stiffer polymer structure. For both Pruriens and Veracruz bean flour, the flour samples' peak viscosities were 72.21 and 72.01 RVU, respectively. This suggests that the flour from the Pruriens bean sample is most suited for creating novel food items that need to have strong gelling strength and suppleness.

The tendency of the goods to swell increases with decreasing sample peak viscosity, whereas the tendency of the products to gel increases with increasing sample peak viscosity. Since the Veracruz bean flour sample had the lowest peak viscosity (270.75 RVU), it swells more than the Pruriens bean. When the swelling capacity is required, this is highly suggested.

**Trough viscosity (TV)**: evaluates the paste or gel's resistance to breaking down when cooled [5]. It is the lowest viscosity in the RVA profile's constant temperature phase and serves as an indicator of how stable starch granules are to heating. According to Table 1, the trough viscosities for the Veracruz and Pruriens bean flour samples are 66.99 and 67.84 RVU, respectively. This greater number that the Pruriens bean obtained suggests that the higher the trough, the greater the sample's holding strength and the granules' capacity to tolerate deformation when the flour is heated and exposed to shear stress.

**Final viscosity (FV):** is used to identify the specific quality of starch, which shows how stable the cooked paste is when used. It also shows how easily the starch can solidify into a gel or viscous paste after cooling, and it shows that starch pastes with a high breakdown value are less stable [11]. Mucuna Pruriens beans had the highest final viscosity (cool-paste viscosity) of 125.04 RVU, indicating high retrogression and precipitation of linear molecules. This retrogradation tendency was caused by the flour sample's amylose content and the presence of hydrocolloids [11].

The **Setback viscosity** (SB): is a measure of the retrogradation of linear starch molecules during cooling and the difference between final viscosity (FV) and trough viscosity (TV). It also shows how starch molecules react during heating, cooking, and chilling. While the Small-Sized Horse-Eye bean flour sample showed the lowest setback of 57.19 RVU while chilling, the flour produced from the Mucuna Pruriens bean flour sample displayed the maximum retrogradation of 57.21 RVU, suggesting a promising potential for application in frozen meals.

**The breakdown viscosity (BDV):** This is a measurement of the starch granules' particle structures breaking down at a steady heating temperature, showing how stable the paste is while cooking, was also noted in the tables above. It was found that the Mucuna Pruriens flour had the greatest breakdown (4.3 RVU), while the Mucuna Veracruz bean had the lowest breakdown viscosity (4.28 RVU). This suggests that the paste has very little ability to tolerate harsh processing. According to [11], a low breakdown viscosity might also indicate that the starch has cross-linking qualities.

## Conclusion

At the 0.05 level of significance and 95% confidence interval, the pasting properties findings demonstrated that the observed differences were statistically significant about species, indicating that species had a substantial effect on pasting characteristics. The f-values were 2.93 and 189.69, respectively, which were lower and greater than the f-critical values of 5.98 and 4.28. The pasting qualities of Mucuna Pruriens flour varied by species in this study, with the Mucuna Pruriens bean species exhibiting the greatest pasting qualities of the sample flour values. Veracruz and Pruriens flours both demonstrated their capacity to enhance food quality and applicability for a range of culinary compositions. They can thus find practical use in the production of cakes and other foods.

## Recommendations

It is recommended that more research be done to assess the functional and proximate properties of the biomaterials to determine potential uses in the food sector.

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