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ISOLATION AND CHARACTERIZATION OF MUCILAGE OBTAINED FROM *COLOCASIA ESCULENTA*

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ABSTRACT
Plant Mucilages are pharmaceutically important polysaccharide with wide range of applications such as thickening, binding, disintegrating, suspending, emulsifying, stabilizing and gelling agents. Naturally available mucilages are preferred to synthetic materials due to their non toxicity, low cost, emollient and non irritating nature. The synthetic polymers have certain disadvantages such as high cost, toxicity, environmental pollution during synthesis, non-renewable sources, side effects, less patient compliance, etc. There are no reports on isolation and characterization of mucilage of Colocasia esculenta. Hence, the present study was focused on isolation of mucilage from Colocasia esculenta family Areceae (Cocoyam) and characterized for its morphological characteristics, identification by chemical tests, Solubility, pH, Swelling index, Density, compressibility index and angle of repose etc. The isolated mucilage showed positive results for Molisch's test and Ruthenium red test which indicated presence of carbohydrate and mucilage. Results of physicochemical tests indicated the suitability of mucilage for tablet dosage form as well as a suspending agent for suspension due to its compressibility, flowability, weakly acidic pH, swelling and viscous nature

KEY WORDS
Mucilage, polymer, Colocasia esculenta, characterization.

INTRODUCTION

Mucilages are most commonly used adjuvant in pharmaceutical preparations. Plant Mucilages are pharmaceutically important polysaccharide with wide range of applications such as thickening, binding, disintegrating, suspending, emulsifying, stabilizing and gelling agents. They have also been used as matrices for sustained and controlled release drugs. These polymers such as natural gums and mucilage are biocompatible, cheap and easily available and are preferred to semi synthetic and synthetic excipients because of their lack of toxicity, low cost, availability, emollient and non irritant nature [1, 2].

The synthetic polymers have certain disadvantages such as high cost, toxicity, environmental pollution during synthesis, non-renewable sources, side effects, less patient compliance, etc. They are also used in cosmetics, textiles, paints and paper-making [3]. Acacia, tragacanth, gum ghati, gum karaya are popular examples of plant mucilages.

Mucilages are polysaccharide complexes formed from sugar and uronic acid units. Mucilages form slimy masses in water, are typically heterogeneous in composition. Upon hydrolysis, arabinose, galactose, glucose, mannose, xylose and various uronic acids are the most frequently observed components. Mucilages are obtained mainly from seeds or other plant parts. Some are obtained from marine algae, and from selected microorganisms [4].

Colocasia esculenta (family *Areceae*) is grown in the tropics and sub-tropical regions of the world particularly in Africa for human nutrition, animal feed and cash income for both farmers and traders [5].

Colocasia esculenta (Cocoyam) is vegetatively propagated using the corms and a lesser extent the cormels. As food for human consumption, the nutritional value of the various parts of cocoyam is primarily caloric. The underground cormels provide easily digested starch and the leaves are nutritious spinach-like vegetable, which give a lot of minerals, vitamins and thiamine [6]. There are two major types commonly grown in Nigeria, namely *Colocasia spp* and *Xanthosoma spp*. Cocoyam ranks the third most valuable root crop in Nigeria [7] and it has been reported that the protein and mineral content of cocoyam is higher than other tubers like yam and potatoes [8].

However there are no reports on isolation and characterization of mucilage of *Colocasia esculenta*. Hence, the present study is planned to isolate and characterize mucilage of *Colocasia esculenta*.

MATERIALS AND METHODS

MATERIALS

The fresh *Colocasia esculenta* tubers were collected from Abraka main market in Ethiope East Local Government Area of Delta State in Nigeria**.** The plant was authenticated at the Pharmacognosy Department of the faculty of Pharmacy, Delta State University, Abraka. All other chemicals used were of analytical grade and distilled water was used throughout the experiments.

EXTRACTION OF MUCILAGE

The fresh *Colocasia esculenta* rhizomes were collected and washed with water. The tubers were crushed and soaked in water for 6 hours, boiled for 30 minutes and left to stand for 1 hour to allow complete release of the mucilage into the water. The mucilage was extracted using a muslin cloth bag to remove the marc from the solution. Acetone (in the volumes of three times to the volume of filtrate) was added to precipitate the mucilage. The mucilage was separated, dried in an oven at 40°C, collected, ground, passed through a # 80 sieve and stored in a desiccator at 30°C & 45% relative humidity till use [9, 10].

PHYTOCHEMICAL SCREENING

Preliminary tests were performed to confirm the nature of mucilage obtained. The chemical tests that were conducted are: test for carbohydrates (Molisch's test), test for Tannins (Ferric chloride test), test for proteins (Ninhydrin test), test for alkaloids (Wagner's test), test for glycosides **(**Keller – Killaini test), test for mucilage (Ruthenium red test), test for flavonoid (Shinoda test), test for reducing sugar (Felhing's test) [11, 12].

PHYSICOCHEMICAL EVALUATION

Bulk density & Tapped density: Using a 100ml capacity measuring cylinder and fifty gram of obtained mucilage the bulk and tapped volume of mucilage were determined. Bulk and tapped density of obtained mucilage were calculated using equation 1 and 2

BD = 50/BV ………………………… (1)
TD = 50/TV…………………………. (2)

BD = Bulk density
TD = Tapped density
BV = Bulk volume of Mucilage
TV = Tapped volume of Mucilage

Carr's Index and Hausner Ratio Determination: Data values obtained from bulk density and tapped density from BD and TD above were used to calculate the Carr's index and Hausner ratio, equation 3 and 4

Carr's index = Compressibility index =

$$100 \times \frac{(TD-BD)}{TD} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Hausner ratio = TD /BD ……………….. (4)

Angle of Repose determination: This was determined following standard U.S.P 2010 method [13].

Solubility Behaviour of mucilage: One part of dry mucilage powder was shaken with different solvents and the solubility was determined

Swelling Index of Isolated mucilage: This was determined following standard B.P 2000 method [14].

pH of Mucilage: Cocoyam mucilage sample (5 g) was weighed in triplicate in a beaker, mixed with 20 ml of distilled water, the resulting suspension stirred for 5 minutes and the pH was measured using a calibrated pH meter [15].

Moisture content: An evaporated dish containing 10 grams of mucilage was heated to 105^{o}C in a gallenkamp oven, until such a time that a constant weight was obtained. The average for three readings was obtained

$$MC(\%) = \frac{W_f - W_i}{W_i} \times 100 \quad (5)$$

Where W_f is the final weight sample and W_i initial weight of sample.

RESULTS AND DISCUSSION

After isolation of mucilage from *Colocasia esculenta* the percentage yield of mucilage was found to be 25%. Phytochemical investigation of isolated mucilage showed the presence of mucilage with ruthenium red and also the presence of carbohydrates while tannins, alkaloids, proteins, glycosides, flavonoids were absent as revealed in **Table 1**.

The morphological and physical evaluation study of isolated mucilage shows, it is a whitish powder, with characteristic odour and lustrous in nature (**Table 2**). When dissolved in water, it gives neutral, colloidal solution; it is soluble in warm water, practically insoluble in ethanol, acetone, methanol and benzene (**Table 3**).

Moisture content of mucilage was found to be 7 % which is within official limit. Mucilage decomposes above 200°C, which is a characteristic of most of the polysaccharide. The isolated mucilage was studied for its physicochemical parameters such as swelling index, angle of repose, density, pH and moisture content. The angle of repose indicated that the powder has good flow. The bulk density and tapped density of mucilage was found to be 0.50 and 0.59 gm/cc. The swelling index was found to be 18 and the pH of solution of *Colocasia esculenta* mucilage was found to be 6.1 which indicate that this mucilage will be less irritating to GIT and suitable for uncoated tablet and as a suspending agent in suspension formulation as revealed in **Table 4**.

Table 1: Phytochemical properties of Mucilage powder

Tests	Observation
Test for Carbohydrates (Molisch's test)	+
Test for Tannins (Ferric chloride test)	_
Test for proteins (Ninhydrin test)	_
Test for alkaloids (Wagner's test)	_
Test for glycosides (Keller – Killaini test)	_
Test for mucilage (Ruthenium red test)	+
Test for flavonoid (Shinoda test)	_
Test for reducing sugar (Felhing's test)	_

+ Present - Absent

Table 2: Organoleptic properties of mucilage

Colour	Odour	Taste	Fracture	Texture
Off white	Odourless	Characteristic	Smooth	Regular

Table 3: Solubility profile of mucilage

Solvents	Solubility
Cold water	Swell to form a gel
Hot water	Soluble
Ethanol	Insoluble
Benzene	Insoluble
Acetone	Insoluble

Table 4: Physicochemical Properties of Cocoyam Mucilage.

Parameters	Observations
Percentage yield	25 %
Solubility	Swells in cold water, dissolves in warm water forming colloidal solution. Insoluble in organic solvents
Swelling index	18
Bulk density	0.50 g/ml
Tapped density	0.59 g/ml
Carr's index (%)	15
Hausner's ratio	1.18
Angle of repose	32.35°
Moisture content	7%
pH of mucilage	6.1

CONCLUSION

The mucilage extracted from *Colocasia esculenta* will be useful as excipient for oral drug delivery systems. Results of physicochemical tests indicated the suitability of mucilage for tablet dosage form as well as a suspending agent for suspension due to its flowability, weakly acidic pH, swelling potential and viscous nature.

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