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Extraction and characterization of mucilaginous material from Dawul Kurundu Leaves (*Neolitsea involucrate*) and Godapara Fruits (*Dillenia retusa*)

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Abstract

Dawul kurundu leaves (DKL) (*Neolitsea involucrate*) and Godapara fruits (GF) (*Dillenia retusa*) are two main mucilaginous materials usedin traditional culinary practices. This study reports on the extraction and characterization of mucilaginous material from DKL and GF. The yield of the mucilaginous material of DKL and GF were recorded as 2.85% w/w and 9.18% w/w respectively. Various parameters such as organoleptic properties, solubility, swelling index loss on drying, ash value together with flow behavior were carried out to characterize the dried mucilaginous materials. DKL showed a characteristic cinnamon oudor and taste and GF showed slightly offensive odour and taste. The result showed that both extracted mucilaginous materials exhibited excellent flow properties and were soluble in warm water and insoluble in organic solvents. It had a good swelling index of DKL and GF were 27.8%, 18.14% respectively. Both mucilaginous materials had acidic nature. The results of the evaluated properties showed that DKL and GF mucilaginous materials have acceptable organoleptic properties and micromeritic properties and can be used as a several food applications.

Keywords: natural polymers, dawul kurundu leaves, godapara fruits, mucilaginous materials

1. Introduction

In recent years, plant derived natural polymers have evoked interest due to owing their versatile applications in health concerning life style. The plant based polymers have been studied for their diverse application in different areas mainly pharmaceutical industry, as well as food, cosmetics, textiles, paints and paper-making. Most of the research studies focus on their applications in pharmaceuticals but they have most common applications on food industry as viscosity enhancers, stabilizers, solubilizers, emulsifiers, bio adhesives, binders etc. [10] In addition to that many research studies have shown that water-soluble gum and mucilaginous materials may have beneficial effects on human health such as including reducing serum cholesterol levels [13].

Mucilaginous material extracted from Dawul kurundu leaves (*Neolitsea involucrate*) and Godapara fruits (*Dillenia retusa*) are used in traditional dishes for centuries in Sri Lanka. Mucilaginous materials extracted are used as textural improver for traditional sweet “Aasmie” and thickening agent in syrups. However, these mucilage materials are not commonly used in food products due to lack of information onthe physicochemical properties of the mucilage and the extraction process.

Although mother nature gave several hydrocolloid gums and mucilaginous materials, Sri Lanka still imports a substantial amount of hydrocolloid gums, mainly gelatine, gum arabic guar gum, sodium alginate, locust bean gum etc. If these locally available gum and mucilaginous materials introduced to domestic market, they can substitute for some of the imported materials as well as economic support for the local farmers.

The aim of the present study was to develop an extraction procedure that optimizes yield and functional properties of the polysaccharide gums. This paper reports on the results of the extraction procedure and physical characterization of the major fraction of dried mucilaginous material from Dawul kurundu leaves and Godapara fruit.

2. Material and methodology

Fresh matured Dawul kurudu leaves and Godapara fruits were collected from trees from Galle, Sri Lanka. They were washed and air died.

2.1 Extraction of mucilaginous materials

One hundred grams of leaves were steam blanched in 1% SMS solution for 10 minutes. Just after blanching leaves were washed with cold distilled water. Leaves were mashed manually in in 1% citric acid solutionas leaves: water 1:8 ratio. Extract was filtered through six layers of muslin cloths.

The extraction of mucilaginous material from Godapara fruits was carried out by procedure descried by Amin *et al* (2007) [1] with few modifications. There in fruits were chopped in to small particles and ground into a paste using laboratory blender. Chopped mass was mixed with distilled water 20:1 ratio. Mixture was heated and stirred continuously at 45 °C for one hour using water bath and mixture was allowed to stand overnight at 4 °C. Concentrated solution was filtered through six layers of muslin cloths.

2.2 Decolouring

Decolouring of mucilaginous material was done by using activated carbon column. Mucilaginous material was filtered through a granular activated carbon filter with 10 mL/ min rate. Filtrate was centrifuged under 3000 rpm for five minutes. Extract was precipitated with three times volumes of 95% ethanol and it was dried in 45 °C oven for 10 hr. The dried mucilage was then collected, ground and passed through 80 mesh sieve. The ground mucilage product was stored in an air tight container at ambient conditions.

2.3 Characterization of the mucilaginous material

i) *Organoleptic test*

The colour, odour and taste of the extracted mucilaginous material were observed.

ii) Solubility test

The separated One gram of mucilaginous powder was dissolved in 2 mL of distilled water, distilled water at 45°C, Acetone, Ethanol, Pet ether and Chloroform and the solubility pattern of the mucilaginous extract was observed and recorded.

iii) pH of gum

One gram of dried mucilaginous powder was dissolved in 99 mL of distilled water and shaked for 5 min. The pH of the solution was determined by using a digital pH meter.

iv) Loss on drying

One gram of powder was weighed accurately in a moisture dish and was dried in a hot air oven at 105 °C until a constant weight was obtained. The percentage of weight loss of the powder was calculated using Eq. 1.

$$\text{Loss on drying} = \frac{\text{initial weight} - \text{final weight}}{\text{initial weight}} \times 100 \qquad (1)$$

v) Determination of swelling index

The tapped volume occupied by 5 g of the extracted mucilaginous material was measured. The gum was then dispersed in 85 mL of distilled water and the volume made up to 100 mL and was allowed to stand for 24 hr. The volume of the mucilaginous material was then determined and the swelling index [7] was calculated as per Eq. 2.

$$\text{Swelling index} = \frac{\text{final volume} - \text{initial volume}}{\text{final volume}} \times 100 \qquad (2)$$

vi) Ash content

Ash content such as total ash, acid insoluble ash and water-soluble ash were determined using Eq. 3, 4 and 5, respectively.

$$\text{Total ash value} = \frac{\text{weight of ash}}{\text{weight of dried powder}} \times 100 \qquad (3)$$

$$\text{Acid insoluble ash} = \frac{\text{weight of acid insoluble ash}}{\text{weight of dried powder}} \times 100 \qquad (4)$$

$$\text{Water soluble ash} = \frac{\text{weight of water soluble ash}}{\text{weight of dried powder}} \times 100 \qquad (5)$$

vii) Determination of Density

a) Bulk Density (D_b)

Ten grams of the extracted mucilaginous powder was introduced into a clean, dry 100 mL measuring cylinder and the volume was recorded. It is expressed in g/ml and was calculated as per Eq. 6,

$$\text{Bulk Density } (D_b) = \frac{\text{weight of powder blend}}{\text{weight of appatrent volume}} \qquad (6)$$

b) Tapped Density (D_t)

Ten grams of the extracted mucilaginous powder was introduced into a clean, dry 100 mL measuring cylinder. The measuring cylinder was then tapped 50 times from a fixed height of about 20 mm and the tapped volume was recorded. It is expressed in g/ml and was calculated as per Eq. 7,

$$\text{Tapped Density } (D_t) = \frac{\text{weight of powder blend}}{\text{tapped volume}} \qquad (7)$$

c) Bulkiness

The inverse of bulk density is called bulkiness.

$$\text{Bulkiness} = \frac{1}{\text{bulk density}} \qquad (8)$$

viii) Powder cCompressibility (Carr's Consolidation Index)

This property is also known as compressibility. Carr's consolidation index was calculated using Eq. 9 and 10.

$$\text{Carr's index} = \frac{\text{tapped density} - \text{bulk density}}{\text{tapped density}} \times 100 \qquad (9)$$

$$\text{Hausner's ratio} = \frac{\text{tapped density}}{\text{bulk density}} \qquad (10)$$

3. Results and discussion

The yield of the mucilaginous material of Dawul kurundu leaves (DKL) and Godapara fruits (GF) were recorded as 2.85% w/w and 9.18% w/w respectively. Dried mucilaginous material for Dawul kurundu leaves gave relatively low yield compared to Godapara fruits.

3.1 Organoleptic properties

Organoleptic properties of the two mucilaginous materials are listed at Table 1.

Table 1: Results for organoleptic evaluation

Organoleptic characters	Dried mucilaginous material of Dawul kurundu leaves	Dried mucilaginous material of Godapara fruits
Odour	Characteristic pale cinnamon odour	Slightly offensive odour
Colour	Brownish	Yellowish brown
Colour of 5% viscous solution	Light brown	Yellow
Taste	Slightly cinnamon taste	Unattractive taste
Texture	Fine and irregular shape	Fine and irregular shape

According to the results the dried mucilaginous material obtain from the DKL shows a characteristic cinnamon taste and odour while GF was not very pleasant. But GF shows a light colour than DKL in dried mucilaginous material whereas both show fine irregular pattern after precipitation.

Table 2: Solubility of mucilaginous material in different solvents

Solvent	Solubility of mucilaginous material of Dawul kurundu leaves in powder form	Solubility of mucilaginous material of Godapara fruits in powder form
Cold water	Partially soluble	Partially soluble
Hot water 45 °C)	Soluble	Soluble
Ethanol	Insoluble	Insoluble
Pet ether	Insoluble	Insoluble
Acetone	Insoluble	Insoluble
Chloroform	Insoluble	Insoluble

DKL and GF shows same pattern in their solubility profile in different solvents (table 2). Both powdered mucilaginous materials of DKL and GF were partially soluble in cold water and completely soluble in hot water. Optimum solubility of both mucilaginous materials was observed at 45 °C as well as those materials kept at 4 °C overnight. When the temperature elevated above 60 °C viscosities of the both mucilaginous materials deducted remarkably. This may be due to the disintegration of the polymer. When preparing aqueous solution of mucilaginous materials heating is necessary to improve the effectiveness of dissolution process. Mucilaginous material of DKL and GF do not dissolve in organic solvents such as ethanol, pet ether, and acetone, chloroform etc. Therefore these solvent can be used as precipitating agents to segregate these materials for industrial purposes. However ethanol and acetone are the most popular precipitating agents for gum and mucilaginous materials.

3.2 Micromeritic study of mucilaginous materials

Table 3: Micromeritic data of mucilaginous materials

	Mucilaginous material of Dawulkurundu leaves	Mucilaginous material of Godapara fruits
pH of 1% solution	6.15 ± 0.2	5.6 ± 0.2
Loss on drying	12.16 ± 0.2	9.91 ± 0.2
Swelling index	27.8%	18.14%
Total ash value	3.4%	2.21%
Acid insoluble ash	0.67%	0.65%
Water soluble ash	2.16%	1.42%
Bulk Density	0.54 g/cm^3	0.72 g/cm^3
Tapped Density	0.61 g/cm^3	0.89 g/cm^3
Bulkiness	1.85 (cm^3/g)	1.39 (cm^3/g)
Carr's index	11.48%	13.59%
Hausner's ratio	1.12	1.16

The data given in table 3 indicate that 1% w/v solution of mucilaginous material of DKL and GFin water gave pH of 6.15 and 5.6 respectively. Both mucilaginous materials show acidic pH while DKL shows less acidic and near to neutral pH. Hence DKL may be less irritating to the gastrointestinal tract. Knowledge of the pH is an important parameter in determining the suitability of mucilaginous materials in different types of food formulation as stability and physiological activity of most food preparations depends on pH [3].
In the optimum ambient temperature, moisture will influence the activation of enzymes and proliferation of microorganisms, thereby affect the shelf life of dried mucilaginous powder. Further it is important to identify suitable barrier packaging for the powdered mucilaginous materials as specially in industrial applications. The results for loss on drying given in table 3 for DKL and GF are 12.16%, 9.91% respectively and it is relatively low values. This indicated that mucilage are hygroscopic in nature and need to be stored in air-tight containers.GF has lower moisture content and is probably less liable to microbial contamination as compared to DKL mucilage although the difference between their moisture contents is not significant [12].
Both DKL and GF shows high swelling characteristics while DKL shows highest swelling index. Swelling capacity of a substance reflects the increase in volume of that substance following water absorption. The relatively higher swelling capacity values that was observed in DKL compared to GF could possibly be due to the higher powder porosity. Generally high swelling index gums and mucilaginous materials may perform well as binder /disintegrant /matrixing agent.
The ash values of DKL and GF was 3.4% and 2.21% respectively (table 3). Ash values reflect the level of adulteration. Adulteration by sand or soil is immediately detected as the total ash which is normally composed of inorganic mixtures of carbonates, phosphates, silicates and silica. Therefore, the low values of total ash and acid insoluble ash obtained in this study indicate low levels of contamination during gathering and handling of crude *Neolitsea involucrate* leaves and *Dillenia retusa* fruits.
The bulk and tapped densities of powdered mucilaginous materials give an insight on the packing and arranging the particles and the compaction profile of a material (11). The Hausner's ratio and Carr's Index can be used as an index for the flowability of a dried powder because the densification occurring during tapped density measurement is influenced by the same inter-particulate interactions which are affecting the flow of powders [9]. Bulkiness value indicates that the powder is 'light' in nature. From the results shown in table 3, GF has a Carr's index of 13.59 which signifies good flow character while DKL has the Carr's index of 11.48 which signifies excellent flow property. As with the Hausner's ratio, GF has a value of 1.16 which also signifies good flow character while DKL has a value of 1.12 which corresponds to excellent flow property.

4. Conclusion

The results obtained from this study proven for the first time, the fundamental characteristic of mucilaginous materials from DKL and GF and recommend further exploration of its potential for use in a variety of fields in food industry. The present investigation is a primary platform to indicate the suitability of these mucilaginous materials as a binding agent. Further work will continue to develop insights to the various applications of these materials.

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6. References

1. Amin MA, Ahamad AS, Irahin N, Yaha N, Yin YY, Extraction, Purification and Characterization of Durian (Durio zibethinus) Seed Gum, Food Hydro collouds. 2007; 21:273-279.
2. Bhaskar DA, Uttam KJ, Mahendrasingh A, Jayram CM, Bhanudas SR. Plant Exudates and Mucilage as Pharmaceutical Excipients. Journal of Advanced Pharmacy Education and Research. 2013; 3(4):387-401.
3. Emejea M, Isimia C, Byrnb S, Fortunakc J, Kunlea O, Of oefuled S. *et al.* Extraction and Physicochemical Characterization of a New Polysaccharide Obtained from the Fresh Fruits of Abelmoschus Esculentus. Iranian Journal of Pharmaceutical Research, 2010; 10(2):237-246.
4. Girish KJ, Dhiren PS, Prajapatia DV, Jainb VC. Gums and mucilage: versatile excipients for pharmaceutical formulations Gums and mucilage, Asian Journal of Pharmaceutical Sciences, 2009; 4(5):308-322.
5. Kulkarni GT, Gowthamarajan K, Rao B, Suresh B. Evaluation of binding properties of selected natural gums: J. Sci. Ind. Res. 2002; 61:529-532.
6. Marceliano B, (ed), Structure and Function of Polysaccharide Gum-Based Edible Film and Coatings, Edible Films and Coatings for Food Applications, Embuscado, M.E; Hurber, KC, 2009, 1-113.
7. Musa H, Muazu J, Bhatia PG, Evaluation of Fonio (Digitaria Exilis) Starch as a Binder in Paracetamol Tablets, Nigerian Journal of Pharmaceutical Science. 2008; 7(1):56-66.
8. Ohwoavworhua FO, Adelakun TA, Some physical characteristics of microcrystalline cellulose obtained from raw cotton of *Cochlospermum planchonii*. Trop. J Pharm Res. 2005; 4:1-7.
9. Oyi A, Allagh TS, Olayemi OJ, Comparative Binding Effects of Wheat, Rice and Maize Starch in Chloroquine Phosphate Tablet Formulations, Research Journal of Applied Sciences Engineering and Technology. 2009; 1(2):77-80.
10. Reddy M, Manjunath K, Pharmaceutical Applications of Natural Gums, Mucilages and Pectins: A Review, International Journal of Pharmaceutical and Chemical Sciences. 2013; 2(3):1233-1239.
11. Russel J, Lantz J, Pharmaceutical Dosage Forms. Marcel Dekker Inc, New York. 2005; 166-167.
12. Singh AK, Selvam RP, Sivakumar T, Isolation, characterisation and formulation properties of a new plant gum obtained from mangifera indica, Int J Pharm Biomed Res, 2010;1(2):35-41.
13. Somboonpanyakul P, Wang Q, Cui w, Barbut S, Jantawat, P, Malva nut gum. (Part 1): Extraction and physiochemical characterization, *Carbohydrate polymers*, 2006; 64:274-253.
14. Tiwari P, Kumar B, Kaur M, Kaur G, Kaur H, Phytochemical screening and Extraction: A Review, Internationale Pharmaceutica Sciencia. 2011; 1(1):98-106.