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PHYSICOCHEMICAL PROPERTIES OF NATURAL POLYMER USED AS NANOCOATING OF FRUITS

Alvikar A. R.[1]*, S. A. Patil[1], S. B. Kubal[1], S. P. Salunkhe[1] and D. K. Gaikwad[2]

[1]Department of Botany, Shivaji University, Kolhapur.

[2]Vivekanand College Kolhapur (MS).

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***Corresponding Author**

Alvikar A. R.

Department of Botany,

Shivaji University, Kolhapur.

ABSTRACT

The Inflorescence of *Parkia biglandulosa*, flowers of *Bombax ceiba*, *Spathodia campanulata*, fruits of *Muntingia calabura*, *Artocarpus heterophyllus*, *Bridelia scandens* leaves of *Jaquinia armilaris* were used for the isolation and characterization of natural Polymers. The thin film of natural polymer was prepared with different ingredients along with Corn Zein and applied for the coating of Tomato and Grape fruits. The physiocochemical properties of natural polymer were analysed. It was noticed that the tapped density (0.90 gm/cc) of *Parkia biglandulosa* and *Muntingia calabura* shows higher than the other mucilage powder, while the bulk density of *Parkia biglandulosa* and *Muntingia calabura* was (0.66 gm/cc). The Carr's Index and Hausner's ratio of *Artocarpous* (fruit) was (92.3 %) higher than the other mucilage. The oil absorption of *Muntingia calabura* and *Spathodea canpanulata* was higher than the other mucilaginous powders. The Water holding capacity of *Muntingia calabura* mucilage was 6 to 7 times higher than the other mucilage. The zeta potential of the mucilage powder of *Parkia biglandulosa, Bombax ceiba, Muntingia calabura and Spathodea campanulata* was higher than other mucilages which improves the flow properties of natural polymers. These natural polymers with better viscosity is helpful to move the various drugs or nutrients through chewing gum, butter, chocolate, margarin candy as well as other food items, this will improves the quality of these products. The results of the present study indicates that the mucilage isolated from various plants indicates the tapped and bulk density in the range of 0.60 to 0.90 gm/cc which indicates the tendency of mucilage particle to adhere to one another. Hence due to slimy solution of mucilage in water and its insolublity in organic solvents, it can perform as best medium in disintigrant and binder or it might be utilized as a gelling agent due to its sticky nature in various pharmaceutical

formulations as well as it might be utilized as a best coater for various types of fleshy fruits during its post harvest storage.

KEYWARDS: Physicochemical properties, Corn Zein, Zeta potential.

INTRODUCTION

Nature has provided us a wide variety of materials to help improve and sustain the health of all living things either directly or indirectly. Mucilage is a plant based polymers studied for their significant role in pharmaceutical dosages, it act as film coating agent, emulsifiers, bioadhesives and binders. The mucilage are characterized for physiocohemical powder characteristic, these are semi-synthetic and synthetic expients, due to lack of toxicity low cost, availability, soothing action and non-irritant nature. (Dwgade et. al 2012). Gums and mucilages are typically heterogeneous polyuronides with similar composition which upon hydrolysis, they yield sugars such as arabinose, galactose, glucose, mannose, xylose and various uronic acids (Kokate et al, 2002).

Gums and mucilages are widely used natural materials for conventional and novel dosage forms, (Umeshkumaret al, 2012).

The synthetic polymers have certain disadvantages such as high cost, toxicity, environmental pollution during synthesis, non-renewable sources, side effects, less patient compliance, etc (Young and Lovell 2014). While the advantages of natural plant based materials include low cost, natural origin, free from side effects, bioacceptable, renewable source, environmental-friendly processing, local availability (especially in developing countries), better patient tolerance as well as public acceptance, from edible sources, etc (Williams and Wilkins)

The need to explore more natural sources of gums in addition to those already known is becoming more demanding because of its wider application in pharmacy, food supplements, printing and binding industries.

The primary motivation for their utilization in the foodstuffs, environmental, cosmetic and construction industries (Garcia et al, 2012). The inflorescence of *Parkia biglandulosa* Whight & Arn, flowers of *Bombax ceiba* Linn, *Spathodia campanulata* P.Beauv and fruits of *Muntingia calabura*.

MATERIALS AND METHODS

Young mature inflorescence of Parkiya biglandulosa, fruits Bridelia scandens, Muntingia calabura , flowers of Bombax ceiba, Spathodia campanulata and leaves of Jaquilina armilaris were collected form adjoining hills of Panhala Dist Kolhapur, and Shivaji University campus, Kolhapur.

Extraction of Mucilage

The mucilage content was extracted first 100 g of plant part that is mature fruits, leaves and flowers of each plant were extracted in 1000 ml of distilled water and boiled for 15 min. It was filtered through buckner funnel, without filter paper. Residue again boiled for 15 min and filtered through musclin cloth. Then equal volume of ethanol was added to precipitate the mucilage. Precipitate was condensed by using rotary evaporator. Precipiated mucilage was dried in oven 40^{o} c. The yield of mucilage was stored in airtight container under room temperature and used for further analysis.

Tapped density (M. R. Shivalingam 2010).

Ten gram of plant powder taken in 100 ml measuring cylinder and tapped for 1000 times and record tapped volume of the powder.

M = mass of the powder, Vt = tapped volume of the powder.

Tapped density (Dt) = M/Vt in (gm/ wt)

Bulk Density (M. R. Shivalingam 2010).

Ten gram of plant powder poured in 100 ml measuring cylinder and record the volume of powder in measuring cylinder.

M = mass of the powder, Vo = Bulk volume of the powder

Bulk density (Db) = M/Vo in (gm/ wt)

Oil Absorption capacity (Raghavendra et al 2007)

Take 0.25 g of plant powder then add ml of oil take weight and record oil absorbed sample weight.

Oil absorption = oil absorbed sample weight - Dry sample weight / Dry sample weight. (g oil/ g dry sample wt).

Water holding capacity (Raghavendra et al 2007)

Take 0.125 g dry mucilagenous plant powder add 12.5 ml of distilled water then record wet sample weight.

Water holding capacity = wet sample wt - dry sample wt / dry sample wt. in g powder / g dry sample wt.

Percentage compressibility or Carr's index (Rao et al 2014)

Carr's index (%) = tapped density - bulk density / tapped density X 100

Housner's Ratio (Rao et al 2014)

Hausner's ratio was calculated by a formula

Housner's Ratio = Tapped density / Bulk density

RESULT AND DISCUSSION

The bulk and tapped density of mucilage obtained from different plant parts is shown in fig. No 1 and 2. The tapped density of *Parkia biglandulosa* and *Muntingia calabura* is higher than the other mucilage powder that is (0.90 gm/cc). While the bulk density of *Parkia biglandulosa* and *Muntingia calabura* is found to be 0.66 gm/cc.

The Carr's Index of different plant parts is shown in fig. No3. It is evident from the fig. that the Carr's Index of Artocarpous (fruit) is (92.3 %) higher than the other mucilage plant part such as inflorescence of *Parkia biglandulosa*, fruits of *Muntingia calabura, Bridelia scndens,* flowers of *Spathodea campanulata*, *Bombax ceiba* and leaves of *Jaquinia armilaris.*

The Hausner's ratio is the ratio of Tapped to the bulk density is shown in fig. no. 4. It is noticed that the ratio of *Artocarpous heterophyllous* and *Aegle marmelos* is higher than the other mucilage powders.

The Oil absorption capacity of mucilage obtained from various plant parts is shown in fig. no.5. It is noticed that the oil absorption of *Muntingia calabura* and *Spathodea canpanulata* is higher than the other mucilaginous powders..

The swelling index of mucilage powder obtained from various plant parts is shown in fig. no 6. It is noticed that the Water holding capacity of *Muntingia calabura* mucilage is 6 to 7 times higher than the other mucilaginous plant parts.

The tapped density (0.90 gm/cc) of *Parkia biglandulosa* and *Muntingia calabura* was higher than the other mucilage powder, while the bulk density of *Parkia biglandulosa* and *Muntingia calabura* was 0.66 gm/cc. The Carr's Index of *Artocarpous* (fruit) was (92.3 %) higher than the other mucilages such as inflorescence of *Parkia biglandulosa*, fruits of *Muntingia calabura, Bridelia scndens, flowers of Spathodea campanulata, Bombax ceiba and leaves of Jaquinia armilaris.* The Hausner's ratio of *Artocarpous heterophyllous* and *Aegle marmelos* was higher than the other mucilage powders. The oil absorption of *Muntingia calabura* and *Spathodea canpanulata* was higher than the other mucilaginous powders. The Water holding capacity of *Muntingia calabura* mucilage was 6 to 7 times higher than the other mucilage.

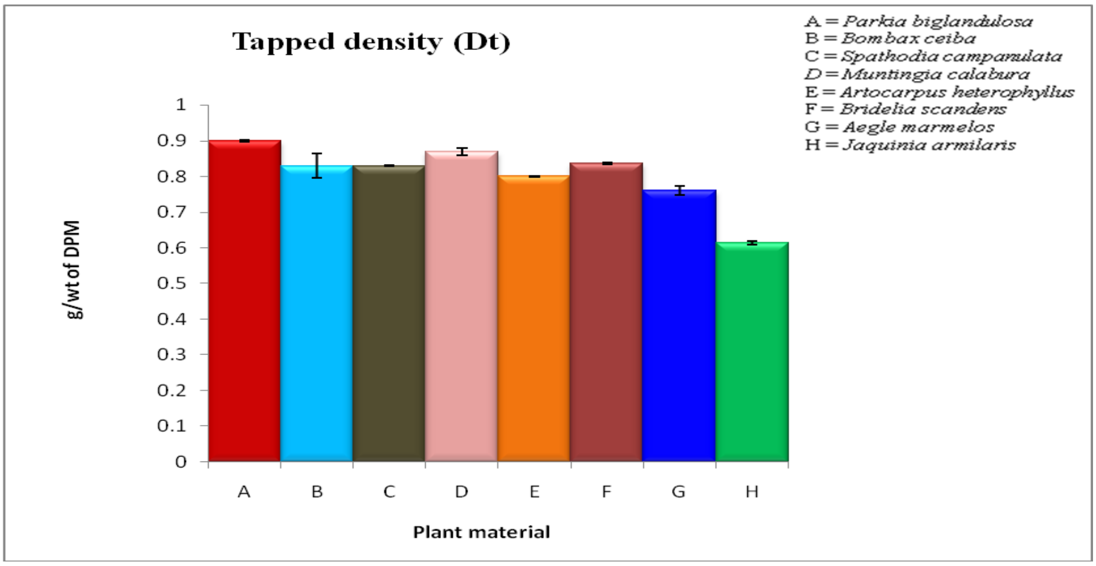

Fig. No. 1: Tapped density of Mucilagenous plants.

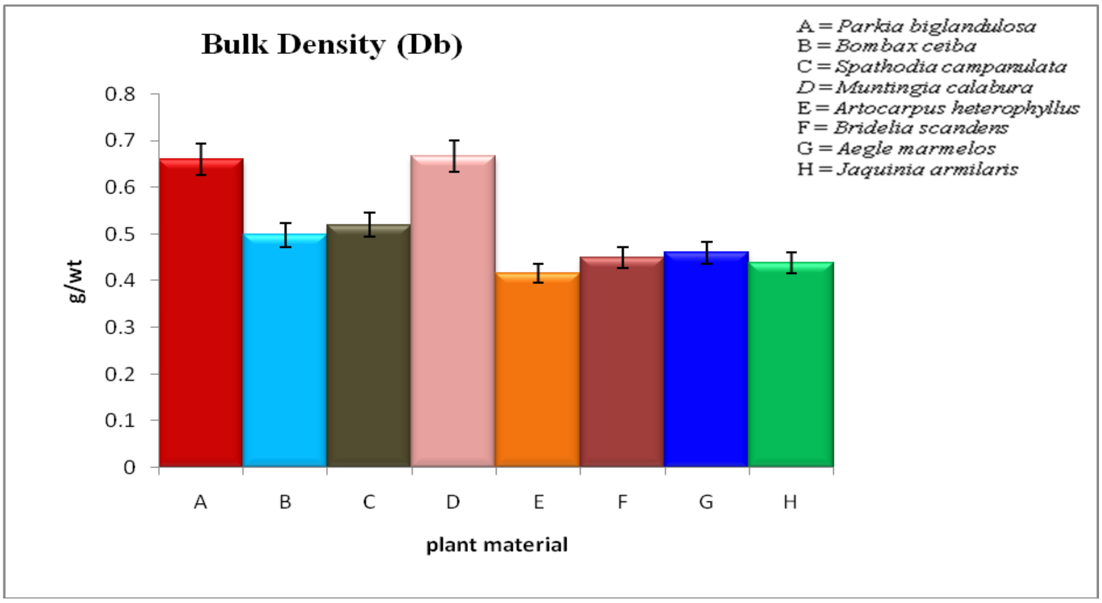

Fig. No. 2: Bulk density of Mucilagenous plants.

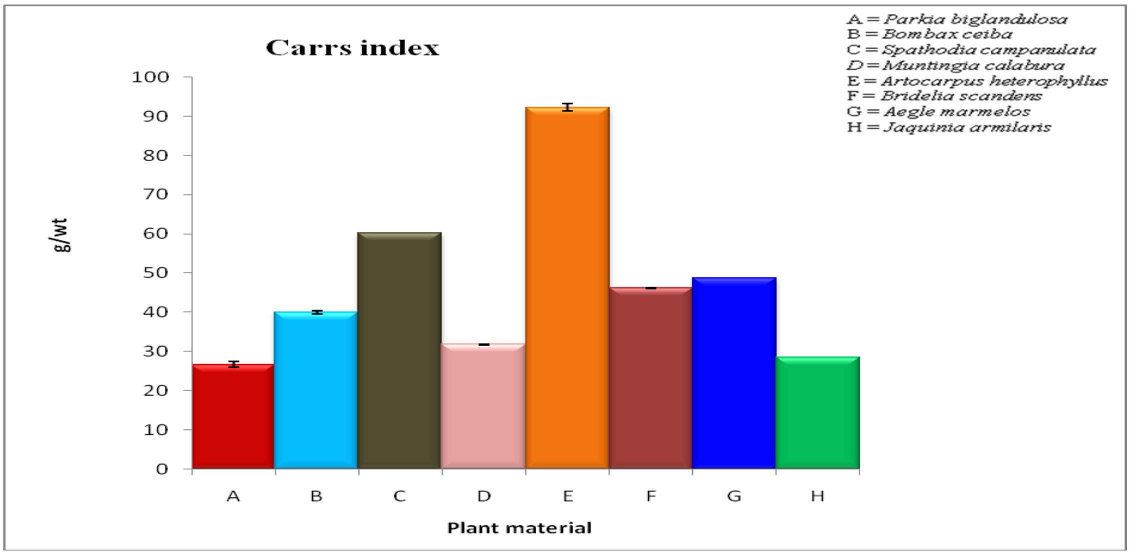

Fig. No. 3 Carr's Index of Mucilagenous plants.

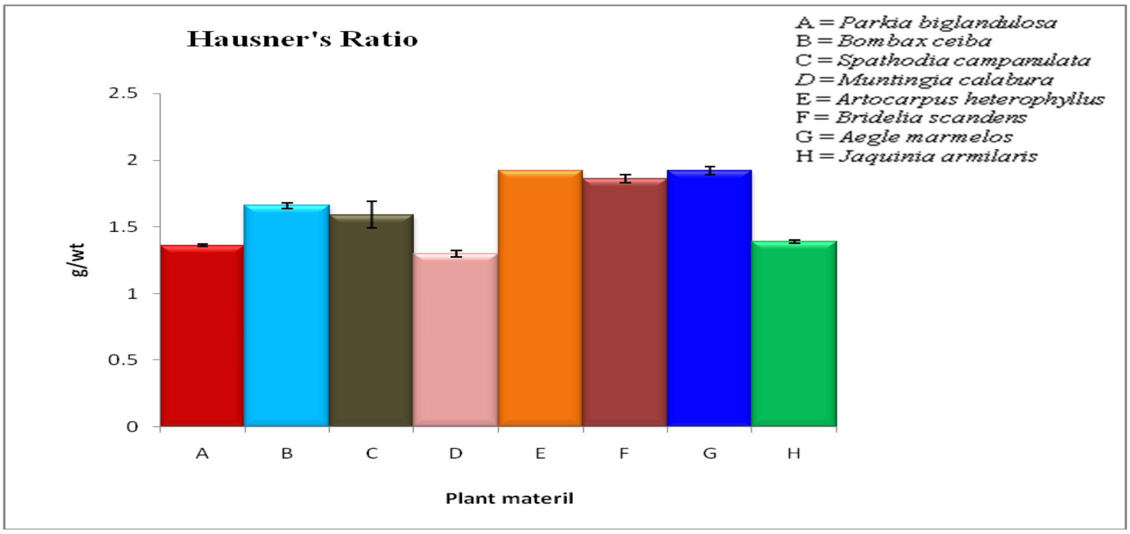

Fig. No. 4 Hausner's Ratio of Mucilagenous plants.

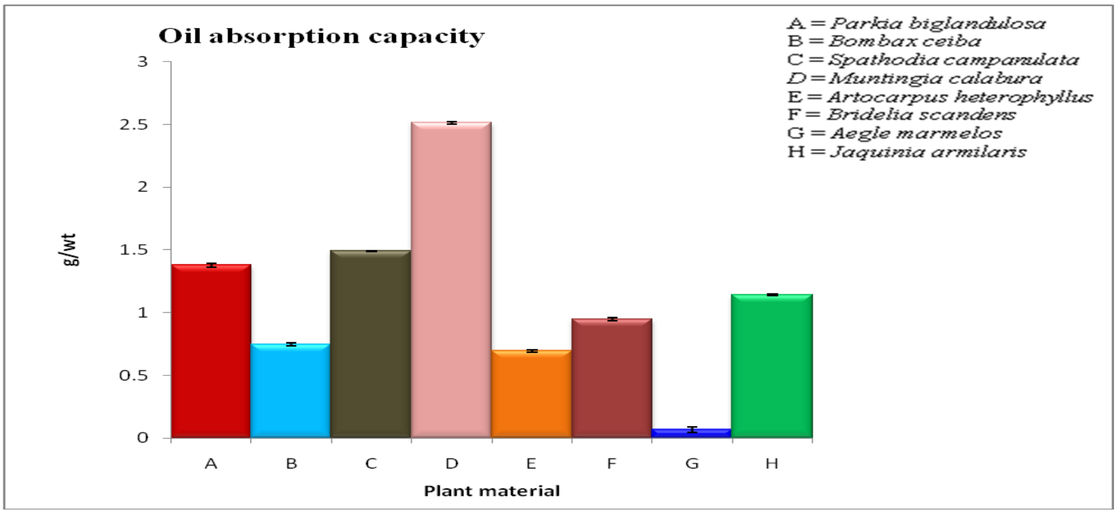

Fig: No. 5 Oil absorption capacity of Mucilagenous plants.

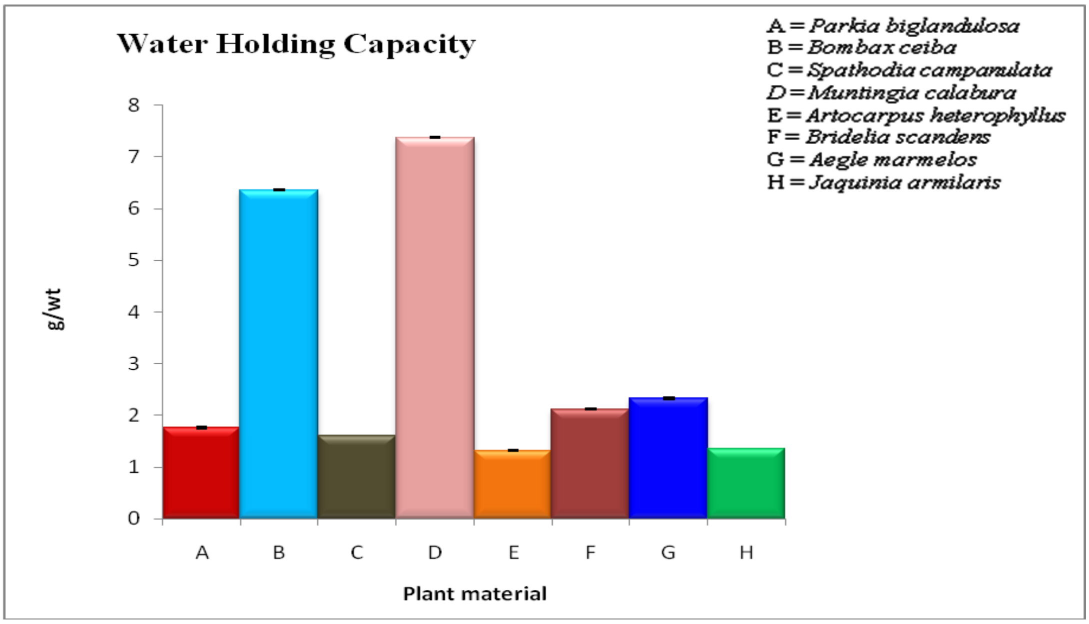

Fig. No. 6 Water Holding Capacity of Mucilagenous plants.

REFERENCES

1. M.R.Shivalingam, K.S.G.Arul Kumaran, D.Jeslin, Y.V.Kishore Reddy, M.Tejaswini, Ch.Madhusudhana Rao, V.Tejopavan(2010). Cassia Roxburghii seed Galactomannan-A Potential Binding Agent in the Tablet Formulation. J. Biomed Sci and Res, 2(1): 18-22.
2. Umeshkumar M. Deogade, Vilas N. Deshmukh, Dinesh M. Sakarkar (2012). Natural gums and mucilages in NDDS: Applications and Recent approaches. *International Journal of PharmTech Research*, 4(2): 799-814.
3. Young and Lovell (2014), Introduction to polymers, 2nd edition, 2-20.
4. Lippincott Williams and wilkins ,Remington, The science and Practice of pharmacy, 21st edition, I, 223,305, 320,756
5. Kokate, C.K., Purohit, A.P., and Gokhale, S.B., *Text Book of Pharmacognosy* (18th Edition, Nirali Prakashan, 41Budhwar Peth, Jogeshwari Mandir Lane. 2002).
6. Garcia-Cruz E.E, J. Rodriguez-Ramirez, L.L.Mendez Legunas, L. Medina-Torres (2012). Rheological and physical properties of spray- dried mucilage obtained from Hylocereus undatus cladodes. *Carbohydrate polymers, 91:* 394-402.
7. Williams and Wilkins (2013). Role of Manganese In *Principles of Nutrition.* (Publ.) John Wiley, N.Y, 735-751.