The Pharma Innovation Journal 2022; 11(2): 2425-2428

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(2): 2425-2428

www.thepharmajournal.com
Received: 11-12-2021
Accepted: 23-01-2022

Nutan Singh
Department of Plant Physiology, Agricultural Biochemistry and Medicinal and Aromatic Plants, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Pratibha Katiyar
Department of Plant Physiology, Agricultural Biochemistry and Medicinal and Aromatic Plants, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Manendra Kumar Ghritlahare
Department of Plant Physiology, Agricultural Biochemistry and Medicinal and Aromatic Plants, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

PS Pisalkar
Department of Agricultural, Processing and Food Engineering COAE, IGKV Raipur, Chhattisgarh, India

Pooja Sahu
Department of Agricultural, Processing and Food Engineering COAE, IGKV Raipur, Chhattisgarh, India

S Patel
Department of Agricultural, Processing and Food Engineering COAE, IGKV Raipur, Chhattisgarh, India

Corresponding Author:
Nutan Singh
Department of Plant Physiology, Agricultural Biochemistry and Medicinal and Aromatic Plants, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Characterization of three biopolymers extracted from Dhawara (*Anogeissus latifolia*), Salai (*Boswellia serrata* Roxb.) and Chironji (*Buchanania lanzan* Spreng) from Balrampur (North Chhattisgarh Region)

Nutan Singh, Pratibha Katiyar, Manendra Kumar Ghritlahare, PS Pisalkar, Pooja Sahu and S Patel

Abstract
Biopolymers produced from natural resources used in food, pharmaceutical, textile, cosmetic and leather industries etc. As it is evident by earlier studies, it is safe for human consumption having the properties of emulsifier, stabilizer and binder. Therefore, the characterization of three biopolymers extracted from Dhawara (*Anogeissus latifolia*), Salai (*Boswellia serrata* Roxb.) and Chironji *(Buchanania lanzan* Spreng) in two experimental year 2018-19 and 2019-20 at Balrampur (North Chhattisgarh Region) was done to analyze the physico-chemical properties. The tested physicochemical parameters were: moisture and ash contents, nitrogen, protein, pH and tannin content. The analysis results showed: 4.21, 4.01 and 1.42% ash content, 4.10, 4.36 and 4.77 pH values, 4.59, 2.89 and 5.69% protein, 0.74, 0.46 and 0.91% nitrogen, 12.83, 9.77 and 18.33% moisture content, 8.12, 3.14 and 7.61% tannin, 1.38, 0.71 and 1.03% phenol content for *Anogeissus latifolia*, *Buchanania lanzan* Spreng. and *Boswellia serreta* Roxb respectively. SEM (Scanning electron microscopy) analyzed for element composition using EDX system indicated that Ca, K and Mg were the major elements of all the three gums.

Keywords: Characterization, biopolymers, *Anogeissus latifolia, Boswellia serrata, Buchanania lanzan*

Introduction
Plant gums are organic compounds that exude from fruit, trunk and branches of trees, either spontaneously or as a result of environmental stress *i.e.*, high temperature, drought, mechanical damage to the plant, such as incision of the bark or the removal of branches, or as a result of biotic stress bacterial or fungal infection. Plant secret glassy masses that range from dark brown to pale yellow in colour. These gums are high molecular weight polymeric compounds mostly comprised of C, H, O, and N that can have colloidal characteristics in a suitable solvent or act as a swelling agent at low dry weight. They are found in nature as salts (particularly Ca & Mg salts), and in some cases proportions of the hydroxyl group are esterified, most frequently as acetates. In general terms gums are either hydrophobic or hydrophilic. Resins, rubber, and other hydrophobic gums are insoluble in water, whereas hydrophilic gums are soluble in water and may be classified into natural, semi-synthetic, and synthetic gums (Sarah, 1998) [13]. Tannin protects from frost whilst resins protect plants from injury. In some plants these substances occur in greater quantities compared with others. Gum ghatti is a translucent and amorphous secretion of the *Anogeissus latifolia* plant of the Combretaceae family (Rani *et al.* 2012) [12]. The tree is quite large and is found in the dry deciduous forests of India. Ghatii gum has been used in a variety of emulsions, suspensions and fixatives in the paper industry (Amar *et al.* 2006) [3]. It is approved for use in food and is on the GRAS list under the Federal Food, Drug and Cosmetic Act. Salai (*Boswellia serrata* Roxb.) is a moderate to large sized deciduous tree of family Burseraceae that generally grows to a height of 4-5 m and has a girth of 1-1.5 m (Dawson, 2006) [9]. It may grow up to 18 m in height and 2.4 m in girth (WHO, 2009) [15]. The tree can be easily identified by its bark that is greenish gray, yellow or reddish gray, fairly thick, smooth, exfoliating in thin papery flakes, blaze pinkish and exuding small drops of resin. Chironji (*Buchanania lanzan* Spreng), also known as char, Chironji, Piyar, and achar, is a species of the Anacardiaceae family of plants. Francis Hamilton was the first to describe it in 1798.

The tree grows wild in northern, western, and central India's tropical deciduous forests, mostly in the states of Chhattisgarh, Jharkhand, and Madhya Pradesh, as well as the Uttar Pradesh districts of Varanasi and Mirzapur.

Materials and Methods

The study of quality analysis of gum samples was done in the laboratory of department of Plant Physiology, Agricultural Biochemistry, Medicinal and Aromatic plants and Department of Agricultural Processing and Food Engineering, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) laboratory. Analysis done using RBD replicated thrice. Ash content of the gum samples was determined by burning 5 g of gum sample in a muffle furnace at 600 ˚C for 4 hour. The ash content was expressed as a % ratio of the weight of ash to weight of the sample. The pH and temperature was recorded using a pre-calibrated pH meter (Model ELICO L1614) (Ameh, 2012) [4]. Kjeldahl semi-micro method (AOAC, 1990) [5] was employed to determine nitrogen. The content of proteins was estimated using the 6.25 nitrogen conversion factor suggested by (Rodriguez *et al.*, 2004). Moisture content of gum samples was determined by drying 5g of the gum sample to constant weight at 80 °C using hot air oven. Dried samples were cooled in desiccators before weighing. Moisture content was expressed as % of mass loss from the original mass as described by Yusuf (2011) [16]. Tannin content was estimated by the method given by Markkar, 1996. Standard tannin acid solution was prepared from a 0.5 mg/ml of the stock and the solution made up to 1ml with distilled water, 0.5 ml of Folinciocateau reagent was added to the sample and standard followed by 2.5 ml of 20% Na_2CO_3 the solution was then vortexed and allowed to incubate for 40 min at room temperature, its absorbance was read at 725 nm against a reagent blank concentration of the same solution from a standard tannic acid curve prepared. The Phenolic content was determined as per the method given by Swain and Hills (1959). Phenolic content of plant extract was determined using FCR (Folin–ciocalteau reagent). Microstructures at SEM can be analyzed for its elemental composition in more detail using EDX system. This is a non-destructive analysis and the elements and their concentration in the sample can be determined reasonably accurately. It's operation is free of liquid nitrogen requirement. Low Z elements like Boron, carbon and oxygen can also be routinely detected.

EDX analysis: Oxford- Energy Dispersive X-ray system (INCA 250 EDS with X-MAX 20mm Detector)

Result

The experiments were carried out in triplets whenever possible and the average was calculated and tabulated in Table (1).

Table 1: Physico-chemical properties of the three samples of gums

Properties/ Sample	*Anogeissus latifolia*	*Buchanania lanzan* Spreng.	*Boswellia serreta* Roxb.
Ash Content %	4.21±0.52	4.01±0.16	1.42±0.08
pH Value	4.10±0.01	4.36±0.40	4.77±0.24
Protein Content %	4.59±0.19	2.89±0.25	5.69±0.15
Nitrogen %	0.74±0.04	0.46±0.04	0.91±0.03
Moisture Content %	12.83±0.78	9.77±0.59	18.33±0.18
Tanin Content %	8.12±0.54	3.14±0.47	7.61±1.05
Phenol Content %	1.38±0.00	0.71±0.05	1.03±0.01

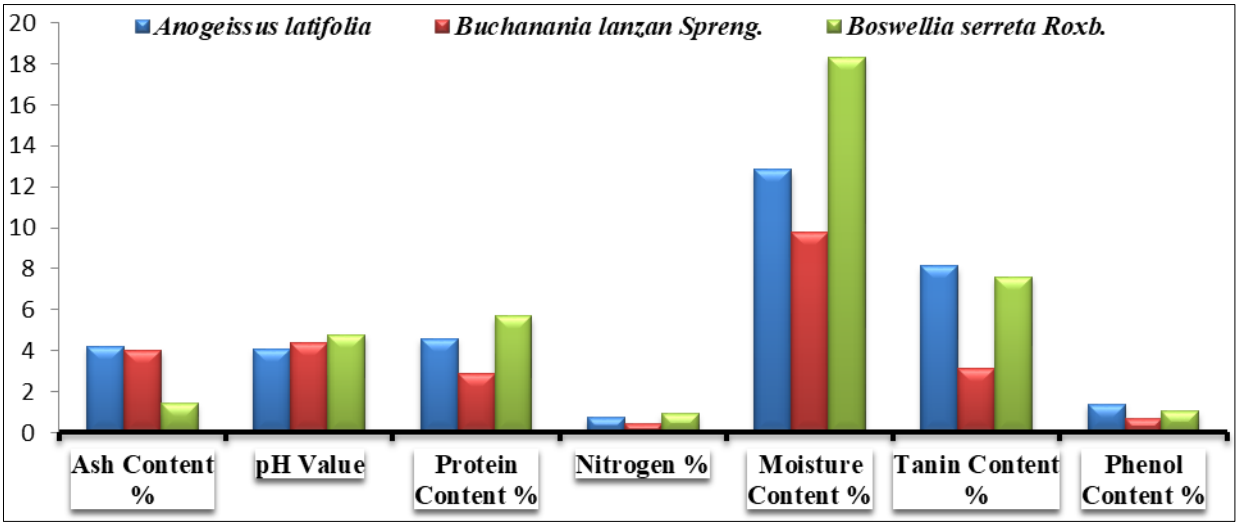

Fig 1: Physico-chemical properties of the three samples of gums.

The ash content indicates the presence of inorganic elements existing in salt form low values of ash content indicates more compatible with stomach environment and low levels of contamination during gathering and handling of crude gums. The critical quantities of foreign matter, acid insoluble matter, calcium, potassium, and magnesium salts were determined using total ash content (Mocak *et al.*, 1998). When compared the ash content of gum of all three experimental trees it was observed that the ash content was minimum in the gum of Salai (*Boswellia serrata* Roxb.) while higher ash content was observed in Dhawda (*Anogeissus latifolia*). There were no significant differences observed in all three gums. When compared the pH content of gum of all three experimental trees it was observed that the pH value was minimum in the

gum of Dhawda (*Anogeissus latifolia*) while highest pH was observed in Salai (*Boswellia serrata* Roxb.). The pH value of all gum samples indicated the slightly acidity in Dhawara (*Anogeissus latifolia*) because of its higher acid content and its plays significantly role in dispersion stability. It is composed of Larabinose, D-galactose, D-mannose, D-xylose and D-glucoronic acid. Similar results were also reported by Ahmed *et al.* (2009) [1] in *Anogeissus leicarpous*. The acidity of plant gums is not unexpected since many of them are known to contain salts (Ca, Mg, K, Na and Fe) of acidic polysaccharides, the acidity of which is due to uronic acids in their structures (Abu Baker *et al.*, 2007; Ahmed *et al.*, 2009 [1]; Elnour *et al.*, 2009. The same value pH was also reported by Bhushette *et al.*, (2017) [7]. Chaudhari and Annapure (2020) [8] observed similar findings in *Limonia acidissima* L. and gum *Acacia*. The protein content 4.59% (average) obtained in Dhawda *(Anogeissus latifolia)* and 2.89% in Chironji (*Buchanania lanzan* Spreng.) and 5.69% in Salai (*Boswellia serrata* Roxb.). When compared the nitrogen % of gum of all three experimental trees it was observed that the nitrogen % was maximum in the gum of Salai while minimum nitrogen % was observed in Chironji. Al-Assaf *et al.*, (2008) [2] studied on the characterization of gum ghatti and comparison with gum arabic found that the protein content of gum ghatti (3.4%) was higher as compared to protein content of gum arabic (2.1%). Similar results were also reported by Kuruwanshi *et al*., (2017) [11] in *Anogeissus latifolia* and Ahmed *et al.*, (2009) [1] in *Anogeissus leiocarpus.* Kang *et al.*, (2011) studies on chemical and physical characterization of the gum ghatti (*Anogeissus latifolia*) found that the protein content (4.18-4.34%) The findings are in agreement with Chaudhari and Annapure (2020) [8] who found nitrogen % ranged 0.35 ± 0.02 and 0.62 ± 1.02 per cent. Siddiqui *et al.*, (2015) [14] who reported 0.31%. Al-Assaf *et al.* (2008) [2] also reported nitrogen % on gum ghatti 0.51%. Nitrogen % of Dhawda (*Anogeissus latifolia)*, Chironji *(Buchanania lanzan* Spreng.) and Salai *(Boswellia serrata* Roxb.) gum samples are in agreement with that reported for Senegal gum nitrogen 0.19-0.62%, protein acidity of *Anogeissus leiocarpus* gum which may be due 1.25-4.09%) (Siddig 1996). When compared the moisture content of gum of all three experimental trees it was observed that the moisture content was maximum in the gum of Salai (*Boswellia serrata* Roxb.), while lowest moisture content was observed in Dhawda *(Anogeissus latifolia).* The all treatments were having significant impact on moisture content in individual gums of experimental trees. The moisture content of good quality gum does not exceed 15% and 10% for granular and spray dried material respectively (FAO, 1999). Moisture content is inversely proportional to self life. The lesser the moisture content, more is the self-stability of gum (Bashir and haripriya, 2016). Thakur *et al.*, (2018) reported the comparative study of physiochemical properties of Chirounji (*Buchanania lanzan* Spreng.) and Bahera was found to be 11.82% and 12.64% moisture content respectively. Similar results were also reported by Siddiqui *et al*., (2015) [14] in *Buchanania lanzan.* The tannin content of gum of all three experimental trees it was observed that the tannin content was highest in the gum of Dhawda (*Anogeissus latifolia*) while, lowest tannin content was observed in Chironji *(Buchanania lanzan* Spreng.) and Salai *(Boswellia serrata* Roxb.). Whereas, the phenol content was maximum in the gum of Dhawda (*Anogeissus latifolia*) while minimum phenol content was observed in Chironji *(Buchanania lanzan* Spreng.). Similar results were found by Chaudhari and Annapure (2020) [8] they studied two species and reported the amount of tannin content as 0.38 ± 0.01 and 0.09 ± 0.01. Samia and Babiker 2009 also reported similar result.

Table 2: Mineral Contents of The three samples

Anogeissus latifolia			***Buchanania lanzan* Spreng.**			***Boswellia serreta* Roxb.**		
Element	Weight %	Atomic %	Element	Weight %	Atomic %	Element	Weight %	Atomic %
Ca	48.61	49.06	Ca	64.8	68.12	Ca	57.94	54.55
K	24.2	25.04	K	5.15	5.55	K	14.32	13.82
Mg	8.15	13.56	Mg	6.62	11.48	Mg	10.58	16.43
Al	0.07	0.1	Al	0.5	0.79	Al	3.9	5.46
Cl	0.23	0.26	Cl	0.77	0.91	Cl	3.27	3.48
Fe	1.07	0.78	Fe	0.96	0.72	Fe	1.49	1.01
Pd	9.98	3.8	Pd	8.8	3.49	Cu	4.32	2.57
Cd	2	0.72	Cd	2.48	0.93	Ni	4.17	2.68
Na	2.55	4.49	Na	0.84	1.53			
Co	1.21	0.83	Co	1.69	1.2			
Mn	0.89	0.65	Mn	1.99	1.53			
Ni	1.03	0.71	Zn	1.98	1.27			
			Cr	1.43	1.16			
			Cu	2	1.32			

The elements *i.e.*, Ca, K, and Mg were present as major element in Dhawda (*Anogeissus latifolia*) and Chirounji (*Buchanania lanzan* Spreng). Pd (Palladium) and Cd (Cadmium) were also found in these gum whereas, Na, Al, Cl, Mn, Fe, Co, Ni were present as minor amount. However, in Salai (*Boswellia serrata* Roxb.) Ca, K, Mg, Cu, Al, Cl, Fe, and Ni are present but Pd and Cd were not found in Salai (*Boswellia serrata* Roxb.) gum. The result on elemental compound indicated that the Ca, K, and Mg were the major element present in the gum (Jani *et al.*, 2015) [10]. Chaudhari and Annapure (2020) [8] also reported similar results.

Conclusion

1. The elements *i.e.*, Ca, K, and Mg were present as major element in Dhawda (*Anogeissus latifolia*) and Chirounji (*Buchanania lanzan* Spreng). Pd (Palladium) and Cd (Cadmium) were also present in these gums.
2. Further research needed to check its availability in order to be used in food industry.

Acknowledgements

The authors are thankful to ICAR and also acknowledge the financial support Network project on Harvesting Processing and Value addition of Natural Resin and gums during the course of investigation.

References

1. Ahmed S, Mohamed E, Elwasila B, Ahmed K. Analytical studies on the gum exudates from *Anogeissus Leiocarpus*. Pakistan J of Nutrition. 2009;8(6):782-786.
2. Al-Assaf S, Amar V, Phillips GO. Characterization of gum ghatti and comparison with gum arabic. In: Gum and Stabilizers for the Food Industries 14, Eds Williams, P.A. and Phillips, G.O. Royal Society of Chemistry. 2008;316:280-290.
3. Amar V, Al-Assaf S, Phillips GO. An introduction to Gum Ghatti: Another Proteinaceous Gum. Foods Food Ingredients J Jpn, 2006, 211.

4. Ameh PO. Physicochemical properties and rheological behavior of *Ficus Glumosa* gum in aqueous solution. Int. J of Modern Chemistry. 2012;2(3):84-99.
5. AOAC. Association of Official Analytical Chemists, Official Methods of Analysis, 15th edn. Washington DC, 1990.
6. Bashir M, Usmani T, Haripriya S, Ahmed T. Biological and textural properties of underutilized exudate gums of Jammu and Kashmir, India. Int. J Biol Macromol. 2018;109:847-854.
7. Bhushette PR, Annapure US. Comparative study of Acacia nilotica exudate gum and acacia gum. Int. J Biol Macromol. 2017;102:266-271.
8. Chaudhari BB, Annapure US. Rheological, Physicochemical, and Spectroscopic characterizations of *Limonia acidissima* L. gum exudate with an application in extrusion processing. Carb. Poly. Technologies and Applications. 2020;2:100020
9. Dawson S. *Boswellia* spp. Frankinscense Plant monograph. Herbal medicine, class of September, 2003:1-20.
10. Jani GK, Shahb DP, Prajapati VD, Jain VC. Gums and mucilages: versatile excipients for pharmaceutical formulations. Gums and mucilages/Asian J. Of Pharmaceutical Sciences. 2009;4(5):309-323.
11. Kuruwanshi VB. Establishment of sustainable tapping Techniques for high gum production. Ph.D. Thesis, Indira Gandhi Krishi Vishwavidyala, Raipur, 2017.
12. Rani P, Sen G, Mishra S, Jha U. Microwave assisted synthesis of polyacrylamide grafted gum ghatti and its application as flocculant. Carbohydrate Polymers. 2012;89:275-281.
13. Sarah LV, Singer BW, Hicchen SM, Townsend JH. The development and initial application of gas chromatographic method for the characterization of gum media. J Amer. Inst. Convers. 1998;37:295-311.
14. Siddiqui MZ, Chowdhury AR, Prasad N. Evaluation of Phytochemicals, Physico-chemical Properties and Antioxidant Activity in Gum Exudates of Buchanania lanzan. Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci, 2015. DOI 10.1007/s40011-015-0539-4.
15. WHO. monographs on selected medicinal plants- Volume 4. World Health Organization, Geneva, 2009.
16. Yusuf AK. Studies on some Physico-chemical properties of the plant gum exudates of *Acacia senegal* (dakwara), *Acacia sieberiana* (farar kaya) and *Acacia nilotica* (bagaruwa). Journal of Research in National Development (JORIND). 2011;9(2):10-17.