IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 10, Issue 12 Ver. IV (Dec. 2016), PP 32-34
www.iosrjournals.org

Chemical Properties of Gums Collected from Some Medicinal Plants

K.V. Badar*, B.T. Pawar** and A.M. Chavan
Dept. of Botany, Dr. Babasaheb Ambedkar Marathwada University, Auranagabad
**Dept. of Botany, Yeshwantrao Chavan College, Sillod, Dist. Auranagbad*
***Dept. of Botany, Shri Muktanand College, Gangapur, Dist. Auranagbad*

Abstract: *Gum is naturally occurring chemical substance in the plant.It exudates naturally from the stem or from the wounds.Physical and chemical properties of gum changes as per the eco-climatic condition of the plant. Gums are colloidal in nature soluble in water but completely insoluble in alcohol and ether. They are noncrystalline in nature and contains large amount of sugar. Chemically it is polysaccharide. Gums are hygroscopic which absorb moisture and become soft in a humid atmosphere. Estimation of crude fibre, Crude fat, crude protein and Nitrogen content were studied during the present investigation. Maximum crude fibre percentage was recorded in Boswellia serrata (9.39%) while minimum with Terminalia arjuna (1.51%). Maximu7m crude fat percentage was observed in Acacia arabica (1.19%) followed by Terminalia arjuna (1.17%) and minimum in Cassine albans (0.3%). Gums obtained from Acacia arabica, Acacia chundra and Terminalia arjuna showed maximum protein content (0.437 %) and maximum nitrogen content (0.250); while gums from Butea monosperma showed minimum protein content (0.07%) and minimum nitrogen content (0.04%).*

Keywords*: Gum, Fats, Fibre, Protein, Nitrogen*

I. Introduction

Gum is a group of plant products resembling carbohydrates. Gums are characterized by ability to dissolve in water forming viscid solution by absorbing water to form gelatinous paste. In some cases the production of gum has been attributed to fungi attacking the plant, these fungi being responsible for enzymes that penetrate the tissues and transform the celluloses and hemicelluloses of the cell wall into gum. Malcolm (1936) concluded that the production of gum in Sudan gum arabic trees is due to bacterial agency. The real cause of production of gum in many trees is uncertain. The best use of gum is to prepare sticky substance for pasting the paper and other things. Viscosity or the 'thickness' of a solution that a gum forms with water is of paramount importance in determining the quality or value of a gum.The higher the viscosity the better the gum. The viscous solutions of gums in water are colloidal in nature. The solubility of gum was checked in polar and non polar solvent in order to understand the chemical nature of gum. Baladrin (1985) explored natural plant chemicals as sources of industrial and medicinal materials. FAO, Rome (1990) reports gum arabic as a natural product complex mixture of hydrophilic carbohydrate and hydrophobic protein components.Gum is also used as medicine in Ayurveda on large scale. Gums are used as nutritive and disease curative plant product in many countries. In chemical properties of gum estimation of moisture, ash, total sugar, reducing sugar, nitrogen, dry matter, crude fibre, fat, phenols and alkaloids was carried out by various workers (Gyedu-Akoto *et al.,* 2008; Osman *et al.,* 1993; Al Ahmadi, 2006; Robinson, 1906). During the present investigation estimation of crude fibre, crude fat, crude protein and Nitrogen content were studied.

II. Material And Methods

Plant gums were regularly collected in all the seasons. It was done by using axe, sterilized blade. Fine cut was made at different parts of the plant, like root, stem, leaves, flower and fruits. Later on at 30, 45 and 60 days exudates gums where collected in presterlized plastic bags, kept in laboratory condition until it was used.

Preparation of fine powder of Gum:

The powder was prepared from collected dry gums and kept in clean glass pots. It was used for the further study of various chemical properties like crude fibre, crude fat, protein and nitrogen content etc. These chemical properties were studied by using following methods:

1) Estimation of crude fibre

Crude fibre (CF) is determined as that fraction remaining after digestion with dilute solutions of sulphuric acid (H_2So_4) and sodium hydroxide (NaOH) under carefully controlled conditions. The major part of it contains carbohydrates and it is valuable parameter in deciding the nutritive quality of animal feed (A.O.A.C, 1970). 2gm gum powder was taken in a 500ml spotless beaker and added 200ml 1.25% H_2SO_4 to it. Break up the lumps with the help of glass rod having a rubber policeman. Cover the beaker with a conical flask, half filled with

cold water, which servers as water condenser.Boiled for 30 minutes made up any loss in volume during the boiling with hot distilled water. Then filtered through Whatman filter paper No. 54 by washing the residue several times with hot distilled water. Take out the residue back in the beaker with 100ml water and to it added 100ml 2.5% NaOH.Boiled for 30minutes as earlier.Filtered through previously weighed Whatman filter paper No. 54. The residue was washed several times with hot water and lastly with 70% alcohol. Dried it over night at 100°C to a constant weight, cooled and weigh. Incinerate the residue along with filter paper in a crucible at 600±20°C for 2hrs in a muffle furnace until all the carbonaceous matter is burnt.Cooled the crucible in a desiccator and weigh.Recorded the loss in weight as crude fibre.

2) Estimation of Crude fat:

The crude fat in the plant material was estimated by the standard Soxhlet method given in (A.O.A.C., 1970). The fat present in the gum material was extracted in the solvent consisting of chloroform ($CHC1_3$) and methanol (CH_3OH). This was done in Soxhlet extraction assembly and after complete evaporation of the solvent, the amount of extracted fat was measured. 2gm dry gum powder was placed into a thimble prepared with Whatman filter paper No.l. The mouth of thimble was plugged with fat free absorbent cotton. Clean, dry 250ml receiver flask from the Soxhlet assembly was taken and the solvent was added to it just to reach the level of the neck. The thimble with sample was introduced into the Soxhlet. The apparatus was assembled and placed on heating mental with temperature controlling device. Water condenser was fitted at the top of the Soxhlet.The fat was extracted for 8 hours at 60°C. Thimble was removed from soxhlet after extraction was over. Apparatus was again assembled and heated to recover most of the solvent from the receiver flask. When the receiver flask contains about 25ml solvent along with the extracted fat, receiver flask was disconnected. In a clean previously weighed beaker solvent was transferred with rising 2 to 3 times. Further it was dried in a hot air oven at 95°C, cooled in a dessicator and weighed. The amount of fat extracted per 2g of the sample was measured and the amount of crude fat as percent of dry matter (DM) was calculated.

3) Estimation of crude protein

This was done by estimating N content in the samples with the help of Microkjeldahl technique (A.O.A.C., 1970). The amount of N content was multiplied by 6.25 factor which gave crude protein content of the samples.300mg gum powder were taken in Kjeldahl flask along with 250mg K_2S0_4 and 40mg $CuSO_4$ and kept overnight. This was digested till the mixture become white. After complete digestion the flasks were allow to cool. The digest was processed for distillation with the help of markham's distillation set. Digest was diluted to 50ml volumetric flask, 5ml aliquots were taken and introduced in distillation unit through the side tube funnel. The glass stopper was immediately fitted. To this 10ml 40% NaOH was added into the digest. NH_3 is liberated into 10 ml 2 percent boric acid (with mixed indicator) containing 50ml conical flask. After appearance of green colour of distillation ammonium borate was titrated against 0.035 NHC1 till the end point (faint pink) was obtained (This gave 1ml 0.035 NHC1 = 0.5mg N% crude protein = % N x 6.25). Crude protein of gum was calculated as percent nitrogen liberated x 6.5.

4) Nitrogen content

Estimations of nitrogen contents were made by Microkjeldahl method (A.O.A.C., 1970). For this 300 mg dry gum samples were taken in Microkjeldahl flasks. A pinch of catalyst was added to it with the help of spatula. 7.5 ml of concentrated sulphuric acid (H_2SO_4) was added to the flask. The flasks were heated on a digestion stand until (6 to 10 hr) the mixture was clear i.e. apple green in colour or colourless. During digestion care was taken to avoid particles of indigested carbon sticking on the sides of the tube.5 ml of the diluted material was introduced in Markham's distillation apparatus, through the side tube funnel to which glass stopper was fitted. 50 ml conical flask containing 10 ml of 2 % boric acid solution mixed with indicator was kept at the delivery end of the condenser to collect the ammonium tetraborate [$(NH_4)_3$ BO_3]. It was then titrated with 0.035 N HCl till the pink colour obtained and titration values were recorded. Nitrogen content present in mg/g dry sample was calculated by calculating the strength of NH_3 in the distillate using equation.

1 ml of 0.35 N HCl = 0.5 of Nitrogen.From the above equation the amount of nitrogen for 5 ml of the sample was calculated, which will be equivalent to that of present in 300 mg of dry sample. It was recorded as percentage nitrogen of dry sample.

III. Results And Discussion

The gum was tested for different chemical properties like crude fibre, fat, protein nitrogen. The results of conducted experiments are summarised in table 01 & 02.

1) Crude fibre and fat content of gum:

It is clear from table 01, that the crude fibre of gum was 1.51 in of *Terminalia arjuna*, 4.46 in *Cassine albens*, 6.92 in *Butea monosperma*, 7.64 in *Mangifera indica*, 7.89 in *Moringa oleifera*, 7.98 in *Acacia arabica*, 8.80 in *Acacia chundra*, 9.12 in *Azadirachta indica*, 9.29 for *Sterculia urens* and 9.39 for *Boswellia serrata*. The highest fat content of gum was observed 1.19 in *Acacia arabica*, 1.17 in *Terminalia arjuna* and 0.98 in *Acacia*

chundra and the lowest fat content of gum was found 0.5 in *Azadirachta indica*, 0.4 in *Butea monosperma* and 0.3 in *Cassine albens* were recorded.

2) Crude protein and nitrogen content of gum:

It is clear from the table 02, that the crude protein of gum was found in between the range of 0.250 % and 0.437 % and percentage of nitrogen content was in between 0.04 % and 0.07 %. Highest percentage of nitrogen was found in gum of *Acacia arabica, Acacia chundra* and *Terminalia arjuna*. *Acacia arabica* gum contain more protein while lowest protein and nitrogen content was reported in *Butea monosperma* gum.

Maximum crude fibre percentage was recorded in *Boswellia serrata* (9.39%) while minimum with *Terminalia arjuna* (1.51%). Maximu7m crude fat percentage was observed in *Acacia arabica* (1.19%) followed by *Terminalia arjuna* (1.17%) and minimum in *Cassine albans* (0.3%). Gums obtained from *Acacia arabica, Acacia chundra and Terminalia arjuna* showed maximum protein content (0.437 %) and maximum nitrogen content (0.250); while gums from *Butea monosperma* showed minimum protein content (0.07%) and minimum nitrogen content (0.04%). Similar results were recorded by Robinson (1906). He presented position of the chemistry of the Gums. Osman (1993) studied molecular characterisation of the polysaccharide gum from Acacia Senegal carbohydrates.

Table 01: Crude fibre and fat content of gums

Sr. No.	Name of plants (Gum sample)	Crude Fibre (%)	Fat (%)
1	*Acacia arabica*	7.98	1.19
2	*Acacia chundra*	8.89	0.98
3	*Azadirachta indica*	9.12	0.5
4	*Boswellia serrata*	9.39	0.58
5	*Butea monspora*	6.92	0.4
6	*Cassine albans*	4.46	0.3
7	*Mangifera indica*	7.64	0.86
8	*Moringa oleofera*	7.89	0.82
9	*Sterculia urens*	9.29	0.54
10	*Terminalia arjuna*	1.51	1.17

Table 02: Crude Protein and Nitrogen estimation of gum

Sr. No.	Name of plants (Gum sample)	Protein Content (%)	Nitrogen Content (%)
1.	*Acacia arabica*	0.437	0.07
2.	*Acacia chundra*	0.437	0.07
3.	*Azadirachta indica*	0.312	0.05
4.	*Boswellia serrata*	0.375	0.06
5.	*Butea monosperma*	0.250	0.04
6.	*Cassine albans*	0.312	0.05
7.	*Mangifera indica*	0.312	0.05
8.	*Moringa oleofera*	0.375	0.06
9.	*Sterculia urens*	0.312	0.05
10.	*Terminalia arjuna*	0.437	0.07

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