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RESEARCH PAPER

Quality Analysis of *Acacia nilotica* (Babul) Gum Exudates

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ABSTRACT

Gums are polysaccharide compounds having many medicinal and food uses. The tapping and extraction of gum was carried out with the trees of desired diameter at different tapping height from ground level. 4-7 cm wise cut treated with different concentration of H_2SO_4. After collection and purification of the gum, the different quality parameters and their optimum value in the gum sample were determined such as moisture content 15.31 %, wb, ash content 1.89 %, volatile matter content 65.78 %, pH 4.44, protein content 16.54 mg/g, tannin content 0.0032 mg/g, methoxyl content 1.37 %, major elemental contents in ppm like copper 67.02, ferrous 1247.90, manganese 95.39 and zinc 94.97 when tree diameter was more than 20 cm and tapping height either more than 80 cm or less than 40cm from ground level. Treating the tapped portion with different concentration of H_2SO_4 did not show significant effect.

Keywords: *Acacia* gum, purification, quality parameters, elemental content

Acacia gum is a dried gummy exudate that collects on the surfaces of the branches and the stems of the Acacia trees, in the form of round or oval tears, about the size of a pigeon's egg but sometimes in vermicular forms, which is collected and purified and then marketed. There are many kinds of Acacia gum in commerce. All the gum yielding Acacias exhibits the same general appearance and differing only in technical characters. After rainy season, the gum exudes spontaneously from the trunk and principal branches. Since the flow is small in quantity it is stimulated by incisions in the bark. To facilitate the flow, a thin strip 60 to 90 cm in length and 2.50 to 7.50 cm wide is torn off. In about a fortnight it thickens and hardens on exposure to the air, in the form of round or oval tears (Orwa *et al.*, 2009). Gum Acacia is highly nutritive. It has been proved that about 7-9 g of the gum is sufficient to support an adult for a day (Anonymous, 1998). In the Indian subcontinent, it furnishes the prime important ingredient of the nourishing food used for lactating mothers especially during the first three months of postnatal period. It is used as a binding agent in the preparation of lozenges, pastilles and compressed tablets (Anonymous, 1998). An important benefit of gums and resins is that they generate foreign currency earnings gained through exports. The

gums and resins subsector also contributes to the local economy and to rural livelihoods. The lack of modern production and processing technology means that gums and resins are collected, cleaned, sorted and graded using traditional, labour intensive processes (Lemenih and Kassa, 2011). In this study, the *Acacia nilotica* (Babul) trees available in reserved forest area of Junagadh district of Gujarat (India) were trapped and exudated gum from each tree was collected and purified. It evaluation for quantity and effect of tree diameter, tapping height from ground level and concentration of H_2SO_4 sprayed ion the yield Agum and the quality parameters has been reported. There is lack of information on this aspect which prompted to conduct the study.

MATERIALS AND METHODS

Tapping and extraction of gum was done at Khadiya Camp Site, Dungar Dakshin Range, Forest Department, Junagadh, which was an isolated area from any disturbance during course of work, while the analytical part was carried out at the Department of Processing and Food Engineering, College of Agricultural Engineering and Technology, Junagadh Agricultural University, Junagadh.

Preparation of gum samples

The trees of desired diameter (< 10 cm, 10-20 cm, > 20 cm) were selected on which an incision was made at predefined tapping (< 40 cm, 40 to 80 cm, > 80 cm) height as per treatment by an axe (Ella, 2012). The cut was made of about 4-7 cm in width and treated with different concentration of H_2SO_4 (0, 40, 60 %) to find out effect on yield and quality. The gum accumulated in width of cut was collected after 25 days once oozing started. These were hand sorted to remove fragments of bark and other visible impurities and then, were spreaded out in the sun to dry for a week. The gum collected from the trees with specified treatment called as crude gum was then purified by straining and centrifugation (Phillips and Williams, 2001) and the yield of gum exudated under different treatments was noted.

Quality parameters analysis of gum samples

After purification, different quality parameters like moisture content (AOAC, 1995), total ash content (AOAC, 1995), volatile matter content (Okalebo *et al.*, 2002), pH (Yusuf, 2011), protein content (Lowry *et al.*, 1951), tannin content (Lelon *et al.*, 2010), methoxyl content (Ranganna, 1977) and trace elements content (copper, ferrous, manganese and zinc) were determined by standard methodology (Anderson *et al.*, 1959).

Statistical analysis

The experiment was carried out in a Factorial Completely Randomized Design (Panse and Sukhatme, 1985) with three replications and the treatment combinations are given in table 1.

Table 1: Details of treatments

Factor	Code	Details
Diameter of bark	A1	< 10 cm
	A2	10 to 20 cm
	A3	> 20 cm
Tapping height from Ground Level	B1	< 40 cm
	B2	40 to 80 cm
	B3	> 80 cm
Treating with H_2SO_4	C1	0 %
	C2	40 %
	C3	60 %

RESULTS AND DISCUSSION

Yield and preparation of gum sample

The collection and drying was carried out followed by crushing, liquefying and centrifugation in Table top centrifuge so that small particles settled down. Then, the solution was filtered and kept in glass bottles. Again drying was done followed by crushing in mixture to prepare fine powder for further analysis. The obtained gum yield is shown in table 2.

Fig. 1: Collected gum sample

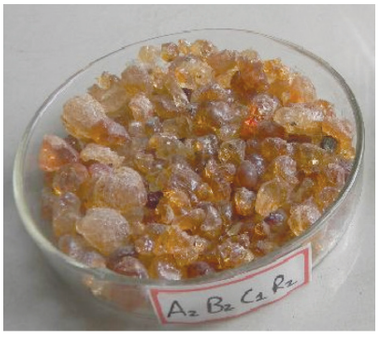

Fig. 2 Dried and purified gum sample

Table 2: Treatment wise mean gum yield

Treatment	Gum yield, g	Treatment	Gum yield, g	Treatment	Gum yield, g
A1B1C1	25.8	A2B1C1	56.5	A3B1C1	70.0
A1B1C2	27.4	A2B1C2	55.1	A3B1C2	74.1
A1B1C3	23.2	A2B1C3	47.5	A3B1C3	83.0
A1B2C1	25.5	A2B2C1	49.4	A3B2C1	71.5
A1B2C2	28.0	A2B2C2	52.0	A3B2C2	67.6
A1B2C3	26.6	A2B2C3	41.0	A3B2C3	76.9
A1B3C1	26.6	A2B3C1	42.6	A3B3C1	81.5
A1B3C2	26.1	A2B3C2	44.5	A3B3C2	88.7
A1B3C3	24.5	A2B3C3	48.0	A3B3C3	89.0

Determination of quality parameters

It can be seen that the highest yield was obtained in A3B3C3, followed by A3B3C2 and A3B3C1. Thus, when the diameter of cut was more than 20 cm no treated with sulphuric acid and the height of tapping was more than 80 cms or less than 40 cms. It can be seen that moisture content of gum found higher of the trees with diameter more than 20 cm followed by 10 – 20 cm (Table 3). With respect to tapping height from ground level, higher value of moisture content was observed when the tapping was done at a height more than 80 cm which nearly followed by height in between 40 – 80 cm. It is also seen that there is a little effect of height on the moisture content. However concentration of H_2SO_4 showed positive effect on moisture content. At 60 % concentration of H_2SO_4, the moisture content of gum was found to be higher, while it decreased with the decrease in concentration. The maximum value was found in *Acacia sieberiana* and least in *Acacia senegal* gum in Table 3.

It can be seen that ash content of gum was found higher from the trees with diameter more than 20 cm followed by 10 – 20 cm (Table 3). With respect to tapping height from ground level, higher value of ash content of gum was observed when the tapping was done at a height more than 80 cm followed by 40 – 80 cm from the ground level. The concentration of H_2SO_4 showed negative effect, as without spray of

H_2SO_4 over tapped portion, the ash content of gum was higher followed by 40 % concentration. The ash content of obtained gum is mentioned in table 3.

It can be seen that volatile matter content was found higher in the trees with diameter of trees in between 10 – 20 cm. With respect to tapping height from ground level, higher value of volatile matter content was obtained when the tapping is done at a height less than 40 cm followed by height in between 40 - 80 cm and more than 80 cm respectively. The concentration of H_2SO_4 shows no significant effect. The maximum value of volatile content of obtained gum and those found literature have been mentioned in table 3.

It is observed that higher the diameter, higher the pH of gum followed by diameter in the range between 10 and 20 cm. While with respect to tapping height from ground level, higher value of pH was found when the tapping has done at a height in between 40 to 80 cm. The concentration of H_2SO_4 gave negative effect, as without spray of H_2SO_4 over tapped portion, the pH of gum found higher followed by 40 % concentration, (Table 3).

It was observed that protein content found higher in the gum of trees with diameter more than 20 cm followed by 10-20 cm (Table 3). In case of tapping height from ground level, higher value of protein content was observed at tapping with a height less than 40 cm followed by 40 - 80 cm and more than 80 cm. The concentration of H_2SO_4 had positive effect, as without spray of H_2SO_4 over tapped portion, the protein content of gum was higher with 60 % concentration, followed by 40 % concentration.

It was found that tannin content of the tapped gum increases as the diameter decreases to less than 10 cm. With in respect of tapping height from ground level, higher value of tannin content was found when the tapping has done at a height less than 40 cm. The concentration of H_2SO_4 showed mixed effect, as without spray of H_2SO_4 over tapped portion, the tannin content of gum was higher and it followed by the gum obtained with the spray of 40 % concentration (Table 3).

Methoxyl content

It was observed that methoxyl content found higher in the trees with diameter more than 20 cm. While for tapping height from ground level, higher value of methoxyl content found when the tapped at a height 40 to 80 cm followed by more than 80 cm. Also, with respect to tapping height there was no

Table 3: Comparison of quality parameters of different *Acacia* gums with the obtained gum(@ Yusuf, 2011)

Quality Parameters	Different types of *Acacia* gum			
	Acacia*@ *senegal	***Acacia*@ *sieberiana***	***Acacia*@ *nilotica***	**Obtained gum**
Moisture content (%)	13.40	16.20	15.60	15.31
Ash content (%)	3.42	3.30	3.54	1.89
Volatile matter (%)	74.30	75.40	65.50	65.78
Tannin content (mg/g)	0.0040	0.0057	0.0024	0.0032
Protein (mg/g)	17.31	15.69	16.94	16.54
pH (25% sol.)	4.50	5.00	4.50	4.44
Ferrous content (ppm)	1278	1222.75	1278	1247
Zinc content (ppm)	92.0	98.145	96.916	94.97
Manganese content (ppm)	105.2	103.5	104.6	95.39
Copper content (ppm)	65.08	65.245	65.251	67.02

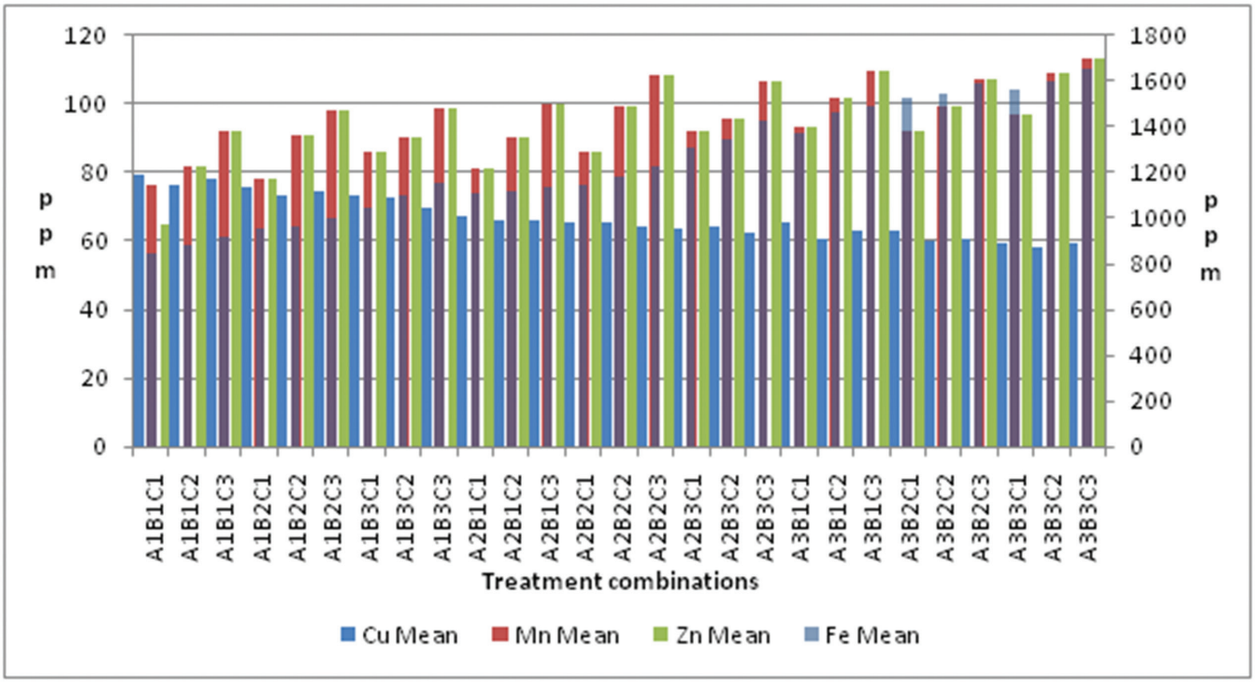

Fig. 3: Trace elements content obtained by Atomic Absorption Spectrophotometer

significant difference on the methoxyl content. The effect of concentration of H_2SO_4 was significant and was higher at 60 % which followed by 0 % (Table 3).

Trace elements

The major elements like copper, ferrous, manganese and zinc were analysed using Atomic Absorption Spectrometer and have been mentioned in table 3. Change in trace element content due to different treatments is shown in Fig. 3.

It was observed that copper content was found higher in the trees with diameter less than 10 cm with tapping height from ground level, at a height less than 40 cm followed by height in between 40 and 80 cm. The concentration of H_2SO_4 however, showed the mixed effect. The ferrous content analysed was higher in the samples of trees with diameter of more than 20 cm and tapped at a height more than 80 cm. The concentration of H_2SO_4 showed negative effect. The manganese content was found higher in the gum samples of trees with diameter of than 20 cm and tapped at a height more than 80 cm. The concentration of H_2SO_4 showed no effect on this element. The zinc content was found higher in the samples of trees with diameter more than 20 cm followed by 10-20 cm. While for tapping height from ground level, higher value of zinc content in the extracted sample was found when obtained from the trees tapped at a height more than 80 cm followed by height in between 40 and 80 cm. The concentration of H_2SO_4 showed a mixed effect. The results on elemental compound indicated that the calcium and lead was the major elemental present in the gum.

From table 3, except moisture content which was slightly more and ash content which was less than the international specifications, while other analysed quality parameters of the obtained gum were almost within the range of international specifications for gum *Arabic*, considered to be the best *Acacia* gum.

CONCLUSION

To get maximum gum yield and quality from the *Acacia* tree at Khadiya Forest Site, the bark diameter should be more than 20 cm and tapping height either more than 80 cm or less than 40cm from ground level. Despite very little physico-chemical differences among the gum samples, values of physicochemical parameters of obtained gum compared well with those reported in previous studies on other *Acacia* gums in many parts of the world and international standard of gum *Arabic*. Therefore, there is a great potential for the exploitation and application of this obtained gum.

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