



Short Communication

## Quality Assessment of Guar Gum (Endosperm) of Guar (*Cyamopsis tetragonoloba*)

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### Abstract

This experiment was conducted in I Lab. of Department of Biochemistry and Food Science Faculty of Agriculture, University of Khartoum, Sudan. Six guar genotypes were used for this study. The results revealed chemical compositions of endosperm of the guar seed as: 4.8-8.7 % moisture, 3.5-5.5 % protein, 0.5-0.9 % fat, 0.5- 1.3 % ash, 1.4- 2.0 % fiber and 83.3-87.5 % carbohydrates. While physical characters are: 1.2337 refractive indices, 0.20-0.47 relative viscosity (H<sub>2</sub>O as solvent), 0.37-.56 relative viscosity (4% NaCl as solvent), 5.0-7.0 pH, 0.035-.0.050 optical density and +28 to +76 specific rotation. Ash compositions of endosperm are potassium: 57 – 79 mg/Kg, sodium 242 – 755 mg/Kg, calcium 11 – 24 mg/Kg, iron 49 – 287 mg/Kg, magnesium 0.2 – 0.09% and phosphorus 15 - 22 % . The total available carbohydrates as mannose and galactose were ranged 67-73% and 28-33%, respectively. Ratio of mannose to galactose is 2:1.

Keyword: Guar, endosperm, mannose and galactose.

### Introduction

Guar seed (*Cyamopsis tetragonoloba*) composed of 30 - 33% hull, 27 - 30% endosperm and 43 - 47% germ. The germ and hull of the guar seeds are known as guar meal, which rich in protein, hence used for the cattle feed. The germ has toxic effect but recently advanced research has been made on the germ to reduce its toxic effect and to make it suitable for animal consumption as a rich source of the protein<sup>1</sup>. The endosperm is commercially important part in the guar seed, as it is converted into powder gum. It contains 41% dry weight and acetone insoluble solids of the seed. At least 75% of acetone insoluble solids of the endosperm are galactomannose and 12% being accounted for as pentosan, protein, pectin, phytin, ash and dilute acid insoluble residue<sup>2</sup>. The guar crop is acquired an economic importance after the discovery of the gummy substance (galactomannan) in its endosperm<sup>1</sup>. Galactomannan are composed of 1 – 4 mannanose backbone with varying degree of 1 - 6 galactose substitution and are found in the cell wall of legume endosperm<sup>3</sup>. Guar seeds are a rich source of mucilage or gum which forms a viscous gel in cold water and used as an emulsifier, thickener, stabilizer in a wide range of food and industrial application<sup>4</sup>. Guar galactomannan has mannose to galactose ( M:G) ratio of 6:1<sup>5</sup>. The pure mannanose without galactose is completely insoluble in the water, but increasing of galactose substitution in guar gum increase the solubility of the polymer by allowing it to become attended<sup>6</sup>. The mannose to galactose ratio is 2:1, guar gum is insoluble in organic solvent, molecular weight range is 50.000 – 80.000 and gum is a white to yellowish white, nearly odorless, free flowing powder with a bland taste<sup>7</sup>.

Objectives of this study are estimated the proximate analysis, physical characters, minerals contents, mannose, galactose, ratio of mannose: galactose and tannin content of endosperm for six selected guar genotypes grown in Sudan.

### Materials and methods

**Sample Preparation:** Six guar genotypes (X<sub>1</sub>H<sub>6</sub>, X<sub>1</sub>H<sub>7</sub>, X<sub>2</sub>H<sub>0</sub>, X<sub>2</sub>H<sub>4</sub>, X<sub>2</sub>H<sub>6</sub> and X<sub>2</sub>H<sub>8</sub>) were collected from the Department of Agronomy, Faculty of Agriculture, University of Khartoum, Sudan. The seeds of the six guar genotypes were soaked in water for 12 hours separately and then hand pounded to separate the endosperm from the hull and germ. The separated endosperms were then dried at 105 °C for 20 minutes and then ground to pass 0.2 mm screen and finally, it is kept in polyethylene bag till start the chemical analysis.

**Physical and Chemical methods:** Refractive indices, specific rotation, relative viscosity, pH value, optical density, protein, ether extract, ash, and fiber contents were determined as described by Noble *et al.*<sup>8</sup>, but Carbohydrates was determined by difference and moisture content was measured according to Patil *et al.*<sup>9</sup>.

**Ash composition:** Minerals contents of endosperm were extracted according to method described by Pearson<sup>10</sup>. The measurement of minerals was done by using atomic absorption as described by Nwajei *et al.*<sup>11</sup>.

**Total available carbohydrates:** Total available carbohydrates content of endosperms were determined as described by Clegg<sup>12</sup>.

100mg of galactose were dissolved in 100 ml distilled water (1mg = 10 ml). Then 10 ml of strong galactose solution was dissolved in 100 ml distilled water to make the dilute galactose solution. The same procedure was done to make the dilute mannose 100 mg anthrone (0.1%): was dissolved in 100 ml sulphuric acid (270 ml Con. H<sub>2</sub>SO<sub>4</sub> was dissolved in 300 ml distilled water). One ml from each dilute galactose, mannose and sample was pipetted into a series of test tubes 1, 2, and 3, respectively. Then 5 ml of the Anthrone reagent was added to each test tube, then the content of each test tube was heated in water bath for 12 minutes and allow cooling to room temperature. Spectrophotometer was set up at 360 nm, so that the scale read zero with distilled water. Then the dilute galactose and mannose and sample were read.

$$\text{CHO as galactose ( or mannose) \%} = \frac{25 \times B}{S \times A}$$

where: B = reading of sample, A = reading of dilute galactose (or mannose) and S = weight of origin sample

**Tannin content:** Quantities estimation of tannin for each separated endosperm was carried out using the modified vanillin-HCL in methanol method as described by Price and Butler<sup>13</sup>. A standard curve was prepared expressing the results as catechin equivalent i.e. amount of the catechin (mg/ml) which gives a colour intensity equivalent to that given by tannins after correction of the blank.

**Statistical analysis:** A test of homogeneity for error variance for each variable was done according to Gomez and Gomez<sup>14</sup>.

## Results and discussion

**Proximate analysis:** Table-1 showed Moisture content of endosperm is ranged from 4.8 – 8.7%, which is higher than those range reported by Thomas<sup>15</sup> and lower than those given by<sup>16</sup>. Protein content is ranged 3.5 – 5.0%.which is agreement with those results given by<sup>15</sup>. Ether extract (fat) of endosperm is ranged from 0.5 – 0.9%, which within the range reported by<sup>4</sup>.

The ash content is ranged from 0.5 – 0.8%, which falls within range reported by Stein and Hall<sup>16</sup>. Fiber contents are ranged from 1.4 – 2.0%, which is online with those ranges given by<sup>16</sup>. Carbohydrates contents are varied from 83.3 – 87.5%, which is higher than those values reported by Thomas<sup>15</sup>. The results revealed that there is highly significant difference in moisture, protein, ether extract, ash and carbohydrates content, but there is no significant difference in crude fiber at level (p≤0.05)

**Physical characters:** Table - 2 represented mean values of refractive indices are 1.2337 for overall samples at Con. 0.1mg/100 ml. Relative viscously of endosperm ranged from 0.20 – 0.47 (H<sub>2</sub>O used as solvent) and varied from 0.37 – 0.65 (4% NaCl used as solvent). It was found that relative viscously of 4% NaCl is higher than those of distilled water. These findings indicated that the relative viscosity is affected by the types of solvents. The pH values varied from 5.0 – 7.0, which fell within range reported by<sup>17</sup>. Specific rotation ranged from + 20 to + 76. Optical density ranged from 0.035 – 0.050. The results revealed that there is significantly difference in relative viscously (in both distilled water and 4% NaCl), pH value, specific rotation and optical density at level (p ≤0.05).

**Ash composition:** Table - 3 showed mean value of Potassium ranged from 57 – 79 mg /Kg. Sodium content varied from 242 – 755 mg/Kg. Calcium mean ranged from 11 – 24 mg/Kg,. Iron content varied from 49 – 287 mg/Kg. Magnesium content varied from 2.5 – 13 %. The mean values of Phosphorus ranged from 15.5 – 22. %.The finding indicated that there is highly significant difference in Na, Mg and Fe, significant difference in Ca and no significant difference in K and P at level (P ≤ 0.05)

**Total available Carbohydrates and tannin contents:** Table-4 represented the total available carbohydrates as mannose is ranged from 67 – 73% while the total available carbohydrates as galactose are ranged from 28 – 33%. These results indicated that the mannose to galactose ratio is 2: 1, which is similar to those values given by Yoko<sup>7</sup>, but it is differing to value given by Edwards<sup>5</sup>. The tannin content is ranged from 445 – 450 mg/100g. The similar results were reported for guar seeds soaked in water for different time intervals<sup>18</sup>. In addition to that there is no significant difference in tannin content at level (P≤0.05).

**Table - 1**  
**Proximate analysis of endosperm (Guar gum) of six guar genotypes**

Parameters	Moisture %	Protein %	Fat %	Ash %	Fiber %	CHO %
X <sub>1</sub> H <sub>6</sub>	6.5	3.5	0.5	0.5	1.5	87.5
X <sub>1</sub> H <sub>7</sub>	7.4	4.5	0.9	0.5	1.4	87.3
X <sub>2</sub> H <sub>0</sub>	4.8	4.4	0.5	0.8	1.9	87.3
X <sub>2</sub> H <sub>4</sub>	8.7	4.0	0.7	1.3	2.0	83.3
X <sub>2</sub> H <sub>6</sub>	7.8	5.0	0.7	0.8	1.9	83.8
X <sub>2</sub> H <sub>8</sub>	6.8	5.5	0.7	1.0	1.4	84.6
Mean	7.0	4.5	10.7	0.8	1.7	71.9
SD	1.3	0.7	0.15	0.30	0.27	1.9

\* Each value is average of three replicates basis on dry weight

**Table - 2**  
**Physical characters of endosperm (Guar gum) of six guar genotypes**

Parameters	Refractive index	Relative viscously		pH	Optical density	Specific rotation
		H <sub>2</sub> O	4% NaCl			
X <sub>1</sub> H <sub>6</sub>	1.2337	0.47	0.42	5	0.035	+ 36
X <sub>1</sub> H <sub>7</sub>	1.2337	0.29	0.65	5	0.035	+ 76
X <sub>2</sub> H <sub>0</sub>	1.2337	0.33	0.45	5	0.035	+ 59
X <sub>2</sub> H <sub>4</sub>	1.2337	0.25	0.37	7	0.050	+ 75
X <sub>2</sub> H <sub>6</sub>	1.2337	0.47	0.64	6	0.040	+ 17
X <sub>2</sub> H <sub>8</sub>	1.2337	0.20	0.45	5	0.040	+ 28
Mean	1.237	0.34	0.50	5.5	0.039	48.5
SD	0	0.11	0..11	0.83	0.005	25

\* Each value is average of three replicates basis on dry weight

**Table - 3**  
**Ash composition of endosperm (K, Na, Ca, Fe, Mg and P ) of six guar genotypes**

Parameters	K (mg/Kg)	Na (mg/Kg)	Ca (mg/Kg)	Fe (mg/Kg)	Mg %	P %
X <sub>1</sub> H <sub>6</sub>	70	491	42.0	100	0.06	0.03
X <sub>1</sub> H <sub>7</sub>	84	755	11.0	196	0.06	0.17
X <sub>2</sub> H <sub>0</sub>	84	491	11.0	100	0.02	0.14
X <sub>2</sub> H <sub>4</sub>	57	642	11.0	279	0.03	0.14
X <sub>2</sub> H <sub>6</sub>	70	566	34.0	287	0.09	0.13
X <sub>2</sub> H <sub>8</sub>	79	415	11.0	113	0.02	0.14
Mean	74	560	20	179.2	0.04	0.13
SD	10.4	122.7	14.17	88.0	0.02	0.04

\* Each value is average of three replicates basis on dry weight

**Table - 4**  
**Mannose, Galactose, Ration of M:G and tannin content of endosperm of six guar genotypes**

Parameters	Mannose (M) %	Galactose (G) %	Ratio M:G	Tannin %
X <sub>1</sub> H <sub>6</sub>	70	30	2:1	4.5
X <sub>1</sub> H <sub>7</sub>	71	33	2:1	4.5
X <sub>2</sub> H <sub>0</sub>	67	33	2:1	4.5
X <sub>2</sub> H <sub>4</sub>	73	28	2:1	4.3
X <sub>2</sub> H <sub>6</sub>	70	30	2:1	4.5
X <sub>2</sub> H <sub>8</sub>	71	29	2:1	4.5
Mean	70.33	30.5	2:1	4.5
SD	1.96	2.07	--	0

## Conclusion

It is concluded that the variation in chemical, physical, ash composition, total available carbohydrate and tannin content is controlled by genetic or environment factors under which plant material were tested

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