

## Physicochemical Analysis of *Acacia tortilis* var. *tortilis* Gum

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### Abstract:

*Thirty samples of Acacia tortilis var. tortilis gum were collected, as natural exudates, from two locations, Algetaina White Nile and Wdbnda Northern Kordofan states. The samples were analysed, the results show that, average values of moisture (11.1%) ash content (1.6%), PH (5.4), specific optical rotation (+83.4), the nitrogen content was(1.5%), and protein content (10.1%),equivalent weight (2117.4), total uronic acid (9.1%), number average molecular weight ( $8.0 \times 10^5$ ), viscosity ( $12.8 \text{ g/ cm}^3$ ), cationic composition was in the order (Ca) > (K) > (Mg) > (Na), (Fe) > (Cr) > (Cd) > (Mn), were at trace level. Sugar analysis shows that rhamnose (2%), and arabinose (46%) galactose (10%).*

**Key words:** L1: Physicochemical Analysis, *Acacia tortilis* var. *tortilis* Gum

## INTRODUCTION

The genus *Acacia* is the second largest within the leguminous family (Moffitt and young 1959). *Acacia* were thought to be, roughly around 1300 species worldwide, 960 of them are native

to Australia, with the remainder spreading around the tropics and the Americas. *Acacia tortilis* var. *tortilis* often called the "umbrella thorn" for its distinctive. Spreading crown is one of the most widespread trees in dry areas of Africa and the Middle East (Dziezak JD.1991). The umbrella thorn is dominant in many savanna communities and important source of browse for both wild and domesticated animals (Sato 1993). *Acacia* gums play an important role the food hydrocolloid in industry which represents a market of over 30 billion US\$. The top two hydrocolloids are starch and gelatin, they account for no less than 50% of the total value. (Higiro et al 2007). *Acacia* gums are used in dairy products such as ice cream, packed milk and processed baby foods, it is also used in packing industry for its comparatively low water absorption properties and is favorable adhesive properties in glazes and topping, one of the main uses of spray dried gums in beverage, and flavor emulsions such as orange juice. Lemon juice, cherry and cola (AbdElraman M.A.2008). In flavor encapsulation it provides protection from oxidation, evaporation and absorption of moisture thus conferring stability, long shelf life and superior product quality (Dziezak JD.1991). *Acacia* gums are used in pharmaceutical industries due to their unique Physicochemical and functional properties. They are used as a protective colloid in emulsion, as a viscosity bulker binding agent and as coating agent in micro-encapsulation. They are also used as suspending agent for coalmine, kaolin and cod liver oil emulsion. In medicine gums have been recommended as an oral laxative, and for treatment of low blood pressure caused by hemorrhage or surgical shock, and as intravenous injections for the treatment of nephritic oedema (Kayongo et al, 1983) and a supportive treatment in kidney failure and gout (Bliss et al, 1996; Osman et al, 2010). *Acacia* gums are soluble fermentable fibre which increases the bacterial mass in human colon and hence utilizes urea by action of bacterial ureases, eliminating ammonia which is used for synthesis of non-essential amino acids and protein in humans

and microorganisms (Assimon and Stein, 1994). For bacteria culture, is very important to provide similar environmental and nutritional condition to that existing in its natural habitat hence, an artificial culture medium must provide all of the nutritional components that a bacterium needs. Most often, a culture medium contains water, a source of carbon energy a source of nitrogen, trace elements and some growth factors (Lidguist, 1999; Osman etal 2016).

## **MATERIAL AND METHOD**

Thirty samples were randomly, mixed to give six composite sample from *Acacia tortilis* var. *tortilis* gum were collected, as natural exudates, from two location Algetaina(White Nile) and Wdbnda(Northern Kordofan) states. The samples were ground using mortar and pestle and kept in separate container for analysis, three comotation samples from each location were prepared by mixing every four gum samples to give a total of 15 samples from each location.

The aims of this were is identify specification parameters of the gum for *Acacia tortilis* var. *tortilis*. The methodology includes international accepted physico chemical methods (Anderson etal, 1983, Osman, 1993).

## **RESULTS AND DISCUSSIONS**

Tables 1and 2 summarize the results of analytical data for gum samples collected in season 2012/2013.The moisture content of Algetaina samples were found to be in the range of 10.92% to 12.34%, with a mean value of 11.39% while Wdbnda samples ranged from 6.07% to 12.35%.With a mean value 10.88%.The results are similar to those reported by Mona. O. H, (2011), for *Acacia tortilis* var. *raddiana*. The Ash content of Algetaina samples were found to range from 1.15% to 2.45%, with a mean value 1.67% while Wdbnda samples ranged from 1.10% to

2.35%. With a mean value 1.61%. The pH values of Algetaina samples were found to range from 5.04 to 6.24, with a mean value 5.40 while Wdbnda samples ranged from 5.01 to 6.21. With a mean value 5.31. The Specific optical rotation of Algetaina samples was found to range from +78.79 to +91.11 with a mean value +83.90 were as Wdbnda samples ranged from +77.86 to +90.09, with a mean value +82.81%. Nitrogen content of Algetaina samples ranged from 1.25% to 1.92% and hence its protein content ranged from 9.68% to 12.86%. The nitrogen for Wdbnda ranges from 1.19% to 1.91% and the protein content ranged from 9.52% to 12.70 %, and is in good agreement with those reported by Walstra, P.(2003). Interestingly the protein content of *Acacia tortilis* var. *tortilis* is five folds greater than that of *Acacia Senegal* var. *Senegal* gum and ten folds that of *Acacia seyal* var. *seyal*. The equivalent weight of Algetaina samples ranged from 1785.7 to 2154.0 and that Wdbnda samples was from 1785.7 to 3502.1.

Uronic acid content of Algetaina samples ranged from 9.01% to 10.90% and of Wdbnda samples ranged from 9.01% to 11.86%. The number average molecular weight of content of Algetaina samples ranged from  $6.0 \times 10^5$  to  $8.8 \times 10^5$  and Wdbnda samples ranged from  $7.10 \times 10^5$  to  $9.80 \times 10^5$ . Number average molecular weight content of *A. tortilis* var. *tortilis* gum samples are in good agreement with those reported Mona. O. H, (2011), for *Acacia tortilis* var. *raddiana*.

The viscosity content of Algetaina samples ranged from 10.1 g/ml to 16.1g/ml and of Wdbnda samples ranged from 11.3g/ml to 17.2g/ml. similar to those reported by Eldeen, etal, (2007).

The monosaccharide composition of the gum samples is given in Tables 1 and 2 show the HPLC the monosaccharide compositions of test samples. All samples have low rhamnose and high arabinose content the mean value of each monosaccharide for Algetaina samples rhamnose 1.63%, arabinose 46.80% and galactose 9.36% and the for

Wdbndasamples rhamnose 1.83% arabinose 44.56% and galactose 10.05%. These results are in good agreement with those reported by Gonzalez, O.N (1991).Low percentage of rhamnose and high percentage of arabinose is atypical characteristic of gum belonging to *gummiferae* series 4 according to Bentham classification Anderson, (1983).Cationic composition of *Acacia tortilis* var. *tortilis* samples was determined using atomic absorption spectrophotometry; Tables 3 and 4 show some of the elements present in the gum samples obtained from Algetina and Wdbnda Locations the major elements content in the order (Ca> K >Mg > Na , Fe> Cd > Cr>Mn) indicate that toxicity is heavier low and satisfies the requirements according to food and pharmaceutical applications analysis of variance show significant in the cationic composition of gum samples obtained from the two differences locations.

## CONCLUSION

\* The gum from *A. tortilis* var. *tortilis* were the two locations show similar characteristics.

\* The gum from *A. tortilis* var. *tortilis* has high protein content.

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**Table 1 Physico-chemical data of *Acacia tortilis* var. *tortilis* gum from Algetina**

Sample NO.	Moisture Content%	Ash's Content	pH	Optical rotation	Nitrogen Content%	Protein Content%	E. W.	Total Uronic acid%	Mn x 10 <sup>6</sup>	Viscosity Cm <sup>2</sup> gm <sup>-1</sup>	Rhamnose%	Arabinose%	Galactose%
A1	11.24	1.50	5.04	+78.79	1.44	10.50	2112.7	9.18	7.1	10.1	1.35	44.88	8.50
A2	11.18	1.45	5.14	+80.07	1.38	09.68	1923.1	10.9	7.7	11.2	1.38	45.88	9.10
A3	11.14	1.30	5.27	+80.11	1.31	11.66	2061.8	9.41	8.8	11.5	1.71	47.15	8.61
A4	11.14	1.30	6.02	+81.48	1.53	10.33	2142.9	9.05	8.7	12.8	1.50	45.99	8.72
A5	11.09	1.60	5.04	+80.21	1.50	10.52	2054.8	9.44	7.6	12.9	1.44	47.2	9.33
A6	10.92	1.80	5.31	+85.45	1.48	09.75	2142.9	9.05	8.7	11.7	1.65	43.99	9.15
A7	11.28	1.15	5.17	+82.18	1.52	11.16	2154.0	9.01	8.1	12.4	1.71	44.98	8.61
A8	11.19	1.55	5.14	+81.11	1.58	11.29	1875.0	10.35	7.4	12.1	1.67	47.59	9.53
A9	11.35	1.20	5.14	+84.09	1.61	11.23	2112.7	9.18	7.1	11.9	1.69	46.13	9.45
A10	11.32	2.20	5.06	+85.17	1.25	10.22	1923.0	10.09	7.7	13.4	1.72	45.69	8.81
A11	11.17	1.80	5.22	+86.68	1.52	10.59	2061.8	9.41	8.8	12.4	1.54	47.81	8.77
A12	11.25	1.60	5.18	+79.01	1.54	11.12	2154.0	9.01	8.1	13.2	1.47	47.53	9.35
A13com	12.34	1.85	5.89	+90.13	1.50	12.86	1829.3	10.61	6.2	14.2	1.92	49.10	11.05
A14com	12.17	2.35	6.24	+89.83	1.87	12.76	1785.7	10.86	6.0	15.3	1.81	48.88	10.79
A15com	12.04	2.45	6.12	+91.11	1.92	11.27	1923.1	10.09	7.7	16.1	1.89	49.12	11.02
Mean	11.39	1.67	5.40	+85.90	1.56	11.05	2017.1	9.76	7.69	12.73	1.63	46.80	9.36
S.D	00.43	0.40	0.43	04.14	0.20	00.96	127.72	0.70	0.88	1.55	0.17	01.55	0.85

Com= composition samples of (A<sub>1</sub>,A<sub>4</sub>)(A<sub>5</sub>, A<sub>8</sub>)(A<sub>9</sub>, A<sub>12</sub>)

**Table 2 Physico-chemical data of *Acacia tortilis* var. *tortilis* gum from Wdbnda**

Sample NO.	Moisture content%	Ash content%	pH	Optical rotation	Nitrogen content%	Protein content%	E. W.	Total Uronic acid%	Mn x 10 <sup>6</sup>	Viscosity Cm <sup>2</sup> gm <sup>-1</sup>	Rhamnose%	Arabinose%	Galactose%
B1	11.19	1.10	5.01	+77.86	1.40	10.31	3502.1	11.15	8.50	11.3	1.19	46.55	10.68
B2	11.15	1.25	5.09	+80.04	1.37	10.62	2329.1	10.41	8.90	12.1	2.13	47.90	11.17
B3	11.16	1.40	5.12	+78.69	1.29	09.81	2378.9	10.61	7.21	12.4	1.45	47.67	8.21
B4	06.07	1.15	5.15	+80.10	1.24	09.52	2061.8	09.40	7.70	13.1	2.15	49.59	9.65
B5	11.10	1.65	5.27	+81.24	1.19	11.14	2061.8	09.18	7.90	12.8	1.55	47.99	8.99
B6	11.02	1.20	6.02	+81.28	1.45	10.31	2854.6	10.99	8.60	12.4	2.05	46.85	10.13
B7	10.89	1.75	5.03	+80.13	1.38	10.50	1785.7	09.44	8.80	11.5	1.91	46.45	9.56
B8	10.75	1.50	5.04	+82.10	1.50	09.68	2150.4	09.05	8.45	13.2	1.78	47.78	8.74
B9	10.22	1.55	5.07	+82.13	1.48	11.13	1923.1	09.01	8.10	11.7	1.95	46.34	10.49
B10	11.13	1.75	5.19	+84.08	1.20	11.24	1923.6	10.51	7.10	12.9	1.24	45.88	9.81
B11	11.14	2.05	5.11	+84.05	1.32	11.20	2142.9	10.90	7.40	11.9	1.98	48.69	8.86
B12	10.98	1.60	5.05	+82.31	1.55	10.13	2154.2	10.34	8.14	15.3	1.60	47.66	9.53
A13com	12.35	2.25	5.18	+89.14	1.79	12.23	2154.2	09.41	9.20	12.1	2.33	48.14	11.12
B14com	12.18	2.35	6.21	+90.09	1.91	12.70	1829.3	10.09	9.80	14.2	1.99	47.94	12.60
B15com	11.95	1.85	6.19	88.89	1.82	12.66	2112.7	11.86	9.70	17.2	2.10	48.87	11.20
Mean	10.88	1.61	5.31	82.81	1.46	10.88	2217.7	10.20	8.40	12.94	1.83	44.56	10.05
S.D	01.44	0.39	0.43	03.81	0.22	01.02	430.55	00.87	0.83	1.58	0.33	1.36	1.13

**Table 3 cationic composition data of *Acacia tortilis* var. *tortilis* gum from Algetina**

Sample NO.	Cd*10 <sup>-4</sup> w%	Fe *10 <sup>-4</sup> w%	Mn*10 <sup>-4</sup> w%	Cr *10 <sup>-4</sup> w%	Naw%	Kw%	Caw%	Mgw%
A1	1.1	2.1	0.36	0.57	0.0035	0.76	0.09	0.23
A2	1.2	2.15	0.49	0.57	0.0032	0.75	0.92	0.23
A3	1.0	2.3	0.45	0.51	0.0033	0.77	0.91	0.24
A4	1.1	2.4	0.50	0.69	0.0033	0.75	0.91	0.23
A5	1.2	2.5	0.39	0.71	0.0034	0.76	0.92	0.30
A6	1.3	2.7	0.52	0.73	0.0035	0.76	0.91	0.29
A7	1.1	2.9	0.53	0.75	0.0031	0.69	0.92	0.28
A8	1.2	2.8	0.59	0.81	0.0032	0.69	0.92	0.27
A9	1.3	3.1	0.68	1.15	0.0034	0.76	0.92	0.27
A10	1.2	3.2	0.64	1.35	0.0031	0.77	0.91	0.26
A11	1.3	3.4	0.76	1.90	0.0035	0.76	0.91	0.26
A12	1.1	2.85	0.81	1.70	0.0031	0.76	0.92	0.24
A13com	1.4	4.15	0.99	2.50	0.0036	0.80	0.92	0.31
A14com	1.3	4.3	1.10	3.30	0.0034	0.80	0.92	0.32
A15com	1.45	4.3	1.15	2.70	0.0038	0.80	0.92	0.32
Mean	1.22	3.01	0.66	1.33	0.0033	0.76	0.86	0.33
S.D	0.12	0.74	0.25	0.89	0.0000	0.03	0.21	0.03

**Table 4 cationic composition data of *Acacia tortilis* var. *tortilis* gum from Wdbnda**

Sample NO.	Cd *10 <sup>-4</sup> w%	Fe 10 <sup>-4</sup> w%	Mn10 <sup>-4</sup> w%	Cr 10 <sup>-4</sup> w%	Na w%	K w%	Ca w%	Mg w%
B1	1.59	3.13	1.06	1.02	0.0056	0.67	0.87	0.44
B2	1.21	2.98	0.99	1.05	0.0045	0.85	1.05	0.55
B3	1.35	2.39	1.10	1.16	0.0037	0.76	0.92	0.65
B4	1.97	2.94	0.59	1.32	0.0035	0.58	0.90	0.25
B5	1.42	3.06	0.90	0.99	0.0077	0.69	0.89	0.39
B6	1.22	2.67	1.17	0.87	0.0056	0.77	0.93	0.48
B7	1.19	2.11	0.98	0.84	0.0022	0.75	0.94	0.78
B8	1.24	3.08	0.76	0.79	0.0068	0.94	0.69	0.36
B9	1.27	2.90	1.16	1.87	0.0044	0.72	0.96	0.23
B10	1.34	3.21	1.02	1.77	0.0035	0.66	1.00	0.27
B11	1.86	3.45	1.15	1.07	0.0033	0.77	0.95	0.28
B12	1.12	2.99	0.95	1.08	0.0039	0.76	0.91	0.28
B13com	1.99	4.06	1.87	2.87	0.0080	0.84	0.88	0.89
B14com	2.11	4.04	1.06	3.04	0.0075	0.79	0.99	0.99
B15com	2.05	4.87	1.07	2.88	0.0091	0.75	1.09	0.95
Mean	1.53	3.19	0.98	1.51	0.0053	0.75	0.93	0.52
S.D	0.35	0.67	0.27	0.77	0.0020	0.084	0.088	0.26