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## COMPARISON OF KARAYA GUM AND TRAGACANTH.\*

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Karaya Gum (*Sterculia urens*) was formerly known as Indian Gum. It comes chiefly from India. The use of Karaya Gum in the preparation of toilet articles has increased in recent years. This has been due to the discovery that Karaya possesses certain physical properties that make it superior to Tragacanth for some purposes.

This laboratory has obtained data in regard to the comparative value of mucilages of Karaya and Tragacanth, and as the literature lacks information on this point, considered it worth while to publish the results.

## I. KARAYA GUM DIFFERS FROM TRAGACANTH IN PHYSICAL AND CHEMICAL PROPERTIES AS SHOWN IN THE FOLLOWING TABLE.

TABLE I.

	Karaya.	Tragacanth.
Physical form	Lumps	Ribbons
Chief chemical principal	Gelose	Bassorin
Solubility in water	More soluble than Tragacanth	
Reaction	Acid (1 Gm. requires 4.5 cc. N/10 alkali to neutralize)	Acid (1 Gm. requires 0.9 cc. N/10 alkali to neutralize)
Appearance of solution in water	Translucent	Opalescent
50% Alcohol	Clear	Precipitates
Borax test (U. S. P.)	Stringy and slimy	Not affected
Iodine T.S.	Colorless—free from starch	Blue color—starch present
Density	1.20	1.25

## II. MUCILAGE OF KARAYA GUM COMPARED WITH MUCILAGE OF TRAGACANTH.

Mucilages of the gums were prepared according to the following formula:

Powdered gum	42 grains
Glycerin (used as preservative)	5 oz. av.
Sufficient water to make	8 oz. av.

Tests were applied to the mucilages to note:

- 1st Ability of the gum to form thick mucilage.
- 2nd Effect of aging on the mucilage.
- 3rd Differences in viscosity due to the method of manufacture, *i. e.*, 1st set of experiments prepared with heat, 2nd set prepared by heating to boiling, 3rd set prepared by boiling two minutes, 4th set prepared by boiling five minutes, 5th set prepared by boiling ten minutes.

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In all experiments in which heat was used, the lot was allowed to cool and then sufficient water added to make 8 oz. av. of mucilage.

The MacMichael Viscosimeter was used to note the variations in viscosity. Readings were obtained with the following standards:

Disc plunger  
No. 22 wire  
Room temperature  
8 r. p. m.

The disc plunger is held or supported in contact with the mucilage by a standard No. 22 wire. The container holding the mucilage rotates at 8 revolutions per minute. The resistance to the wire imparted by the viscosity of the mucilage is registered on a dial and the number of divisions indicated on the dial multiplied by 205 permits a mathematical comparison in terms of poises. However, an easier comparison can be made by recording the divisions registered on the dial, as the poises run as high as 26,000, whereas the readings on the dial are simple numbers.

TABLE II.

Gum.	Aging Period.	Made without Heat.	Method of Manufacture.			
			Brought to Boil.	Boiled Two Minutes.	Boiled Five Minutes.	Boiled Ten Minutes.
Tragacanth	Original reading	17	19	39	61	61
Aleppo	After 3 months	73	84	90	108	101
No. 1	After 10 months	93	117	140	120	115
Karaya	Original reading	14	35	20	21	25
Superior	After 3 months	26	34	27	28	26
Grade	After 10 months	20	19	15	15	10

The above table shows changes in viscosity during a ten-month aging period.

Comparison:

- 1st. Tragacanth produces a thicker mucilage.
- 2nd. Tragacanth Mucilage becomes thicker on aging; Karaya becomes thinner on aging.
- 3rd. A two-minute boiling period is required to obtain thickest mucilages of Tragacanth.
- 4th. Application of heat in the preparation of mucilage of Karaya should be avoided.

TABLE III.

Gum.	Aging Period.	Treatment.	Method of Manufacture.			
			Made without Heat.	Boiled Two Minutes.	Boiled Five Minutes.	Boiled Ten Minutes.
Tragacanth	Original reading	W/o neutralization	91	140	130	110
		Neutralized	85	49	27	27
Aleppo	After two months	W/o neutralization	128	140	138	117
		Neutralized	160	55	30	29
No. 1	After four months	W/o neutralization	145	150	150	120
		Neutralized	147	48	28	26
Karaya	Original reading	W/o neutralization	68	63	56	46
		Neutralized	93	...	...	...
Superior	After two months	W/o neutralization	59	63	60	55
		Neutralized	64	69	53	44
Grade	After four months	W/o neutralization	35	45	40	33
		Neutralized	36	27	25	21

The preceding experiments were repeated with three different samples of high grade Karaya and Tragacanth gums, and although slight variations occurred in viscosity, the general results were the same.

Karaya gum is five times as acid as Tragacanth. Because of the possibility of incompatibility due to the acid, and also to note effect of neutralization, a series of experiments was made in which one-half of each experiment was neutralized. The standard formula for the mucilage used in obtaining results for Table II was again used, with a like series neutralized with potassium hydroxide. The same standards used in obtaining data for Table II were used in Table III.

There is an interesting observation drawn from the above results, *i. e.*, neutralized mucilages of Tragacanth made with the aid of heat show a stable viscosity, though decidedly less viscous than the mucilage made without neutralization and without heat.

This establishes the fact that the acid in Tragacanth effects a decrease in mucilaginous properties when heat is applied to the powdered gum or mucilage. Heat should be avoided as much as possible in powdering gum Tragacanth.

Because neutralized Karaya mucilage becomes stringy, the results in the above table are of no consequence.

In order to present the comparison of the two mucilages in another way which is more applicable, experiments were prepared containing  $\frac{3}{4}\%$ , 1%,  $1\frac{1}{2}\%$  and 2% of the gums, respectively. The solutions were prepared without aid of heat.

As the viscosity as determined by the viscosimeter does not definitely indicate the fluidity of a preparation, it was necessary to introduce another test to note this physical property.

The standard used to obtain the following data consisted of a glass tube 36 inches long, with a bore of 1 centimeter. The number of seconds required for a 30-inch column of mucilage to flow from the tube held in a vertical position was noted.

TABLE IV.

		Standards—MacMichael's Viscosimeter—No. 22 Wire-Disc Plunger— 8 R. P. M.—No. Divisions Revolved. Flow Test—30-Inch Column— 1-Cm. Bore. No. of Seconds Required to Flow.							
		% Strength of Solution of Gums.							
Gum.	Aging Period.	$\frac{3}{4}\%$		1%		$1\frac{1}{2}\%$		2%	
		Viscosi- mer.	Flow Test.	Viscosi- mer.	Flow Test.	Viscosi- mer.	Flow Test.	Viscosi- mer.	Flow Test.
Tragacanth	Original reading	11	..	30	..	72	...	211	..
Aleppa	After 4 months	18	..	43	..	87	...	235	..
No. 1	After 6 months	20	6	47	29	94	140	236	..
Karaya	Original reading	151	..	28	..	64	...	121	..
Superior	After 4 months	8	..	21	..	35	...	91	..
Grade	After 6 months	6	..	13	1	19	3	55	23

Three samples of each gum were tested as shown in the above table and the results were similar.

The above results again show that aging increases the viscosity of Tragacanth solution and decreases the viscosity of Karaya solution.

Based on the flow test, a 1% solution of Tragacanth has approximately the fluidity of a 2% Karaya solution after aging about six months.

## CONCLUSIONS.

1. Tragacanth has greater mucilaginous properties than Karaya. It is necessary to use fully twice as much Karaya to obtain a comparative thick mucilage with Tragacanth.

2. Maximum viscosity is obtained by boiling the Tragacanth mucilage two minutes; Karaya mucilage by manufacture without the aid of heat.

3. The greater acidity of Karaya should be considered in pharmaceutical preparations as a source of incompatibility.

4. Tragacanth mucilage becomes thicker on aging; Karaya mucilage becomes thinner on aging.

Karaya possesses the following advantages over Tragacanth:

1. More readily soluble. One per cent of Karaya can be completely dissolved in water in 30 minutes.

2. Karaya mucilage applied to the skin produces a softer effect than Tragacanth.

3. Karaya is preferable to Tragacanth when used in hair preparations.

Tragacanth produces a very stiff effect to the hair, whereas Karaya spreads better and keeps the hair in place without the conspicuous stiff "board" effect common to Tragacanth hair products.

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 LIQUOR CALCIS SULPHURATÆ.\*

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## PRELIMINARY REPORT.

Experience in the preparation of Liquor Calcis Sulphuratæ N. F. has shown that it is almost impossible to obtain a solution of uniform strength by following the N. F. directions. Not only do the finished solutions vary in strength when prepared by different members of a class, but also when made by the same person.

The purpose of this investigation was to determine, if possible, whether or not the quantities of lime and sulphur could be reduced, and to outline a method whereby a finished product of a uniform strength could be obtained.

A total of 16 solutions was prepared, some according to the directions in the N. F. while in others the quantities of the ingredients were altered as well as the technique used in preparing the solutions.

Two solutions were made according to the N. F. directions, *i. e.*, by adding a mixture consisting of 165 Gm. of lime and 250 Gm. of sulphur to 1750 cc. of boiling water. The mixture was boiled and reduced to 1000 cc., at which volume it was maintained, while boiling, by the frequent addition of water. The mixture was allowed to cool and finally strained through muslin. The finished solutions were

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