

## 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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assayed for their lime and sulphur content, the results of which are shown in the following table:

| Solution No. | Cc. Collected. | % CaO. | % S. | Total CaO Gm. | Total S Gm. | % CaO Used. | % S Used. |
|--------------|----------------|--------|------|---------------|-------------|-------------|-----------|
| 1            | 540.0          | 16.42  | 25.9 | 88.66         | 139.86      | 53.73       | 53.94     |
| 2            | 590.0          | 10.94  | 22.3 | 64.54         | 131.57      | 39.11       | 52.62     |
| Av.          | 565.0          | 13.68  | 24.1 | 76.60         | 135.71      | 46.42       | 54.28     |

It will be noted that although both solutions were prepared in a similar manner, the amount of finished product finally collected was 50 cc. greater in solution No. 2. Likewise, the lime and sulphur content varied a great deal, a variation which could not possibly be due to the difference in the volumes of the solutions collected. Reference to the table shows that approximately 50% of the lime and sulphur were actually used in the preparation of the solutions.

Since nearly half of the original lime and sulphur remained after preparing the solution, it was decided to prepare another series of solutions starting with the same quantities of lime and sulphur, but increasing the quantity of water. The increase in the amount of water to be added was based upon the assumption that if starting with 1500 cc. of water and concentration to a total volume 1000 cc., an average of approximately 550 cc. of finished solution could be obtained, then by using 2250 cc. and concentrating to a total of 1450 cc. it should be possible to collect approximately 1000 cc. of finished product having a lime and sulphur content which, theoretically at least, would differ only slightly from the N. F. preparation. The results obtained are given in the following tables:

| Solution No. | Cc. Collected. | % CaO. | % S.  | Total CaO Gm. | Total S Gm. | % CaO Used. | % S Used. |
|--------------|----------------|--------|-------|---------------|-------------|-------------|-----------|
| 7            | 922.5          | 10.18  | 16.20 | 93.85         | 149.36      | 56.87       | 59.74     |
| 8            | 990.0          | 8.4    | 15.08 | 83.16         | 149.29      | 50.40       | 59.71     |
| 9            | 950.0          | 8.96   | 15.48 | 85.12         | 147.06      | 51.59       | 58.82     |
| 10           | 875.0          | 8.12   | 14.86 | 71.05         | 130.02      | 43.06       | 52.07     |
| Av.          | 934.3          | 8.91   | 15.40 | 83.29         | 143.93      | 50.48       | 57.47     |

The results show that by increasing the amount of water in order that the volume of the finished product would measure approximately 1000 cc. there was a decrease of nearly 5 per cent in the lime and nearly 10 per cent in the sulphur content. Taking into consideration the amounts of lime and sulphur actually used in preparing the solutions, it will be noted that whereas in the N. F. solutions about 46 per cent lime and 55 per cent sulphur were used, in this case the amounts dissolved in solution increased to an average of 50 and 57 per cent, respectively. Apparently, therefore, the addition of a larger quantity of water at the beginning of the preparation only slightly increased the total quantities of lime and sulphur which would go into solution. Under this condition it is obvious that the percentage strengths of the lime and sulphur would be much greater in the N. F. solutions.

Solutions were again prepared, this time the technique was varied as well as the amounts of the ingredients. Instead of adding the N. F. quantities of lime and sulphur to 1750 cc. of water and concentrating down to a total volume of 1000 cc., the formula was computed on the basis of a 1000 cc. of water added at the beginning. This required 94.28 Gm. of lime and 142.85 Gm. of sulphur. In order to maintain a constant volume, the mixture was boiled with a reflux condenser for three and one-half hours, the length of time required to prepare the solution accord-

ing to the N. F. directions. A volume of 950 cc. of finished solution was obtained which assayed 7.64 per cent lime and 11.68 per cent sulphur, thereby using up 77.21 per cent of the original lime and 78.14 per cent of the sulphur. Although the percentage strengths of the active ingredients were somewhat lower than the N. F. products, at the same time the total quantity dissolved was much greater. In using smaller quantities of the ingredients less liquid was held in contact with the residue thereby making it possible to collect nearly as much of the finished product as the original water added. By reducing the quantities of lime and sulphur to one-third the N. F. formula and adding 1000 cc. of water and preparing the solution in the same manner as the above, 932 cc. of finished product were obtained which assayed 4.34 per cent lime and 5.0 per cent sulphur. The total quantities of lime and sulphur dissolved amounted to 77.22 and 97.02 per cent, respectively. Decreasing the original quantities of lime and sulphur caused a corresponding decrease in their percentage in the finished product. It will be noted that practically all of the sulphur went into solution. Increasing the original quantities of lime and sulphur failed to materially increase their relative percentage strengths in the finished solution. This was shown by the fact that when 215 Gm. of lime and 326 Gm. of sulphur were used the per cent of lime and sulphur in the finished solution was 9.36 and 19.32 per cent, respectively. The total per cent of lime and sulphur used was 40.05 and 54.52, respectively. It is possible that a much larger quantity of soluble sulphides were formed but due to the bulk of the residue so much liquid was absorbed that the remaining liquid was insufficient to dissolve them.

In order to determine the amount of soluble sulphides which were presumably left in the residue after the preparation of the solution, and which were not dissolved, due to the lack of sufficient liquid, a series of solutions were prepared according to the N. F. directions.

The residue left on preparing the first solution was added to more water and the concentrating and boiling for one hour repeated, and so on; 1750 cc. of water were added in each case to the left-over residues in preparing solutions Nos. 5 and 6. In No. 12, 2250 cc. were added to the original ingredients; 500 cc. in 12*b*; and 1000 cc. in the cases of 12*c*, *d* and *e*. The following table offers a summary of the results of this experiment.

| Solution No. | Cc. Collected. | % CaO. | % S.  | Total CaO Gm. | Total S Gm. | % CaO Used. | % S Used. |
|--------------|----------------|--------|-------|---------------|-------------|-------------|-----------|
| 4            | 590.0          | 10.90  | 22.30 | 64.54         | 131.57      | 39.11       | 52.62     |
| 5            | 650.0          | 8.60   | 7.79  | 55.90         | 50.60       | 55.64       | 42.72     |
| 6            | 740.0          | 5.72   | 2.64  | 42.32         | 19.53       | 94.97       | 28.79     |
| 12 <i>a</i>  | 1085.0         | 2.52   | 1.69  | 27.34         | 18.33       | 16.57       | 7.33      |
| 12 <i>b</i>  | 500.0          | 6.14   | 6.90  | 30.70         | 34.50       | 22.30       | 14.89     |
| 12 <i>c</i>  | 985.0          | 3.86   | 2.54  | 38.02         | 25.02       | 35.54       | 12.68     |
| 12 <i>d</i>  | 1050.0         | 3.50   | 0.52  | 36.75         | 5.46        | 53.30       | 3.17      |
| 12 <i>e</i>  | 840.0          | 1.24   | 0.14  | 10.41         | 1.17        | 32.33       | 0.70      |

The results seem to indicate that a considerable quantity of sulphides can be dissolved by repeated treatment of the residues with water. Reference to solutions Nos. 4, 5 and 6 will illustrate this point.

From the residue left on preparing solution No. 4 there was obtained 8.60 per cent lime and 7.79 per cent sulphur, and when the residue from No. 5 was in turn treated with water and additional 5.72 per cent lime and 1.69 per cent sulphur was

recovered. There was dissolved, therefore, from the original residue left after the preparation of solution No. 4, a total of 14.32 per cent lime and 10.43 per cent sulphur in a total of 1390 cc. of finished product. Summing up, the original residue yielded a total of 25.26 per cent lime and 32.73 per cent sulphur by the foregoing treatment, and 1980 cc. of finished product were obtained. The series 12*a*, *b*, *c*, *d* and *e*, showed substantially the same results. As a result of repeated treatments of the residues in this series with water, 4460 cc. of finished product were obtained before practically all of the lime and sulphur in soluble form had been extracted. It will be noted that the final solution prepared, No. 12*e*, contained only a small amount of dissolved lime together with just a trace of sulphur.

It is quite apparent that the soluble sulphides, which were subsequently dissolved in the finished product by the repeated addition of water to the residues, were formed, during the concentrating and boiling of the original mixture, and that further treatment of the residue with water supplied the necessary solvent. If the assumption just made is correct a large quantity of the soluble sulphides, remaining in the residue after removal of the concentrated sulphide solution, could be obtained by washing the residue with additional hot or cold water. In this manner a definite quantity of finished product could be collected each time. It would seem that this procedure would be much more satisfactory than that of collecting only the liquid which separates from the residue, the amounts of which cannot help but vary each time the preparation is made. The N. F. directions specify that the mixture of lime, sulphur and water be concentrated to a volume of 1000 cc. and maintained at this volume, while boiling, for one hour. Experience has shown that it is quite difficult, if not almost impossible to keep the volume constant. The solution necessarily has to be prepared in large containers and any little variation in volume represents a relatively large increase or decrease in the amount of finished product obtained, and hence the percentage strengths of the lime and sulphur will seldom if ever be the same in different solutions.

This investigation is being continued. An analysis of the residues and of crystals forming in the solution is now being carried on.

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## A COMPARISON OF RESULTS OBTAINED BY TWO METHODS OF INSTRUCTION EMPLOYED IN TEACHING PHARMACEUTICAL CHEMISTRY.\*

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In the presentation of the subject matter of any course of study an instructor is confronted with the pedagogical problem of how to present the particular course material in order to get the best results with an especial student group immediately at hand. To correctly determine what is the best method that should be used for a certain student group is not a simple matter, especially since the instructor usually has little or no advanced information on the average scholastic ability, coöperative desire and interest of the students in the group. An experienced instructor will

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