# ESTIMATION OF SUGAR IN URINE BY BANG'S METHOD.*

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Bang's solution, for the quantitative determination of sugar in urine, introduced to medical and chemical literature about six years ago, has been well received by physicians and analysts in Chicago, and its use as a delicate and very accurate reagent is spreading.

## PREPARATION OF BANG'S SOLUTION.

First prepare a concentrated solution of copper sulphate in distilled water, using 250 grams in 1500 cc. of water. The copper sulphate should be chemically pure and contain 5 molecules of water. The amount of copper present should be determined by electrolysis. After the determination of the exact amount of copper in the solution, a calculation should be made as to the number of cc. of solution containing 25 grams of copper sulphate. The number of cc. may be more or less than 150, according to the copper sulphate employed. Let us say, for example, that it takes 154.2 cc. instead of 150 cc. You may now place a label on the stock bottle reading, 154.2 cc. equals 25 grams $CuSO_4+5H_2O$.

You are now ready to make the two solutions employed in the reagent.

*Solution No. 1.*—Weigh accurately into a beaker 500 grams potassium carbonate, 400 grams potassium sulphocyanate, 100 grams potassium bicarbonate and dissolve in 1200 cc. of distilled water at 60° C. The salts should be chemically pure. When dissolved, place in a 2 liter volumetric flask, reduce temperature to 30° C. and run in, slowly, by means of a burette, 154.2 cc. of the concentrated copper solution, shaking the mixture while the copper is being added. This is very necessary to prevent precipitation. Finally add enough distilled water to make 2 liters.

*Solution No. 2.*—Dissolve 200 grams potassium sulphocyanate and 6.55 grams hydroxylamine sulphate in distilled water at ordinary temperature to make 2 liters of solution.

Allow both solutions to stand over night, then titrate solution No. 2 against No. 1 and balance so that 50 cc. of No. 2 will exactly decolorize 50 cc. of No. 1.

The operation of this reagent is dependent upon the well-known reducing powers of sugar, as found in urine, and of hydroxylamine. When urine containing sugar is added to the alkaline copper solution, the sugar reduces the blue cupric salt to the yellowish cuprous salt, the amount of cupric salt so reduced depending upon the amount of sugar present. The amount of unreduced cupric salt present is then determined by the amount of hydroxylamine solution necessary to complete the entire reduction.

## THE APPLICATION OF THE TEST.

1. Measure accurately 10 cc. of urine into a 200 cc. Jena flask.
2. Add to the urine exactly 50 cc. of solution No. 1 (blue copper solution).
3. Heat this flask on a wire gauze over a Bunsen flame so regulated that the flame turns a small spot of the gauze red. Protect flame from air currents.
4. After boiling commences, allow to boil for exactly three minutes.

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*Caution*—If the urine contains more than 0.6 percent of sugar, the blue color will be entirely destroyed. If the blue color turns yellowish on boiling, a smaller amount of urine must be used. Take 2 or 5 cc. of urine diluted with water to 10 cc. and repeat the operations this far.

5. Cool flask and contents to room temperature, quickly, by immersing the flask in cold water.

6. Titrate the contents of the flask with No. 2 solution (hydroxylamine solution) until the blue color is exactly decolorized. This titration should be so conducted that the solution runs from the burette rapidly, but in drops.

7. From the number of cc. of No. 2 solution used, calculate, from the appended table, the sugar in milligrams in the amount of urine used.

BANG'S TABLE OF REDUCTION EQUIVALENTS.

| Cc hydroxylamine solution used | Mg. sugar represented | Cc hydroxylamine solution used | Mg. sugar represented | Cc hydroxylamine solution used | Mg. sugar represented | Cc hydroxylamine solution used | Mg. sugar represented |
|---|---|---|---|---|---|---|---|
| 0.75 | 60.0 | 13.00 | 39.0 | 25.50 | 23.5 | 38.00 | 10.4 |
| 1.00 | 59.4 | 13.50 | 38.3 | 26.00 | 22.9 | 38.50 | 9.9 |
| 1.50 | 58.4 | 14.00 | 37.7 | 26.50 | 22.3 | 39.00 | 9.4 |
| 2.00 | 57.3 | 14.50 | 37.1 | 27.00 | 21.8 | 39.50 | 9.0 |
| 2.50 | 56.2 | 15.00 | 36.4 | 27.50 | 21.2 | 40.00 | 8.5 |
| 3.00 | 55.0 | 15.50 | 35.8 | 28.00 | 20.7 | 40.50 | 8.1 |
| 3.50 | 54.3 | 16.00 | 35.1 | 28.50 | 20.1 | 41.00 | 7.6 |
| 4.00 | 53.4 | 16.50 | 34.5 | 29.00 | 19.6 | 41.50 | 7.2 |
| 4.50 | 52.6 | 17.00 | 33.9 | 29.50 | 19.1 | 42.00 | 6.7 |
| 5.00 | 51.6 | 17.50 | 33.3 | 30.00 | 18.6 | 42.50 | 6.3 |
| 5.50 | 50.7 | 18.00 | 32.6 | 30.50 | 18.0 | 43.00 | 5.8 |
| 6.00 | 49.8 | 18.50 | 32.0 | 31.00 | 17.5 | 43.50 | 5.4 |
| 6.50 | 48.9 | 19.00 | 31.4 | 31.50 | 17.0 | 44.00 | 4.9 |
| 7.00 | 48.0 | 19.50 | 30.8 | 32.00 | 16.5 | 44.50 | 4.5 |
| 7.50 | 47.2 | 20.00 | 30.2 | 32.50 | 15.9 | 45.00 | 4.1 |
| 8.00 | 46.3 | 20.50 | 29.6 | 33.00 | 15.4 | 45.50 | 3.7 |
| 8.50 | 45.5 | 21.00 | 29.0 | 33.50 | 14.9 | 46.00 | 3.3 |
| 9.00 | 44.7 | 21.50 | 28.3 | 34.00 | 14.4 | 46.50 | 2.9 |
| 9.50 | 44.0 | 22.00 | 27.7 | 34.50 | 13.9 | 47.00 | 2.5 |
| 10.00 | 43.3 | 22.50 | 27.1 | 35.00 | 13.4 | 47.50 | 2.1 |
| 10.50 | 42.5 | 23.00 | 26.5 | 35.50 | 12.9 | 48.00 | 1.7 |
| 11.00 | 41.8 | 23.50 | 25.8 | 36.00 | 12.4 | 48.50 | 1.3 |
| 11.50 | 41.1 | 24.00 | 25.2 | 36.50 | 11.9 | 49.00 | 0.9 |
| 12.00 | 40.4 | 24.50 | 24.6 | 37.00 | 11.4 | 49.50 | 0.5 |
| 12.50 | 39.7 | 25.00 | 24.1 | 37.50 | 10.9 | 50.00 | 0.0 |

## PUSHING BEYOND THE HALF-WAY MARK AND WHAT AM I DOING?

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Chief among the characteristics that carry men past the half-way mark on the road to success is eagerness to keep on learning more about business methods and principles. The ablest men are constant students. They agree with the statement recently made by the treasurer of a large steel corporation: "I have been in business for about thirty years and if my business experience has taught me one thing, it is this: *'That the more a man knows about business principles*