

fever; Asiatic cholera; bubonic plague; cerebrospinal meningitis; tetanus; anthrax.

VI. Bacterin and Serum Therapy.

The aim of bacterin and serum therapy, the production of a condition of immunity for therapeutic purposes. What occurs in spontaneous recovery. Mechanism of Immunity. Bacterin and serum therapy depend upon the principles of active and passive immunization respectively.

Bacterin and serum therapy of diphtheria; tetanus; typhoid fever; pneumonia; broncho-pneumonia; influenza bronchitis and "common colds;" pertussis (whooping-cough); Asiatic cholera; plague; dysentery; tuberculosis; meningitis; staphylococcic infections, acne, carbuncle, furunculosis, sycosis; streptococcic infections, septicemia, erysipelas, puerperal fever, streptococcic sore throat, rheumatism and various complications; gonococcic infection, acute and chronic gonorrhoea, gonorrheal rheumatism, etc.

VII. The toxins of the Higher Plants and Animals and their antibodies. The phytotoxins, ricin, abrin, crotin. The zoötoxins, phrynolysin (toad poison), arachnolysin (spider poison), snake poison, scorpion poison, bee poison. Antiferments.

VIII. Chemotherapy; distinguished from pharmacotherapy by Ehrlich. Atoxyl, Salvarsan. Chemotherapy of malignant tumors.

IX. Diagnostic Tests and Reactions.

Tuberculin reactions; the subcutaneous reaction, cutaneous reaction, Moro's tuberculin ointment, Von Pirquet's cutaneous test, intradermal tuberculin test, the opthalmo reaction, the mallein test, agglutination tests, Abderhalden's test and various tests by other authors. The opsonic index.

GLYCERITE OF BISMUTH.

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The present formula for making Glycerite of Bismuth, N. F., is faulty in that a considerable loss of bismuth occurs in the process and the glycerite is therefore indefinite in strength.

No method for assay nor standard of strength is appended, and thus any product made according to the formula will be approved, but in the use of this glycerite for making elixir of bismuth and similar preparations there will be necessarily a variation in strength.

In preparing the bismuth and sodium tartrate, the subnitrate is first dissolved in nitric acid and water, the solution is diluted, then tartaric acid and sodium bicarbonate are added successively, which probably results in the formation of bismuthyl-sodium tartrate. Whatever the composition of this salt, it is soluble to a considerable extent in the strongly acid liquor, and is not wholly thrown out by further dilution.

Dr. E. H. Squibb has recommended to increase the dilution from 1000 Cc. of added water to 5000 Cc. This throws out the bismuth salt more completely,

but still results in considerable loss. Moreover this dilution is troublesome to handle and demands large containers and a large volume of purified water for the preparation of a relatively small amount of the glycerite.

The water used must either be distilled, which is costly, or a specially purified water which will not darken the salt or solution is needed. Furthermore it was found that the loss of bismuth occurs not only in the first washings, but in the last as well. If the present (1000 Cc.) amount of water be employed and three washings given, there will be a loss of about 5 to 7% of the bismuth and the final product will be strongly acid and not entirely soluble. The addition of sufficient sodium hydroxide to produce a neutral or faintly acid solution will bring all of the salt into solution, but on standing the salt will partially crystallize out. This is not due to supersaturation, for the separation will still take place after considerable dilution and the salt is soluble in alkaline liquids.

This method of procedure, which at first appeared quite satisfactory, proved to be anything but so on standing, and elixir of bismuth made with it, also gave trouble by separation of the bismuth compound.

Attempts were then made to recover all of the bismuth used by neutralizing the strongly acid liquor before washing. Since the tartaric acid and sodium bicarbonate are used in molecular proportions, a neutral solution should be obtained by simply neutralizing the free nitric acid present.

On trial, however, it was found that the bismuth precipitate is quite soluble in neutral solutions, and that while more of the salt was thrown out by the addition of alkali, yet it was impossible to entirely precipitate it by this method. While the liquid is still strongly acid, the salt begins to redissolve on the addition of alkali.

The amount of dilution is also a factor in the case. After a number of trials it was found that the addition of 64 gms. of sodium bicarbonate or of about 70 Cc. of concentrated water of ammonia, resulted in the least loss of bismuth. If the excess of alkali be added before dilution, the magma is more dense and washes more easily.

In these experiments the total mixture was made up to a volume of about 2000 Cc., which is about the same dilution as the present directions.

Further experiments were made to determine the relative advantages of ammonium tartrate and sodium and potassium tartrate (Rochelle salt) for securing a soluble salt. It was found that a soluble salt could be obtained by using Rochelle salt in place of sodium tartrate, but that relatively more of the former is required. Thus while theory requires 217 gm. of Rochelle salt, in place of 177 gm. of sodium tartrate, 300 gm. of Rochelle salt was required to produce a clear glycerite. This solution keeps well but has considerable color, and is not economical.

In a similar way ammonium tartrate was tried, and was found to be inferior to the sodium salt for the purpose.

The amounts of wash-water and the number of washings were also varied. It was found to be impracticable to wash the magma entirely free from acid, but the final acidity should not be strong. When the amount of wash-water and

the amounts decanted are uniform, five to six washings are ample. At the end the washings will be acid to litmus paper but not strongly so.

Some attention was also paid to the assay of this preparation. Attempts were first made to ignite it directly to bismuth oxide and sodium carbonate, then wash out the carbonate with hot water and weigh the oxide. This can be done, but the ignition must be made very slowly or the residue will deflagrate violently enough to throw practically the entire contents of the crucible out. This explosion usually comes without warning, and over a very low flame. A preliminary treatment with strong nitric acid tends to prevent it, but even then there is danger and the operation is slow, for digestion with the nitric acid must be continued for ten to fifteen hours before ignition can safely follow.

Furthermore the heat evolved in ignition from the action of the nitrate on the organic matter present, almost fuses the bismuth oxide and makes it very difficult to wash. In fact it cakes so hard that one never feels satisfied that it is thoroughly washed, and no way was found of avoiding the caking.

The sulphide method of estimating bismuth was found to be not only much more satisfactory, but shorter and easier to operate. By this method the glycerite is simply measured, diluted, saturated with hydrogen sulphide and the precipitate collected, washed, dried and weighed.

One point was settled in the series of experiments, namely, that crystallization in the glycerite does not occur primarily because of supersaturation. The solution is heavy in salts, probably containing nearly 400 gm. of tartrates in 1000 Cc., yet samples containing 110% of standard have stood nearly four months (present writing) without precipitation. Apparently the compound is easily thrown out of solution by other salts, or even by hydrolysis, but when in proper condition the solution is stable.

The following formula is recommended for this preparation:

GLYCERITUM BISMUTHI—GLYCERITE OF BISMUTH.

Bismuth Subnitrate	156 gm.
Nitric Acid	148 cc.
Tartaric Acid	232 gm.
Sodium Bicarbonate	325 gm.
Glycerin	
Distilled water each a sufficient quantity to make about 1000 Cc.	

Mix the nitric acid with 300 Cc. of distilled water, in a bottle having a capacity of about 4000 Cc. and dissolve the bismuth subnitrate in the mixture. Then slowly add 600 Cc. of distilled water and dissolve 116 gm. of tartaric acid in the mixture. Now add, in small portions, 195 gm. of sodium bicarbonate, shaking frequently and avoiding loss by effervescence. When all is added fill the bottle with distilled water and mix well. Allow the magma to settle and decant the clear liquid. Again fill the bottle with water and wash the magma by decantation as before, until the wash-liquor has but a slight saline taste. Then pour upon a filter and allow to drain, rinsing the bottle with a little water.

Now transfer the moist magma to a porcelain evaporating dish and add 116 gm. of tartaric acid, then slowly, and in small portions 130 gm. of sodium bicarbonate. Heat the mixture on a steam-bath until solution is effected and the total volume

is reduced to 475 Cc. Then add 475 Cc. of glycerin, if necessary, enough water to make 950 Cc. of solution, and filter. Estimate the amount of bismuth in the liquid by the process given below, and adjust it by evaporation or the addition of equal values of glycerin and water to contain the equivalent of 12.8 gms. of bismuth oxide in each 100 Cc.

A colorless or pale-yellow liquid having a slight odor of glycerin and a sweet, followed by a saline taste.

Specific gravity about 1.378 at 25° C.

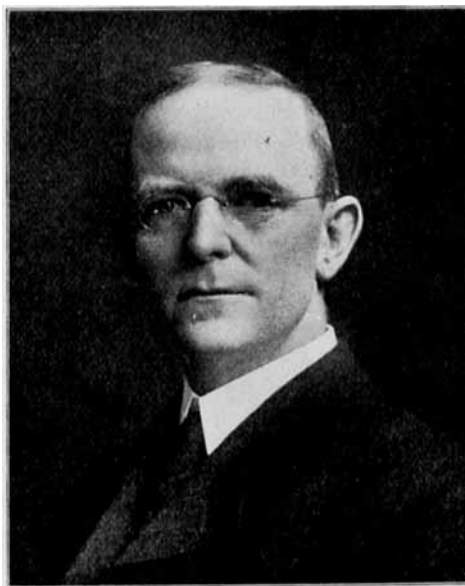
If 5 Cc. of the glycerite, accurately measured, be diluted to about 200 Cc. with water, this solution saturated with hydrogen sulphide and allowed to stand two hours, then the precipitate collected on a tared filter, washed thoroughly with hydrogen-sulphide test solution, then with a little alcohol, and finally with recently distilled carbon disulphide until all free sulphur is removed, then dried to constant weight at 100° C., the residue should weigh not less than 0.690 gm.

(The weight obtained multiplied by 0.905 and this product by 20 gives the equivalent of bismuth oxide per 100 Cc.)



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