

COMMENTS ON SOLUTION OF MAGNESIUM CITRATE.

BY FREDERICK KLEINSCHMIDT.

It is the purpose of this article to show that a stable solution may be produced with considerable less Citric Acid than the U. S. P. prescribes.

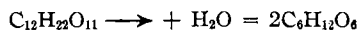
The pharmacist, in making Solution of Magnesium Citrate has two points in view: a stable solution and a palatable article for sale.

In order to obtain a stable solution, Pharmacopœia Commissions in 1900 and again in 1910 concluded to increase the amount of citric acid to be used, with the result that we now have a product unnecessarily high in acidity, resulting in frequent complaints by consumers on account of its sour taste. We understand that only some States of the Union enforce this excessive citric acid content.

The precipitate which may form in Solution of Magnesium Citrate is known as $(C_6H_5O_7) Mg_3 + 14H_2O$ and also as $(C_6H_5O_7) Mg_3 + 13H_2O$. Either salt may form.

We have found that Solution of Magnesium Citrate, made according to the formula given below, which contains 20% less citric acid than the U. S. P. X formula, will not precipitate when subjected to a temperature of 150° F. for 20 minutes, and that it then remains clear for a number of months at room temperature.

We claim that during the warming of the solution a portion of the cane sugar is reduced to invert sugar, and it is this chemical process taking place in the warm solution which prevents the formation and consequent precipitation of the less soluble basic magnesium citrate,



Through the affinity for water of the invert sugar (formed during the heating process) the formation of magnesium citrate + 14H₂O or + 13H₂O is inhibited.

The saturation point of CO₂ in and above the solution materially influences the formation of the less soluble basic salt. The greater the saturation the less the chance of precipitation.

On page 945 of the JOURNAL A. PH. A. (September 1930) it is stated that the true solution of the precipitation problem is solved "(a) by a complete sterilization of the finished solution (including bottles and stoppers), and (b) proper sealing of the bottle." Of course, any liquid in a bottle and not properly sealed will deteriorate sooner or later. While sterilization may assist towards a permanent solution, we believe that it is the above-mentioned reaction taking place during the heating process which determines the stability of the solution. Complete sterilization is by no means the *sine qua non*.

Now as to Magnesium Carbonate. We know that magnesium carbonate is not a definite chemical but a mixture of Mg CO₃ + MgO + H₂O. This product continually varies as to its MgO and H₂O contents. It absorbs moisture easily and fairly rapidly. The first U. S. P. requiring an MgO assay was that of 1900, namely, 40 per cent. Ten years later, at the request of some producers, the MgO was lowered to 39.2 per cent. In our experience as manufacturers of Magnesia our purchases of magnesium carbonate analyzed 40% MgO or over. It is therefore obvious that the MgO content of 40% was wisely adopted by the U. S. P.

of 1900 and should be retained. The acidity of this preparation is still more increased when a magnesium carbonate of 39.2% MgO content is used. The magnesium carbonate on the market usually assays between 40 and 41 per cent. Its quantity in the official formula should therefore be changed to 14 Gm.

From our extensive experience, we therefore recommend the adoption by the U. S. P. Revision Committee of the following formula:

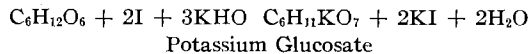
Magnesium carbonate 40%	14 Gm.
Citric acid	28 Gm.
Sugar	35 Gm.
Sodium bicarbonate	q. s.
Flavor	q. s.

to make a solution of not more than 330 cc. The solution should be kept at a temperature of 140° to 160° F. for twenty minutes, filtered hot and immediately bottled, carbonated and sealed. Or the solution may be made at room temperature and the bottles, after being sealed, subjected to a similar temperature.

Solution of Magnesium Citrate thus prepared will remain clear if made *lege artis*, for a long time—it has remained so for two years.

The draft of the medicine itself is made more agreeable to the patient, and the pharmacist has a decidedly more salable product.

The invert sugar was determined by the Iodine method after Willstätter and Schudel, Schmidt, "Organische Chemie," page 1030.



TO DOUBT IS DESIRABLE; NOT TO TRY WOULD BE REPREHENSIBLE.

Every physician should be an investigator. Much of the practice of medicine becomes by reason of its nature, an experiment. The same disease in different individuals causes different reactions, and so treatment needs constant variation, to fit this individuality of our patients. Careful notes of the results of treatment of any sort can be made by any physician; this is investigation. When the accumulated data is studied critically, deductions of very considerable value may be made and important light thrown on therapeutic measures. There remains much that can be studied with very simple apparatus on patients at home as well as in hospitals. In recent years so many complex pieces of apparatus have been devised to record this or that about patients that we are tempted to forget that the physician's five senses and a critical intelligence with very few mechanical aids still are capable of making important advances in medicine. It is well to remember that most of what we have learned in the past in medicine came from such simple methods rather than from the application of complicated apparatus. In the field of methods of treatment there still is need of much investigation. The group of self-limited diseases, as defined by Jacob Bigelow, is a very large one. The fact that scarlet fever rather recently has been removed from this group lends encouragement to the idea that others, too, may be removed by discovering methods for their cure or prevention. Many conditions that now can be ameliorated, may, by reason of investigation, be brought under better control. Many remedies, that we now use, need a better understanding of why and how they work. Many undiscovered remedies probably await the results of trial. Valuable still should be the contributions of students of medicine, who with intelligent skepticism combine thought and knowledge in the study of the many problems that confront practitioners of medicine. An intelligent skepticism assuredly is needed by practitioners now as in years past.—Henry A. Christian, M.D., in the *New England Journal of Medicine*, June 19, 1930.