

part of the city these prescriptions gravitated to a well-known pharmacist whose business greatly increased and who is now a real favorite with the prescribers.

Similar work is being done in other parts of the country. The work of the Twin Cities is well known in Cleveland and Milwaukee, where work of this kind is being done. These three centers have helped each other by exchanging their literature and in other ways.

How can pharmacists everywhere be induced to undertake identical or similar work? This Section on Practical Pharmacy and Dispensing could very consistently advocate similar endeavors and activities in every part of our country. Section action to do some publicity work in this respect would well come within the scope of the Section.

ENTERIC COATING OF CAPSULES.*

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INTRODUCTION.

A problem which arises from time to time at the prescription counter is the enteric coating of capsules. A common example is a prescription calling for ipecac in capsules coated with salol. As sometimes dispensed, these capsules appear crude and unsightly, due to poor technique in coating. Furthermore, in some cases the coating applied does not protect the capsule from the digestive processes of the stomach, with the result that the drug acts as an emetic, to the discomfort of patient, physician and pharmacist.

A comprehensive investigation of enteric coatings was recently conducted by Wruble (1), with the object of developing a new coating suitable for large scale production. The primary purpose of the present investigation was to develop a method of coating capsules that would be practical for the retail pharmacist.

EXPERIMENTAL DATA.

Spraying with Melted Salol.—According to Wruble (1), the spraying of solutions of salol in volatile solvents such as ether gave unsatisfactory results. However, Bowers (2) recently reported that capsules could be coated with salol very conveniently and efficiently by melting the salol and spraying it on with a straight-stem atomizer while agitating the capsules in a glass mortar. He stated that with a little practice, a pharmacist, with the aid of the delivery boy to shake the glass mortar, could coat 100 or more capsules in less than two minutes and that the salol coating sticks to the capsules like glue.

In the tests made in the present study, No. 1 gelatin capsules containing 15 grains of sodium bicarbonate were used. A test was made of Bowers' method, using a DeVilbiss No. 16 atomizer. The method proved rapid and convenient, and a smooth coating was obtained. However, the coating was brittle and crystalline and adhered poorly. An attempt was made to secure a coating of salol in an

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amorphous, supercooled form by cooling the capsules to 0° C. before spraying. The coating was better at first, but on standing it showed the usual brittleness of salol. By varying the temperature of the melted salol, it was found best to have the salol near the melting point (about 42° C.), but the coating was still brittle.

Tests of Hilton's Method.—S. L. Hilton (3) has recommended that the capsules be coated in a dish with a solution of white shellac in Spirit of Ammonia, U. S. P. VIII, allowed to dry, and coated in the usual manner with salol. A trial was made of this method, with the modification that the salol was sprayed on. A smooth coat was obtained, which, however, still had its usual brittleness. An obvious advantage in the Hilton method lies in the fact that since shellac itself gives an enteric coating, the capsule should still be enteric even if the salol coating comes off. A test was made in which the shellac coating was followed by a coating of salol which had been digested with shellac on the water-bath. This procedure improved the physical properties of the coating but the coating was not sufficiently soluble in artificial intestinal fluid.

Shellac Coatings.—Difficulty was experienced in dissolving white shellac in alcohol, whereas orange shellac dissolved readily. Capsules coated with a 10% alcoholic solution of orange shellac were satisfactory in regard to solubility but the appearance was poor.

Tests to Overcome Brittleness of Salol.—Salol was melted and digested on a water-bath with gelatin. The melted mixture, after filtration through cotton, was sprayed on capsules, giving a smooth coat which was less brittle than salol alone. However, when tested in the artificial digestive fluids, it was found that gelatin hastened disintegration and hence such a coat is useless. The artificial gastric and intestinal fluids used throughout the investigation were made as recommended by Toplis (4).

Some other tests were made which proved unsatisfactory for the reasons indicated as follows. Rosin dissolved in ether with salol gave a smooth coat which retained its brittleness. Salol melted with camphor or thymol gave a breakable coat of poor adherence. A coat formed by spraying melted salol containing 10% of spermaceti was breakable but the solubility results were good as the coating disintegrated in 1 hour in intestinal-fluid while 5 hours were required in gastric fluid. Melted salol mixed with glycerin gave a brittle coat.

Stearic Acid Coatings.—Toplis (4) suggested the use of stearic acid as an enteric coating. Likewise Freeman (5) recommended a process of immersion of capsules in melted stearic acid. In our tests, the spraying of melted stearic acid produced a rather smooth coat, which lacked a neat appearance and also had the objectionable property of disintegrating in gastric fluid in less than an hour.

Development of a Salol-Stearic Acid-Shellac Coating.—Capsules coated with various proportions of melted salol and stearic acid were too soluble in gastric fluid. Capsules coated with mixtures of melted salol and alcoholic solutions of shellac (10%) withstood the action of gastric fluid for 6 hours and intestinal fluid for 1 hour.

When a small amount of stearic acid was added to a mixture of melted salol and an alcoholic solution of shellac, and the mixture sprayed on capsules, a good coat was obtained having ideal solubility, as it resisted gastric fluid for six hours

but disintegrated in intestinal fluid in half an hour. The formula and directions for this coating are as follows:

Salol	22.5 Gm.
Stearic acid	2.5 Gm.
10% Alcoholic solution of orange shellac	10.0 cc.

Melt the salol and stearic acid on a water-bath and add (all at once) the alcoholic solution of shellac. Let stand for a while before stirring (lest the shellac be precipitated) and then mix well by shaking. Spray the mixture with a fine spraying atomizer on capsules contained in a glass mortar.

The coating was also used on test capsules made similarly to the test tablets described by Wruble (1). These capsules contained methylene blue and calcium sulphide. If such a capsule dissolves in the stomach, eructations of H_2S follow; if it dissolves in the intestines, the urine is colored blue; if neither occurs, it is evident that the capsule has not disintegrated at all. In the tests made, the urine was colored blue and there were no eructations of H_2S , thus indicating that the coating was effective.

The physical properties of this coating represent a decrease in brittleness as compared with salol alone. The capsules can withstand ordinary handling although the coat can be rather easily scraped off with the finger nail. The capsules should be dispensed in a cardboard box, using cotton to prevent excessive jarring, and the patient should be instructed not to use capsules which lose part of the coating through handling.

SUMMARY.

1. Enteric coatings of salol may be applied to capsules by spraying the melted salol from an atomizer but the coating is brittle and adheres poorly.
2. Capsules coated with stearic acid disintegrate too rapidly in artificial gastric fluid.
3. A coating applied by spraying a mixture of salol, stearic acid and an alcoholic solution of shellac can withstand ordinary handling and possesses ideal solubility, as shown by laboratory tests and by actual trial.

REFERENCES.

- (1) Milton S. Wruble, *Amer. J. Pharm.*, 102 (1930), 318.
- (2) T. J. Bowers, "Selling and Service," 2, No. 5 (1931), 6.
- (3) S. L. Hilton, "Proc. National Conference on Pharmaceutical Research," 1929-1930, pages 19-20.
- (4) Toplis, *Amer. J. Pharm.*, 87 (1915), 518.
- (5) H. J. Freeman, *Pharm. J.*, 120 (1928), 412.

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Red Cross Roll Call comes between Armistice Day and Thanksgiving. Christmas Seals sale for control of Tuberculosis from now until Christmas. Pharmacists have always participated heartily and will do their part in supporting this work.