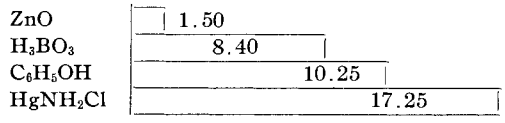
A Study of Silica Gel as a Carrier for Antiseptics*,†

*By William A. Prout‡, Mae S. Eddleman** and Rhett G. Harris††*

In 1937, Peronnet and Genet (1) reported that silica gel as an ointment base had certain characteristics which indicated to us its potential possibilities as a carrier for certain germicidal substances. It was shown by these investigators that silica gel formed with glycerin a stable ointment base which could be kept over a period of several months without deterioration and which might be used in the manufacture of certain ointments which are official in the pharmacopœia of France. Upon the assumption that a satisfactory ointment base had been perfected, we have attempted to evaluate the efficiency of the silica gel and glycerin and other silica gel bases as carriers of certain antiseptic medicaments by comparing the bacteriocidal action of the ointments made with these silica gel bases with the bacteriocidal action of the same antiseptic medicaments when incorporated in the base now official in the United States Pharmacopœia XI.

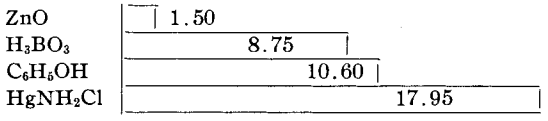
Ointments made with Base "A"
(Silica Gel and Glycerin)



Zone in mm.

Controls: U. S. P. Base—no zone.
Base "A"—no zone.
U. S. P. ointments ZnO, H_3BO_3 and C_6H_5OH—no zone.
$HgNH_2Cl$—6 mm. zone.

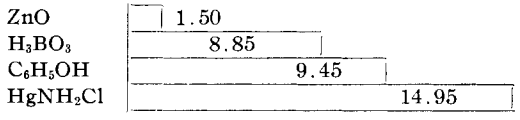
Ointments made with Base "B"
(Silica Gel and Expressed Oil of Almond)



Zone in mm.

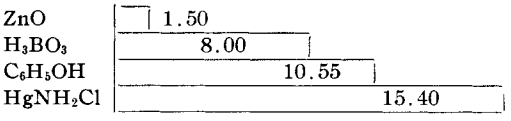
Controls: U. S. P. Base—no zone.
Base "B"—no zone.
U. S. P. ointments ZnO, H_3BO_3 and C_6H_5OH—no zone.
$HgNH_2Cl$—6 mm. zone.

Ointments made with Base "C"
(Silica Gel and Cottonseed Oil)



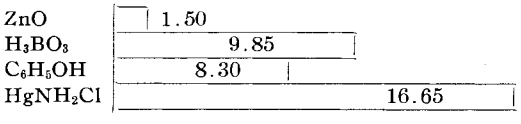
Controls: U. S. P. Base—no zone.
Base "C"—no zone.
U. S. P. Ointments ZnO, H_3BO_3 and C_6H_5OH—no zone.
$HgNH_2Cl$—6 mm. zone.

Ointments made with Base "D"
(Silica Gel and Olive Oil)



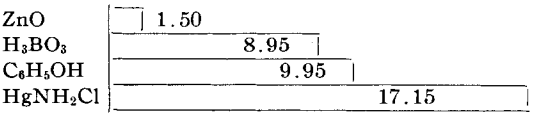
Controls: U. S. P. Base—no zone.
Base "D"—no zone.
U. S. P. Ointments ZnO, H_3BO_3 and C_6H_5OH—no zone.
$HgNH_2Cl$—6 mm. zone.

Ointments made with Base "E"
(Silica Gel and Liquid Petrolatum)



Controls: U. S. P. Base—no zone.
Base "E"—no zone.
U. S. P. Ointments ZnO, H_3BO_3 and C_6H_5OH—No zone.
$HgNH_2Cl$—6 mm. zone.

Ointments made with Base "F"
(Silica Gel and Castor Oil)



Controls: U. S. P. Base—no zone.
Base "F"—no. zone.
U. S. P. Ointments ZnO, H_3BO_3 and C_6H_5OH—No zone.
$HgNH_2Cl$—6 mm. zone.

EXPERIMENTAL

Six different bases were prepared by incorporating silica gel with glycerin, expressed oil of almond, cottonseed oil, olive oil, liquid petrolatum and castor oil, respectively. With each of these six bases, ointments of zinc oxide, ammoniated mercury, phenol and boric acid were prepared. The twenty-four ointments were then compared with the corresponding pharmacopœial ointments, by using the agar cup-plate method for testing antiseptics and

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* Presented before the Section of Practical Pharmacy and Dispensing, A. PH. A. Richmond meeting, 1940.

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disinfectants (2), which is one of the accepted methods of the United States Food and Drug Administration. Briefly, the procedure is as follows: 20 cc. of nutrient agar which had been melted and cooled to 42–45° C. and to which had been added 0.1 cc. of a 24-hour broth culture of *Staphylococcus aureus*,[1] were poured into a sterile petri dish and allowed to harden at room temperature. By means of a sterile cork borer, a disk, 1.5 cm. in diameter, was cut out of the solidified agar, leaving a cup with an approximate depth of 0.2 cm. Into this cup was placed 0.5 Gm. of the ointment to be tested, and the plate was then incubated under an unglazed porcelain top for 24 hours. At the end of the period of incubation, the zones of inhibition were measured by means of a vernier caliper. Each ointment was prepared secundum artem, maintaining the pharmacopœial strengths of the active constituents and employing the bases previously mentioned.

The accompanying graphs show the differences between the zones of inhibition produced by the germicidal agents when incorporated in the silica gel bases and the same germicidal agents when incorporated in the pharmacopœial base. It will be be noted that the zones produced by any one of the antiseptic medicaments are approximately the same with all six silica gel bases; that there are significant differences between the individual antiseptic medicaments, which would be expected inasmuch as the germicidal power of the medicaments *per se* varies greatly; that the corresponding ointments prepared with the pharmacopœial base failed, with the exception of ammoniated mercury, to exhibit any zones of inhibition.

DISCUSSION

Earlier investigation of two of the authors (3) has shown that these same antiseptic medicaments when prepared with other bases failed (again with the exception of ammoniated mercury) to exhibit any zones of inhibition when tested in a similar manner. At present the explanation of these observed differences is theoretical and is based upon the apparent constitution of the bases employed.

An ointment that has any antiseptic value owes that characteristic to the fact that the medicament, in sufficient concentration to destroy microörganisms, is capable of diffusing from the base to the surface upon which it is applied. Any factor or factors which have a tendency to influence the diffusion of the medicament from the ointment base will, in turn, affect the antiseptic property of the ointment. It would appear as though silica gel, due to its high water content, permits a greater diffusion of the medicament from the ointment. On the other hand, the pharmacopœial base having a relatively low water content and holding securely what little water is present, apparently does not afford a very good carrier for certain antiseptic substances.

[1] No. 209, obtained from the United States Department of Agriculture.

CONCLUSIONS

1. Silica gel, when combined with such substances as glycerin, expressed oil of almond, liquid petrolatum, castor oil, olive oil and cottonseed oil, respectively, appears to react satisfactorily as a carrier for certain antiseptic medicaments.

REFERENCES

(1) Peronnet and Genet, *J. pharm. chim.*, 26 (1937), 490.

(2) *U. S. Department of Agriculture, Circ.* 198 (1931), 14.

(3) Prout, Wm. A., and Strickland, Mae, *Jour. A. Ph. A.*, 26 (1937), 730.

Phenolic Ointments*

By Carl B. Burnside† and Rudolph A. Kuever‡

INTRODUCTION

Phenol Ointment has long been used as an antiseptic application. It has been official in the United States Pharmacopœia (1) since 1873 at which time it first appeared in the fifth revision under the title, Ointment of Carbolic Acid. This ointment contained 12.5% of phenol. In six revisions of the United States Pharmacopœia the formula for the official ointment was altered as many times. Its phenol content has been gradually reduced until at present it contains 1.8 to 2.2%. The title was changed from Ointment of Carbolic Acid to Ointment of Phenol in the eighth revision and in the eleventh revision it takes the name Phenol Ointment.

* Presented before the Scientific Section, A. PH. A., Richmond meeting, 1940.

† Abstract from a thesis presented to the Graduate College of the State University of Iowa in partial fulfilment of the requirements for the degree Master of Science.

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