in the first 1000 ml. of percolate represented, in trial 1, 91.9% and in trial 2, 86.9% of all the tannin available in the drug. Variations in the two trials may be attributed to differences in time required for the menstruum to pass through the drug, probably caused by different pressures being exerted in packing the drug in the tubes.

Modified Diacolation Compared.—Fluidextracts of Krameria were prepared in conical and cylindrical percolators, the dimensions of which have already been outlined, by the National Formulary VI procedure, and by a modified process in which no weak percolates were collected. These were assayed and compared with the fluidextracts made by modified diacolation. The results are shown in Table V.

Comments: The results would indicate that modified diacolation has no advantage over the official process in which a long cylindrical tube is used as the percolator except, perhaps, economy of alcohol. The process does show advantages, however, over the National Formulary VI process conducted in a conical percolator.

Loss of Tannin in Fluidextract of Krameria.—All of the fluidextracts prepared in this study were assayed for tannin after they had aged for known periods of time. It was found that, in general, the amount of tannin lost in Fluidextracts of Krameria became greater with increased aging time. Although the fluidextracts prepared by modified diacolation were not allowed to age as long as the others, results showed that they exhibited approximately the same degree of instability.

SUMMARY AND CONCLUSIONS

1. It is not possible to extract the tannin from krameria completely and efficiently by ordinary percolation methods without the collection of weak percolates.

2. Increasing the length of the drug column seems to increase the efficiency of extraction when the National Formulary VI process of percolation is employed.

3. It is possible to remove approximately 90% of the tannin from krameria without the collection and evaporation of weak percolates by employing a modified diacolation procedure.

4. Modified diacolation seems to be preferable to the National Formulary VI process in which a conical percolator is employed for the preparation of Fluidextract of Krameria, but it apparently possesses no advantages over the same process using a long cylindrical tube as the percolator.

5. Losses of tannin in Fluidextracts of Krameria were studied. As high as 12.5% of the original tannin was lost over a period of four and one-half months.

6. As far as they were observed, Fluidextracts of Krameria prepared by a modified diacolation process lost their tannin at about the same rate as did those prepared by other methods.

REFERENCES

(1) "A. O. A. C. Official Methods of Analysis" (1930), page 155.

(2) Arnett, S. W., and Lee, C. O., JOUR. A. PH. A., 27 (1938), 312.

(3) Scoville, W. L., *Ibid.*, 9 (1920), 868.

(4) Husa, W. J., and Magid, L., *Ibid.*, 24 (1935), 839.

(5) Rosenwasser, N., PROC. A. PH. A., 30 (1882), 519.

(6) Kelly, E. F., and Krantz, J. C., JOUR. A. PH. A., 13 (1924), 815.

(7) Breddin, H., *Pharm. Ztg.*, 80 (1935), 354.

(8) Husa, W. J., and Huyck, C. L., JOUR. A. PH. A., 27 (1938), 205.

(9) Husa, W. J., and Huyck, C. L., *Ibid.*, 27 (1938), 211.

(10) Breddin, H., *Pharm. Ztg.*, 75 (1930), 1261.

(11) Breddin, H., *Ibid.*, 79 (1934), 148.

(12) Gstirner, F., *Ibid.*, 79 (1934), 310.

(13) Keller, F., *Apoth. Ztg.*, 49; *Deut. Apotheke*, 2 (1934), 592; through *C. A.*, 28 (1934), 3835.

(14) Husa, W. J., and Huyck, C. L., JOUR. A. PH. A., 27 (1938), 290.

A Study of Hydrophile Ointment Bases*

By G. W. Johnston† and C. O. Lee‡

The so-called "Absorption Bases" are relatively new products. The word absorption is used to denote their hydrophile or water-holding property and not to describe their action when applied to the skin. However, claims are made for the absorption of many of these preparations which are being marketed under a variety of names.

These bases have found a definite place in pharmacy and cosmetology because of their special properties. Due to the interest and attention that they have been receiving it was felt that it would be worth while to attempt to produce a similar preparation from official substances.

* An abstract of a thesis presented to Purdue University in partial fulfilment of the requirements for the Master of Science degree by G. W. Johnston, August 1939.

† Assistant in Pharmacy, Purdue University.

‡ Professor of Pharmacy, Purdue University.

It is the aim of this paper to discuss the problem of making an absorption base comparable to the commercial products. Furthermore, it is our purpose to show that such a base may be used in the preparation of most of the ointments of the U. S. Pharmacopœia and the National Formulary.

WATER ABSORPTION BASES

Navarre (1) states that preparations of this kind are of two types: (*a*) those made with a concentrate dissolved in hydrocarbons, and (*b*) those made with a concentrate along with lanolin, hydrocarbons or lipids. It is further stated that absorption bases are compounds composed of the so-called oxycholesterol fraction of lanolin, referred to as the concentrate, fused with various hydrocarbon products such as petrolatum, mineral oil and paraffin, and with lanolin. The concentrates may contain 25 per cent or more of the oxycholesterols. It is claimed that the commercial absorption bases contain 5 to 10 per cent cholesterols in hydrocarbon bases.

The chief problem seems to be that of adding something to petrolatum to increase its water-holding property. Cetyl alcohol has been investigated in this respect. In 1917 Axelrod (2) presented a product with the following formula: petrolatum 70 parts, paraffin 20 parts, cetyl alcohol 10 parts, anhydrous wool fat 5 parts and water 100 parts.

Zugabe (3) reported an analysis of Eucerin, a trade-marked base. He claimed it to be composed of the following: cholesterol 5 per cent, anhydrous lanolin 15 per cent and petrolatum 80 per cent.

In the same year a formula was suggested for an anhydrous vaseline made from oxycholesterol 5 parts, wax and paraffin each 2 parts and liquid petrolatum 91 parts. It was claimed that this product was easily miscible with water (4).

Lifschuetz (5) discussed these bases and claimed that the water-absorbing properties of wool fat are attributable to its content of free alcohols, which are present to the extent of 5 to 8 per cent. It was also stated that upon the addition of 3 per cent of these alcohols to paraffin or vaseline, the latter acquired the property of absorbing a high content of water even up to 300 or 400 per cent.

In 1932 Schmatolla (6) wrote a series of articles upon increasing the hydrophilic properties of petrolatum. He presented formulas containing one-half to one per cent cholesterol in petrolatum bases. Seidler (7) at about the same time discussed the influence of cholesterol in ointments with a high water content.

Artl (8) in 1924 showed that the addition of one per cent of cetyl alcohol to petrolatum increased its water-absorbing power to 100 per cent. It has also been shown that the addition of 10 per cent of cetyl alcohol to lard will give a base capable of absorbing 100 per cent water.

In 1928 Wratschkoss (9) stated that he was able to prepare a water-absorbing base by heating petrolatum and glycerin to 280° in a thin-walled aluminum container. He did not mention the amount of water absorbed.

The method of Gottardo (10) is still different. He hydrogenated hydrocarbons and rendered them hydrophilic by means of the action of saturated solutions of salts, such as the chlorides of sodium, magnesium, calcium and iron. The properties of the hydrophilic petrolatums thus obtained varied with the salt used.

EXPERIMENTAL

The foregoing discussion of water-absorption bases, while brief, gives a clue to their approximate composition. The information to be found in the literature did not settle the problems of procedure in preparing such products. The matter of grades or quality of hydrocarbons, especially petrolatums, also waxes, wool fat and other constituents seemed to us to constitute sources of trouble.

We prepared 44 different bases using varying proportions of the following substances: cholesterol, white petrolatum, anhydrous lanolin, white wax, paraffin, ceresin, cetyl alcohol, oleic acid, yellow wax, liquid petrolatum, lecithin, cetaceum, glyceryl monostearate, sodium oleate, glycerin, sodium lauryl sulfonate, cholesterol esters, oxycholesterol and water.

It is not necessary to discuss all of these formulas in detail. The one which we found to be most likely in all respects was number 37. Its composition is as follows.

Cholesterol	5.0 Gm.
Anhydrous wool fat	20.0 "
Liquid petrolatum	45.0 "
Cetaceum	25.0 "
White wax	5.0 "

Procedure.—The wax and cetaceum are melted in a porcelain dish upon a water-bath. The lower melting point fats are then added and stirred sufficiently to insure a homogeneous mixture. The temperature is then increased to about 150° and the cholesterol added. Stirring is continued until solution is effected, after which the base is allowed to cool.

To incorporate the water the base is melted and the temperature maintained at about 45° to 50°. Water having the same temperature is then added in small portions with stirring until emulsification takes place, as evidenced by the formation of a white cream.

The limits of water absorption were determined for each of our formulas by repeated experimentation, the aim being to produce a base that would take up three or more times its weight of water.

Emulsification and Stability.—We were able to incorporate about 300 per cent of water in a base composed of 5 per cent each of lanolin and cholesterin in petrolatum early in our study but it was observed that upon standing or being rubbed upon the skin there was separation of water. An additional binding agent seemed necessary to produce more stable emulsification. Accordingly several such agents were tried, namely, cetyl alcohol, ceresin, lecithin, cetaceum, oleic acid, glyceryl monostearate, sodium lauryl sulfonate, white and yellow wax, etc. Of these agents white and yellow wax and cetaceum seemed to be the proper agents to add. These are to be found in our formula 37.

It was further observed that petrolatums varied greatly in their physical properties. This led us to abandon petrolatums in favor of the use of liquid petrolatum and relatively high percentages of white wax, cetaceum and lanolin.

Several investigators suggested the value of oxycholesterol and cholesterol esters in formulas of this kind. Our experience indicated that these substances do yield good water-holding formulas but that they lose their water after a week or so unless a rather large percentage of anhydrous lanolin is present. Oxycholesterol yielded products that were rather dark in color and which did not seem to exhibit as good emulsifying powers as those prepared with cholesterol.

Properties of Water-Holding Bases.—After a formula, satisfactory with respect to the emulsification of water is concerned, has been found there are many other factors to be considered. Among these are viscosity, melting point, spreading quality, adhesiveness and texture.

In general appearance and behavior, our base 37 and some of those on the market were quite alike. However, they were not alike in all physical respects as shown in Table I.

Table I.—Constants of Ointment Bases

Base	Engler Degrees	Kinematic Viscosity	Melting Point
Aquaphor	1.68	0.080	40.0°
Base 37	2.21	0.135	41.1°

These tests were carried out according to the directions of the U. S. Pharmacopœia XI.

Pharmaceutical Application of Absorption Bases.—After formulating base 37, it was decided to study the limitations of its use in making ointments of official medicinal strength. Aquaphor was used as the control base.

The general procedure was as follows: The proper amounts of the base and water were formed into an emulsion cream. The medicinal ingredients were then levigated with a portion of the emulsion until smooth, and the remainder gradually incorporated. In the case of liquid ingredients simple admixture with the cream was all that was needed. Where solids and liquids were both present they were mixed, then added to the cream as described above.

We were able to make very satisfactory U. S. Pharmacopœia ointments of: boric acid, tannic acid, rose water, chrysarobin, ammoniated mercury, yellow mercuric oxide, iodine and zinc oxide. Ointment of pine tar was too soft and the addition of 10 per cent of white wax was necessary. Ointments of belladonna, nutgall and phenol were unsatisfactory in that they caused the emulsion cream to break. Doubtless this difficulty can be overcome with further study.

Of the National Formulary ointments the following proved to be satisfactory in appearance and general properties: compound ointment of benzoic acid, calamine, capsicum, mild mercurous chloride, mercuric nitrate, red mercuric oxide, stainless iodized ointment, coal tar, compound ointment of tar, lead oleate, potassium iodide, scarlet red, mustard, alkaline sulfur ointment and zinc stearate.

Ointment of ichthammol was too soft and required the addition of white wax equal to the amount of ichthammol. We were unable to produce a satisfactory ointment of menthol or resorcinol.

Stability of Absorption Base Ointments.—The official ointments, as described, prepared with absorption bases were subjected to variable temperatures in order to determine their stability at summer heat and at lower temperatures. They were placed in an oven at 33° for 24 hours. Separate samples were placed in a refrigerator for the same length of time at 10°.

Of the 25 ointments studied about 10% of them were stable at 33° but only about 40% of them showed stability at 10°. Those which showed separation of any kind under this treatment were considered unstable.

The water content of these ointments was variable due to their variations in medicinal agents, and the base. In all instances, 25 Gm. of the base were used, with sufficient active ingredients for a 100-Gm.

formula of official strength ointment, and enough water to make 100 Gm. of the product. The water content ranged from 100 per cent to 300 per cent. About 50 per cent of these showed no loss of water over a period of 25 days at room temperature even during summer heat. Several showed loss of water within a few days.

CONCLUSIONS

These observations have led us to conclude that ointments prepared with water-absorption bases containing fairly high amounts of water are sensitive to temperature changes. For this reason we believe that hydrophile ointment bases are much less suited to stock ointments than to those for extemporaneous use.

REFERENCES

(1) Navarre, M. G., *Am. Perf. Bull.* No. 4 (1937).

(2) Axelrod, S., *J. Ind. Eng. Chem.*, 9 (1917), 1123.

(3) Zugabe, D., *Pharm. Zgt.*, 78 (1933), 25.

(4) Anonymous, *Schweiz. Apoth. Ztg.;* through YEARBOOK AM. PHARM. ASSOC., 7 (1918), 128.

(5) Lifschuetz, J., *Pharm. Zentralh.*, 63 (1923), 305; through *Pract. Drug.*, 42 (May, 1924), 34.

(6) Schmatolla, O., *Pharm. Ztg.*, 77 (1932), 727, 1153.

(7) Seidler, P., *Ibid.*, 77 (1932), 1219.

(8) Artl, E., *Ibid.*, (June 11, 1924); through YEARBOOK AM. PHARM. ASSOC., 13 (1924), 39.

(9) Wratschkoss, F., *Pharm. Monatsh.* (March, 1928); through YEARBOOK AM. PHARM. ASSOC., 17 (1928), 674.

(10) Gottardo, E., *Chem. Abstracts*, 28 (1934), 922.

Book Reviews

The Squibb Ancient Pharmacy, by GEORGE URDANG and F. W. NITARDY. 190 pages, $4^1/_4$ x 7. E. R. Squibb & Sons, New York, 1940. Price, $1.00.

This little volume is a catalog of a European collection of old drug jars, mortars, utensils, furnishings and apothecary shop fixtures, acquired by E. R. Squibb & Sons of New York in 1932. This collection is housed in two rooms on the 28th floor of the Squibb Building at 58th Street and Fifth Avenue, New York. The rooms are designed in the style of an old apothecary shop and are open to inspection by pharmacists and other interested persons. The catalog gives detailed descriptions of the old faience ware, glassware, mortars, pictures, books and documents. The text is well illustrated and contains many historical data which should be of interest to all pharmacists who take pride in their calling.—A. G. D.

The Homeopathic Pharmacopœia of the United States. Published under the direction of the Committee on Pharmacopœia of the American Institute of Homeopathy. Fifth Edition, revised, price, $6.00. First Supplement, 50¢. The publications may be purchased from Boericke & Tafel, Homeopathic Pharmacists.

The Homeopathic Pharmacopœia is one of the books on drug standards named in the Federal Food, Drug and Cosmetic Act. It deals with the drugs and medicines used by the homeopathic practitioners and is prepared by the Committee on Pharmacopœia of the American Institute of Homeopathy and collaborators. The present members of the committee are T. H. Carmichael, M.D., Chairman; G. W. Boericke, M.D.; H. S. Nicholson, M.D.; J. S. Stewart, M.D.; F. F. Massey, M.D. In addition to listing standards for drugs and medicines used in homeopathic practice, the volume also gives information relative to their botany, chemistry, pharmacy and pharmacology, also the preparation of dilutions and dosages. Pharmacists who are called upon to fill homeopathic prescriptions should provide themselves with the revised edition of this Pharmacopœia as homeopathic preparations must conform to the standards provided thereby.—E. G. E.

A reprint of *German Medicinal Plants, No. 8, 1938.* A contribution to the knowledge of the drug, *Herba Lobelia*, and requirements for its cultivation by DR. ISE ESDORN, from the Institute of Applied Botany, Hamburg.

The method of cultivation of lobelia is described—the flowering time in Germany is July to August and the harvesting season is near the end of the flowering time. The author states that the cultivation presents no great difficulties and the market price of the drug is satisfactory. The roots and seeds are described, also methods of analysis. The alkaloidal strength of the dried drug decreases some on storage—it dropped from 0.36% to 0.34% in six months.—E. G. E.

Argyria—the Pharmacology of Silver. By WILLIAM R. HILL, M.D., Instructor in Dermatology and Syphilology, University of Pennsylvania, and DONALD M. PILLSBURG, M.A., Associate Professor of Dermatology and Syphilology. Published November 1939 by Williams and Wilkins Company, Baltimore. Price, $2.50, bound in cloth.

"The study of the pharmacology of silver in relation to the problem of argyria has been carried out