cc. of the filtrate with tenth-normal thiocyanate solution using 3 cc. of ferric ammonium sulfate T.S. as indicator. Carry out a blank determination, omitting only the chloroform liniment, and correct the volume of silver nitrate consumed in the assay by the volume consumed in the blank determination. Each cc. of tenth-normal silver nitrate is equivalent to 0.00398 Gm. of $CHCl_3$.

The following results were obtained with commercial samples run by the official procedure and the pressure bottle method.

TABLE II.—RESULTS EXPRESSED AS GM. OF $CHCl_3$ PER 100 CC.

Sample.	U. S. P. XI Method, Tinfoil on Cork Stopper.	U. S. P. XI Method, Tinfoil on Rubber Stopper.	Pressure Bottle Method.
1	35.47	37.11	41.34
2	28.06	37.76	40.30
3	...	32.14	34.18
4	...	33.98	40.99
5	...	40.99	43.48
6	...	36.47	38.95

DISCUSSION.

The proposed method eliminates distillation, the four-hour refluxing period, and a transfer of the reaction mixture; thereby decreasing the opportunity for error and at the same time greatly shortening the time required for the determination. Slightly higher results are obtained by the gravimetric modification of the recommended procedure.

SUMMARY.

1. A simpler and less time-consuming procedure for the assay of chloroform liniment is recommended.

2. The average recovery of chloroform by this procedure is 98.4 per cent.

REFERENCES.

(1) Kunke, W. F., *J. A. O. A. C.*, 12, 264 (1929).
(2) Beal, G. D., and Szalkowski, C. R., JOUR. A. PH. A., 22, 540 (1933).
(3) Moraw, H. O., *J. A. O. A. C.*, 10, 352, 358 (1927).
(4) Willgerodt, T. M., *Am. J. Pharm.*, 97, 584 (1925).

HYDROGENATED CASTOR OIL IN OINTMENTS.—PART II COSMETICS.*

BY GEORGE W. FIERO AND LAURENCE D. LOCKIE.[1]

Solidifying agents employed in cosmetics are chiefly waxes such as white beeswax, spermaceti, paraffin, ceresin, etc. Waxes differ from true fats in that they are not saponifiable (*i. e.*, not glycerides of fatty acids) and supposedly are not as readily absorbed by the skin. The use of animal fats, such as lard, is unsatisfactory because of the tendency to rancidity.

Hydrogenated castor oil was found satisfactory as a base for ointments (1). Since ointments are closely related to many cosmetics, the use of the oil as a substi-

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tute for waxes was investigated. Hydrogenated castor oil may be prepared with any desired melting point up to about 86° C. For certain cosmetics, a lower melting point oil might be used. However, the tendency to rancidity varies with the extent of hydrogenation, completely hydrogenated castor oil not being susceptible to rancidity. Partially hydrogenated castor oil does not develop rancidity nearly as readily, however, as untreated castor oil.

The hydrogenated castor oil used in these experiments was practically completely hydrogenated, having an iodine value of practically zero and a melting point of about 86° C. It was a hard, brittle, more or less translucent, glossy substance which could readily be reduced to a powder.

Cold Cream.—Cold cream, although made by a number of different formulas, consists chiefly of liquid oils (such as mineral oil), wax (spermaceti, etc.), emulsifier and water. The usual proportions are wax 12–20%, oil 40–60% and water 20–35% (2). **Unguentum Aquæ Rosæ,** U. S. P., contains 24.5% waxes, 56% oil and 19% water. This, however, is much stiffer than most commercial cold creams.

EXPERIMENTAL.

In order to ascertain the effect of substitution of hydrogenated castor oil for waxes in cosmetics, a series of cold creams was prepared. The basic formula was high in both wax and water so that the substitution would readily be noticed in comparative stiffness and the absorption of water.

Basic Formula.

Wax	20 Gm.
Mineral Oil	50 cc.
Water	30 cc.
Emulsifier, *q. s.*	

The cream was prepared in the conventional manner by melting the wax and mineral oil and incorporating the aqueous solution of the emulsifier previously heated to the same temperature. An electric mixer was used for emulsification and the product then stirred by hand occasionally until it cooled. In the case of hydrogenated castor oil, because of its higher melting point, a higher temperature was necessary.

Borax Creams.—Borax creams were prepared by using one Gm. of borax as an emulsifier. Prepared with white wax, the creams were well emulsified, fairly stiff (stiffer than commercial products). This product (I) was used as a standard for comparison. Creams were prepared substituting hydrogenated castor oil for the wax. It was found that more rapid and prolonged agitation was necessary to effect emulsification. The product was unsatisfactory, having a "grainy" consistency. When first prepared, it was softer than that prepared with white wax (I), but after standing two days was stiffer than this cream.

Creams were prepared using a mixture of equal parts of white wax and hydrogenated castor oil with the following results:

Amount Used.	Stiffness when Prepared.	After Two Days.
20 Gm.	Much stiffer than I	Much stiffer than I
16 Gm.	Stiffer than I	Stiffer than I
12 Gm.	Slightly softer than I	Same as I
8 Gm.	Quite soft	Slightly softer than I
4 Gm.	Thick liquid	Very soft cream

Creams prepared with a mixture of wax and hydrogenated castor oil readily emulsified and did not possess the "grainy" consistency which characterized those prepared with the hydrogenated castor oil alone. All of these creams became stiffer after standing for two days.

Triethanolamine Creams.—Creams were prepared using two cc. of triethanolamine and eight Gm. of stearic acid as the emulsifier, the former being dissolved in the water and the latter

melted with oil and wax. These creams emulsified easier than borax creams, the creams were more jelly-like and translucent, especially when first prepared, and the creams were stiffer (due to the stearic acid content).

Creams were prepared with white wax, spermaceti and hydrogenated castor oil. The first was well emulsified and stiffer than I (made with borax). This (II) was used as a standard for comparison of triethanolamine creams. The cream prepared with spermaceti was satisfactory when first prepared, but after standing two days was yellow colored and water had separated. The hydrogenated castor oil cream emulsified readily and was free from the "grainy" consistency of the borax cream. It was about the same consistency as the wax cream (II) when first prepared, but after standing for two days was much stiffer.

Creams were prepared using equal parts of white wax and hydrogenated castor oil and with equal parts of spermaceti and hydrogenated castor oil. In each case the cream was stiffer than with either base alone. The wax-hydrogenated castor oil cream was softer than the spermaceti-hydrogenated castor oil cream when first prepared, but after two days both creams had stiffened and were about the same consistency. Creams prepared with one part of white wax to three of hydrogenated castor oil and vice versa were softer than those made with equal parts.

Creams were prepared using a mixture of equal parts of white wax and hydrogenated castor oil with the following results:

Amount Used.	Stiffness when Prepared.	After Two Days.
20 Gm.	Much stiffer than II	Much stiffer than II
16 Gm.	Stiffer than II	Stiffer than II
12 Gm.	Slightly softer than II	Same as II
10 Gm.	Softer than II or I	Same as I
4 Gm.	Much softer than I or II	Slightly softer than I

CONCLUSIONS.

1. Hydrogenated castor oil (m. p. 86° C.) is unsatisfactory for a borax cold cream when used alone, but is very satisfactory when triethanolamine stearic acid is used as emulsifier.

2. Creams prepared with hydrogenated castor oil are stiffer than those prepared with white wax or spermaceti.

3. A mixture of equal parts of hydrogenated castor oil with white wax or spermaceti possesses greater hardening power than any of the bases alone.

4. The total solidifier content of cold creams may be reduced by 40% by using a mixture of equal parts of hydrogenated castor oil with wax.

REFERENCES.

(1) Fiero, G. W., JOUR. A. PH. A., 25 (1936), 826.

(2) Goodman, Herman, *Cosmetic Dermatology*, page 286 (McGraw-Hill Book Co., N. Y.), 1936.

THE APPLICATION OF STATISTICAL METHODS TO PHARMACEUTICAL RESEARCH. V. HOW MANY ARE ENOUGH?*

BY JAMES C. MUNCH.[1]

"When it is not in our power to determine what is true, we ought to act according to what is most probable" (14). Gauss' Law of Errors states that the probability of an error of observation having a magnitude "x" is $y = h\, e^{-h^2x^2}dx$. The probability integral derived from this law, when "P" represents the probability of occurrence of any particular error (1, 8, 10, 14, 15, 17) is

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