

the difference in stability under different forms of storage being negligible. I, therefore, recommend that the above standards be included under the respective preparations in the next Pharmacopœia—provided, of course, that the Revision Committee find it advisable and decide to make "official" data of this kind. I am of the opinion that the expression "Cool Place" in the U. S. P. X used in the directions for making soap liniment is too indefinite and conveys the idea that as long as it is kept for twenty-four hours away from the radiator or stove and not exposed to the direct sunlight it is sufficient compliance, but, for reasons pointed out before, it is not sufficient. Neither can satisfactory results be obtained by keeping it at or about 0° C. I should, therefore, suggest that a definite temperature or a range of temperatures, at least, be given in the next Pharmacopœia and my opinion is that about 10° C. would be cool enough to cause all the sodium palmitate to settle out and yet not so cold as to cause the preparation to congeal.

I take the opportunity at this time to acknowledge my indebtedness to Professors Clyde M. Snow and Albert H. Clark and S. W. Morrison of the University of Illinois School of Pharmacy and L. E. Warren of the Drug Research Unit for the valuable aid they have rendered in connection with this work.

BIBLIOGRAPHY.

J. W. E. Harrison, *JOUR. A. PH. A.*, 12 (1923), 333.

UNIVERSITY OF ILLINOIS SCHOOL OF PHARMACY,
701 S. WOOD ST.,
CHICAGO, ILL.

ANALYSIS OF TINCTURE OF LEMON.

BY L. B. FRANCHINA AND FRANK A. LEE.

Some time ago, one of us¹ reported the results of an investigation on Tincture of Sweet Orange Peel, showing the amounts of oil of orange and of alcohol that the official preparation should contain. The results of the work demonstrated that a tincture prepared according to the U. S. P. IX should contain not less than 1 per cent of oil of orange, and not more than 77 per cent of alcohol. In the present work, Tincture of Lemon was studied to determine the amount of oil of lemon present in the tincture prepared as directed by the U. S. P. X. The quantity of alcohol was also determined, although the importance of this assay is not so great as in the previous investigation, because the present pharmacopœia has set a standard for the amount of alcohol that should be present in the official tincture.

The lemons used included four different grades from California, and a mixed grade from the same state; the *Villa Franca* and the *Ponderosa* from Florida; and lemons from Sicily. The usual maceration period of three days was allowed in all cases, accompanied by the customary agitation. Alcohol of the U. S. P. X was used as menstruum, and was shown by analysis to meet the official requirements. The completed tinctures prepared according to the directions of the U. S. P. X, were yellow in color, and were possessed of an odor decidedly more aromatic and suggestive of lemon, than a solution of citral in water. They pro-

¹ F. A. Lee, "Analysis of Tincture of Sweet Orange Peel," *THIS JOURNAL*, (Aug. 1924), 712.

duced the usual cloudiness when added to water, due, of course, to the precipitation of the oil of lemon. The preparation made from the *Ponderosa* lemons was not as aromatic as the others. Furthermore, the color of the tincture prepared from the latter variety was not as deep as that of those made from the other kinds.

The content of oil of lemon in the tinctures prepared by the official process ranged from 1.2 per cent to 2.1 per cent. The quantity of alcohol present, in most cases, was a little lower than that included in the range given in the U. S. P. X. It was found to average about 65 per cent by volume. This result may have been due to the condition of the fresh fruit, or possibly even to mechanical differences in preparing the tincture. The finished tinctures were assayed for total oil of lemon¹ (corrections were applied as directed) and for alcohol content.² The specific gravity of each preparation was also taken. Table I shows the results of the work with the various tinctures prepared from the peel grated from the fresh fruit, as directed by the U. S. P. X. Size and condition of the lemons are included.

TABLE I.
RESULTS OF ANALYSES OF TINCTURES MADE ACCORDING TO U. S. P. X.

Source and grade of lemons.	Lemon oil.	Alcohol.	Sp. gr. of tincture.	Av. Wt. of individual lemons.	Remarks.
California Grade 1	1.8%	64.75%	0.89131	75 Gm.	All lemons were clear and surfaces smooth
California Grade 2	1.9%	67.16%	0.89398	65 Gm.	More or less spotted
California Grade 3	2.1%	64.48%	0.88832	56 Gm.	Rough and spotted
California Grade 4	2.0%	66.03%	0.88592	55 Gm.	Spotted. Soft
California Grade 1	1.3%	67.00%	0.89298	70 Gm.	
California Grade 2	1.8%	71.73%	0.87252	62 Gm.	
California Grade 3	1.4%	68.37%	0.89242	57 Gm.	
California Grade 4	1.7%	64.69%	0.89393	55 Gm.	
California Mixed	1.9%	64.65%	0.88840	62 Gm.	Tincture light in color
California Mixed	1.6%	64.98%	0.88765	60 Gm.	Tincture light in color
Florida Villa Franca	1.4%	67.35%	0.89375	150 Gm.	Lemon oil brownish in color Lemons dark greenish brown in color
Florida Ponderosa	1.2%	66.82%	0.90341	575 Gm.	Seeds symmetrically arranged around the center
Sicily	1.8%	58.35%	0.89268	75 Gm.	Lemons clear and smooth

Tinctures were also prepared from the spent drugs, in order to ascertain the amounts of oil of lemon and alcohol that would be present in such a preparation. The products, however, not having been made according to the specifications of

¹ Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists (1925), No. 22, 353. (Precipitation method.)

² *Ibid.*, No. 18, 352.

the U. S. P. X could not be classed as legal. These tinctures, prepared from the exhausted drugs, were found to contain only a small amount of oil of lemon, as might be expected; and the percentages of alcohol were much higher than were found in the official tinctures. All of the products made in this way were very light in color, and had only a slight odor of lemon. Table II is made up of the results of the analyses of tinctures manufactured from the exhausted drug.

TABLE II.
RESULTS OF ANALYSES OF TINCTURES MADE FROM SPENT DRUG.

Source and grade.	Lemon oil.	Alcohol.	Sp. Gr. of tincture.	At. wt. of individual lemons.	Remarks.
California Grade 1	0.35%	81.63%	0.83832	75 Gm.	All of these tinctures were very light in color. Lemon odor, slight.
California Grade 2	0.10%	82.66%	0.82724	65 Gm.	
California Grade 3	0.10%	88.21%	0.83561	56 Gm.	
California Grade 4	0.40%	88.35%	0.83134	55 Gm.	
Florida Villa Franca	0.60%	76.55%	0.85129	150 Gm.	
Florida Ponderosa	Trace	88.37%	0.83108	575 Gm.	
Sicily	0.60%	88.43%	0.84109	75 Gm.	

Unquestionably the most valuable index of purity of the finished preparation at least so far as chemical analysis is concerned, is the total amount of oil of lemon it contains. However, if a given sample were to run high in alcohol, it could be regarded with suspicion. These tabulations show that the quantity of oil of lemon in the official tincture of lemon should not be less than 1 per cent. The upper limit of alcohol, placed at 75 per cent by the U. S. P. X, is satisfactory.

The tinctures made from the spent drug are: 1. Very low in oil of lemon. 2. High in alcohol content. 3. Low in respect to specific gravity, when compared with the official tinctures. All of these results are to be expected. Most of the oil was extracted during the first maceration. The menstruum first used, also took out most of the water, which accounts for the higher percentage of alcohol in the tinctures prepared from the spent drug. The larger amount of alcohol present in the tincture gives rise to the lower specific gravity. With these results at hand, one could quite easily tell whether or not a sample had been prepared from the freshly grated peel, or from the extracted drug.

In conclusion, it is suggested that standards for the official tincture should be as follows: Not less than 1 per cent of oil of lemon. The upper limit of not more than 75 per cent of alcohol, given in the present pharmacopœia, is satisfactory.

The authors wish to thank Dr. F. H. Heath, of the University of Florida, and Mr. M. Pearce, of Tampa, Fla., for the Florida lemons.