angustifolia roots is to be followed by further studies on a larger amount of material kindly supplied by Professor Lloyd.

The chief constituent of the oil appears to be a tetrahydrosesquiterpene with two double bonds, hence a chain hydrocarbon, which, however, is not straight chained.

By catalytic hydrogenation a new pentadecane, which also, of necessity, is not a straight chain hydrocarbon, has been obtained.

A preliminary suggestion as to the possible structure of the tetrahydrosesquiterpene under consideration may be found in the formula:

$$C_5H_{11}CH:CHCH_2CH:CH\ C_5H_{11}$$

in which the pentyl radicles are of an iso character. Thus far, however, there is nothing to show that the molecule is as symmetric as the formula would indicate.

PRESERVATIVE EFFECT OF CERTAIN SUBSTANCES UPON CARREL-DAKIN SOLUTION.*

BY JOSEPH W. E. HARRISSON.

Much has been written about the preparation and manufacture of Carrel-Dakin Solution and the number of ways of obtaining a suitable product is legion. A general review in the JOURNAL OF THE AMERICAN PHARMACEUTICAL ASSOCIATION (Vol. 13, Nos. 1, 2, 3, 4) is undoubtedly the best available discussion on the history, manufacture and preserving of Dakin's Solution.

It occurred to the writer after reviewing the literature that some substance might be found that would not disturb the reaction of the solution and yet would stabilize the available chlorine. The addition of 0.5 per cent. of borax or 0.5 to 1.0 per cent. of sodium carbonate has been suggested (*Jour. Biol. Chem.*, 1919) and also the addition of sodium chloride (*Bulletin* Cincinnati General Hospital).

As to the stability of a 0.5 per cent. available chlorine solution we find according to Johannesen (*Arch. Pharm. Chem.*, 27) such a solution when kept at 0° C. in amber bottles will deteriorate over a period of 8 weeks at a loss of 0.006 per cent. chlorine per week, and when kept at 18° C. a loss of 0.011 per cent. chlorine per week.

According to an investigator in the department of pathology of the University of Edinburgh a 2.92 per cent. available chlorine solution kept in clear glass bottles assayed 2.62 per cent. available chlorine after a period of two years.

Borax, sodium bicarbonate, sodium chloride, benzosulphinide and acetanilide were selected as substances which might have a preservative effect upon Dakin's Solution. The Dakin Solution was made according to the Daufresne formula and also according to the disodium phosphate formula suggested by E. F. Kelly for inclusion in the Tenth Revision of the United States Pharmacopœia.

Daufresne Formula.		*Kelly Formula.*	
CaOCl	70.8 Gm.	CaOCl	40.0 Gm.
Na_2CO_3	36.8 Gm.	Na_2HPO_4	40.0 Gm.
$NaHCO_3$	30.4 Gm.	Water	
Water		To make	1000 cc.
To make	2000 cc.		

The technic of manufacture being the usual procedure in both.

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*Section on Practical Pharmacy and Dispensing, A. Ph. A., Buffalo meeting, 1924.

Adjustment of alkalinity of the Daufresne formula was made with sodium bicarbonate of alkalinity to alcoholic phenolphthalein but not to powdered phenolphthalein. No adjustment was made on the Kelly formula, it supposedly being of the proper alkalinity. Sufficient of each solution was made so that 100 cc. of each of the following solutions could be made and placed in both clear glass and amber glass bottles—cork-stoppered bottles were used.

No. 1	100 cc. Daufresne	Clear glass and amber glass	Plain
No. 2	100 cc. Daufresne	Clear glass and amber glass	1 per cent. Borax
No. 3	100 cc. Daufresne	Clear glass and amber glass	1 per cent. Sodium Bicarbonate
No. 4	100 cc. Daufresne	Clear glass and amber glass	2 per cent. Sodium Chloride
No. 5	100 cc. Daufresne	Clear glass and amber glass	5 per cent. Sodium Chloride
No. 6	100 cc. Daufresne	Clear glass and amber glass	0.25 per cent. Benzosulphinide

The same outline was followed using the Kelly formula.

The bottled solutions were made July 3, 1923, and placed in the laboratory without any particular attention being paid as to their location or temperature. They were not, however, where the rays of the sun would strike them. They were analyzed for their available chlorine content at various intervals, using the method of the U. S. P. IX for assaying Solution of Chlorinated Soda, except that the available chlorine is reported weight in volume.

Assays of the solution over a period of one year are tabulated below:

CLEAR GLASS BOTTLES.

Kelly Formula.

	1923.					1924.	Loss over	Per cent.
	7/3.	7/6.	7/24.	8/21.	9/2.	7/18.	one yr.	loss.
Plain	0.781	0.681	0.508	0.398	0.396	0.068	0.713	91.2
1 p. c. Borax	0.798	0.578	0.269	0.205	0.193	0.025	0.773	96.8
1 p. c. Sod. Bicarb.	0.749	0.596	0.287	0.220	0.220	0.025	0.724	96.6
2 p. c. Sod. Chlor.	0.773	0.683	0.589	0.589	0.463	0.153	0.620	80.2
5 p. c. Sod. Chlor.	0.808	0.766	0.676	0.676	0.543	0.196	0.612	75.7
0.25 p. c. Saccharin	0.808	0.701	0.570	0.570	0.438	0.076	0.732	90.5

Daufresne Formula.

	1923.				1924.	Loss over	Per cent.
	7/6.	7/29.	8/22.	9/1.	7/18.	one year.	loss.
Plain	0.454	0.331	0.226	0.180	0.008	0.446	98.2
1 p. c. Borax	0.454	0.331	0.213	0.174	0.050	0.404	88.9
1 p. c. Sod. Bicarb.	0.450	0.300	0.177	0.146	0.042	0.408	90.6
2 p. c. Sod. Chlor.	0.450	0.283	0.226	0.180	0.068	0.392	87.1
5 p. c. Sod. Chlor.	0.450	0.331	0.226	0.191	0.119	0.331	73.5
0.25 p. c. Saccharin	0.356	0.138	0.075	0.042	0.016	0.340	95.7

AMBER BOTTLES.

Kelly Formula.

	1923.				1924.	Loss over	Per cent.
	7/6.	7/24.	8/21.	9/1.	7/18.	one year.	loss.
Plain	0.739	0.739	0.739	0.739	0.715	0.014	1.8
1 p. c. Borax	0.726	0.726	0.726	0.726	0.678	0.048	6.6
1 p. c. Sod. Bicarb.	0.726	0.688	0.658	0.639	0.485	0.241	32.8
2 p. c. Sod. Chlor.	0.733	0.733	0.733	0.733	0.733	None	None
5 p. c. Sod. Chlor.	0.798	0.798	0.798	0.798	0.798	None	None
0.25 p. c. Saccharin	0.739	0.739	0.739	0.739	0.739	None	None

Daufresne Formula.

	1923. 7/6.	7/29.	8/20.	9/1.	1924. 7/18.	Loss over one year.	Per cent. loss.
Plain	0.501	0.494	0.494	0.477	0.443	0.068	13.5
1 p. c. Borax	0.501	0.494	0.489	0.471	0.391	0.110	21.9
1 p. c. Sod. Bicarb.	0.495	0.470	0.450	0.450	0.306	0.189	38.1
2 p. c. Sod. Chlor.	0.501	0.488	0.488	0.482	0.408	0.093	18.5
5 p. c. Sod. Chlor.	0.490	0.475	0.470	0.463	0.366	0.124	15.5
0.25 p. c. Saccharin	0.381	0.239	0.227	0.219	0.195	0.186	48.8

It will be noticed that the loss of available chlorine in the clear glass bottles is very nearly parallel in the two different types of Dakin's Solution, the solution containing five per cent. sodium chloride showing the greater amount of available chlorine after a period of one year; the maximum loss being 96.8 per cent. and the minimum 73.5. None of the solutions kept in the clear glass bottles are sufficiently stable to suggest any possibility of using a preservative, in this type of container.

The solutions stored in amber bottles showed different keeping qualities, and that made by the formula as suggested by Kelly was stable in three instances whereas that manufactured according to Daufresne lost 13.5 per cent. of its available chlorine in its most stable solution.

The appearance of the different solutions after standing a period of one year was different and in a general way they can be tabulated as follows:

	White. Kelly.	Daufresne.	Amber. Kelly.	Daufresne.
Plain	1	−1	1	2
1 per cent. Borax	2	−3	−3	−2
1 per cent. Sodium Bicarbonate	2	1	−3	−1
2 per cent Sodium Chloride	3	Purple	1	−1
5 per cent. Sodium Chloride	4	3	3	−1
0.25 per cent. Saccharin	+4	3	1	−1

Key: 1—White sediment; 2—Clear; 3—Crystalline sediment; 4—Brown sediment.

It would seem, therefore, according to the foregoing facts, that for all practical purposes the solution made according to the Kelly formula can be expected to be stable for a period of at least three months if kept in amber bottles. The addition of two per cent. sodium chloride or twenty-five hundredths of one per cent. of benzosulphinide would undoubtedly stabilize the Kelly formula indefinitely and could be added without any harmful therapeutic effects.

LAWALL LABORATORIES,
PHILADELPHIA, PA.

SULPHUR IN THE UNITED STATES.

W. T. Lundy of Freeport, Texas, gives the total value of sulphur shipped from the United States at $25,000,000 for 1923. "The essential factors," he states, "which govern the prosperity of the sulphur industry in the United States are: That new uses be found which will gradually increase domestic consumption and foreign shipments to the approximate equivalent of the present large production; that the important items of fuel oil cost and supplies be maintained under the present favorable conditions; and also that methods and principles of taxation, both state and federal, be made equitable, and so applied to the sulphur industry that economical methods of production will in no way be adversely influenced or limited."