

THE BEHAVIOR OF SUBSTANCES TOWARD POLARIZED LIGHT
USED AS A PHARMACOPOEIAL STANDARD

BY

GEORGE EDWARD SCHINDLER

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THE BEHAVIOR OF SUBSTANCES TOWARD POLARIZED LIGHT
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The behavior of substances toward polarized light was first used as a pharmacopoeial standard when it was introduced into the United States Pharmacopoeia of 1890. It was next adopted by the British Pharmacopoeia of 1898, followed by the Spanish Pharmacopoeia of 1905, the French Pharmacopoeia of 1908, and the German Pharmacopoeia of 1910, and lastly by the Netherlands Pharmacopoeia of 1915.

In the United States Pharmacopoeia of 1890, as well as in all later editions, a short monograph upon the determination of the optical rotation of organic substances is included. This monograph gives a brief description of the apparatus employed, definitions of terms used, methods of carrying out determinations and formulas for the calculation of results. Six substances are here directed to be tested by their optical activity. This number is increased to twenty-three in the edition of 1900 and to twenty-eight in that of 1910.

The British Pharmacopoeia of 1898 uses the optical activity as a test for nine substances. This is increased in the edition of 1914 to twenty-eight.

The other Pharmacopoeias that have adopted optical activity as a test are as follows: Spanish Pharmacopoeia of 1905 with eleven substances, French Pharmacopoeia of 1908 with forty-seven substances; German Pharmacopoeia of 1910 with seventeen substances; Netherlands Pharmacopoeia of 1915 with seven substances.

TERMS USED TO INDICATE OPTICAL ACTIVITY.

Angle of Rotation

United States Pharmacopoeia - 1890, 1900, 1910.

Angular Deviation

French Pharmacopoeia - 1908.

Circular Polarization

United States Pharmacopoeia - 1890, 1900.

Deviates Polarized Light

United States Pharmacopoeia - 1890, 1900, 1910.

Dextrogyrate

United States Pharmacopoeia - 1890, 1900, 1910.

French Pharmacopoeia - 1908.

Spanish Pharmacopoeia - 1905.

German Pharmacopoeia - 1910.

Dextro rotatory

United States Pharmacopoeia - 1890, 1900, 1910.

Laevogyrate

United States Pharmacopoeia - 1890, 1900, 1910.

French Pharmacopoeia - 1908.

Spanish Pharmacopoeia - 1905.

German Pharmacopoeia - 1910.

Laevorotatory

United States Pharmacopoeia - 1890, 1900, 1910.

Optically Active

United States Pharmacopoeia - 1890, 1900, 1910.

Optically Inactive

United States Pharmacopoeia - 1890, 1900, 1910.

French Pharmacopoeia - 1908.

Optical Rotation

United States Pharmacopoeia - 1890, 1900, 1910.

British Pharmacopoeia - 1914.

French Pharmacopoeia - 1908.

Netherlands Pharmacopoeia - 1915.

Rotates the Plane of a Ray of Polarized Light

British Pharmacopoeia - 1898, 1914.

Specific Molecular Angle

French Pharmacopoeia - 1908.

Specific Rotation

United States Pharmacopoeia - 1900, 1910.

Specific Rotatory Power

United States Pharmacopoeia - 1890

French Pharmacopoeia - 1908

Turns the Polarized Ray of Light

German Pharmacopoeia - 1910.

NAMES OF INSTRUMENTS EMPLOYED.

The instruments employed by the various pharmacopoeia for determining optical activity are designated as follows:

Half Shadow Instrument of Laurant

United States Pharmacopoeia - 1890, 1900, 1910.

Half Shadow Instrument of Schmidt & Hansch

United States Pharmacopoeia - 1910.

Polarimeter

United States Pharmacopoeia - 1910

German Pharmacopoeia - 1910

Spanish Pharmacopoeia - 1905

Netherlands Pharmacopoeia - 1915

Polariscope

United States Pharmacopoeia - 1910

British Pharmacopoeia - 1914

French Pharmacopoeia - 1908

Polaristrobometer of Wild

United States Pharmacopoeia - 1890, 1900.

TEMPERATURE STANDARDS

The standard temperature for determining optical rotation varies with the different pharmacopoeias, as follows:

United States Pharmacopoeia - 1890

15°- 20°C

United States Pharmacopoeia - 1900

25°C

United States Pharmacopoeia - 1910

25°C

British Pharmacopoeia - 1898

60°F - Oil of Dill

British Pharmacopoeia - 1914

15.5°C - Camphor

Spanish Pharmacopoeia - 1905

No standard given.

French Pharmacopoeia - 1908

15°C, 18°C, 20°C.

German Pharmacopoeia - 1910

20°C.

Netherlands Pharmacopoeia - 1915

No standard given.

The substances for which optical activity is used as a test in the various pharmacopoeias, together with the standard requirements, are given in the appended list.

UNITED STATES PHARMACOPOEIA-1890

Substance

Standard

Oil of
Bitter Almonds Optically inactive

Oil of
Orange Peel Its optical rotation should not be less
than 95° to the right in a 100 mm. tube
and at a temperature of about 15° to 20°C .

Oil of
Bergamot Its optical rotation should not be more
than 20° to the right in a 100 mm. tube
and at a temperature of about 15° to 20°C .

Oil of
Wintergreen It deviates polarized light slightly to
the left.

Oil of
Lemon Its optical rotation should not be less
than 60° to the right in a 100 mm. tube,
and at a temperature of about 15° to 20°C .

Oil of
Santol It deviates polarized light to the left.

UNITED STATES PHARMACOPOEIA -1900

Substance	Standard
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Unless otherwise specified all determinations are in a 100 mm. tube and at 25°C.

Camphor	It is optically active, being dextrogyrate.
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Oil of Anise	The optical rotation is -2° .
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Oil of Orange Peel	The optical rotation is $+ 95^{\circ}$.
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Oil of Cajaput	Angle of Rotation should not exceed -2° .
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Oil of Caraway	The optical rotation is from $+ 70^{\circ}$ to $+ 80^{\circ}$.
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Oil of Chenopo- dium	The optical rotation should not exceed -5° .
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Oil of Cinnamon	The optical rotation is from $+ 1^{\circ}$ to $- 1^{\circ}$.
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Oil of Coriander	The optical rotation is from $+ 7^{\circ}$ to $+ 14^{\circ}$.
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Oil of Cubeb	The optical rotation is from $- 25^{\circ}$ to $- 40^{\circ}$.
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Oil of Erigeron	The optical rotation is about $+ 50^{\circ}$.
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Oil of Hedeoma	The optical rotation is from $+ 18^{\circ}$ to $+ 22^{\circ}$.
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Oil of Lemon	The optical rotation is not less than $+ 60^{\circ}$.
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Oil of Pepper- mint	The optical rotation is from $- 25^{\circ}$ to $- 30^{\circ}$.
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Oil of Spear- mint	The optical rotation is from $- 35^{\circ}$ to $- 48^{\circ}$.
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UNITED STATES PHARMACOPOEIA - 1900

	Standard
Substance :	Unless otherwise specified all determinations are in a 100 mm. tube and at 25°C.
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Oil of Myristica	The optical rotation is from + 14° to + 28°.
Oil of Rosemary	The optical rotation should be not more than + 15°.
Oil of Savin	The optical rotation is from + 40° to + 60°.
Oil of Santal	The optical rotation should be not less than - 16° nor more than - 20°.
Oil of Sassafras	The optical rotation should not be more than + 4°.
Oil of Thyme	The optical rotation should not be more than - 3°.
Sugar	In solution it should be dextrogyrate.
Sugar of Milk	An aqueous solution is dextrogyrate.

UNITED STATES PHARMACOPOEIA - 1910.

Substance	Standard
Camphor	The Specific Rotation (α_D) of Camphor in a solution in alcohol at 25°C is between + 41° and + 42° in a 200 mm. tube, containing 10 gm. of Camphor in each 100 mls. of solution. The alcohol must be of the strength of about 95 % by volume.
Codeine	A saturated aqueous solution of Codeine is laevorotatory.
Copaiba	The volatile oil separated from Copaiba by distillation with steam shows an angle of rotation in a 100 mm. tube of not less than - 7° at 25°C.
Oil of Bitter Almonds	It is optically inactive or dextrorotatory, not exceeding + 0°10'.
Oil of Anise	The optical rotation varies from + 1° to - 2°.
Oil of Orange Peel	The optical rotation is not less than + 95°.
Oil of Cajaput	The optical rotation does not exceed - 4°.
Oil of Caraway	The optical rotation varies between + 70° and + 80°.
Oil of Clove	The optical rotation does not exceed - 1°10'.
Oil of Cinnamon	The optical rotation varies from + 1° to - 1°.
Oil of Chenopodium	The optical rotation varies between - 4° to - 10°.
Oil of Coriander	The optical rotation varies from + 8° to + 13°.
Oil of Cubeb	The optical rotation varies from - 20° to - 40°.

Substance	Standard
Oil of Fennel	The optical rotation varies from $+ 12^{\circ}$ to $+ 24^{\circ}$.
Oil of Juniper	The optical rotation varies from 0° to $- 15^{\circ}$.
Oil of Lavender	The optical rotation varies from $- 1^{\circ}$ to $- 10^{\circ}$.
Oil of Lemon	The optical rotation varies from $+ 57^{\circ}$ to $+ 64^{\circ}$.
Oil of Peppermint	The optical rotation varies between $- 23^{\circ}$ to $- 33^{\circ}$.
Oil of Spearmint	The optical rotation varies between $- 38^{\circ}$ to $- 55^{\circ}$.
Oil of Myristica	The optical rotation varies from $+ 12^{\circ}$ to $+ 30^{\circ}$.
Oil of Pimenta	The optical rotation varies from 0° to $- 4^{\circ}$.
Oil of Santal	The optical rotation varies from $- 15^{\circ}$ to $- 20^{\circ}$.
Oil of Sassafras	The optical rotation varies from $+ 3^{\circ}$ to $+ 4^{\circ}$.
Oil of Thyme	The optical rotation is slightly laevorotatory.
Sugar	The specific rotation $(\alpha)_D$ of Sugar, determined at 20°C , in a solution in distilled water, containing 100 mls the equivalent of 26 gm. of Sugar, previously dried to constant weight at 105°C , and using a 200 mm. tube, is not less than $+ 65.9^{\circ}$.
-Sugar of Milk	The specific rotation $(\alpha)_D$ of Sugar of Milk determined at 25°C , in a solution in distilled water, containing 100 mls the equivalent of 10 gm. and using a 200 mm. tube, is from $+ 52.2^{\circ}$ to $+ 52.5^{\circ}$.

UNITED STATES PHARMACOPOEIA - 1910

Substance	Standard
Scopolamine Hydro- bromide	The specific rotatory power of the salt, determined in an aqueous solution containing the equivalent of 5 gm of anhydrous Scopolamine Hydrobromide in a 100 mls of solution at 25°C., is from - 22° to - 25.75° in a 100 mm. tube.
Terbene	Its optical rotation does not exceed + 0.3°.

Substance

Standard

Capaiba	The optical rotation is from $- 28^{\circ}$ to $- 34^{\circ}$.
Oil of Dill	The optical rotation is not less than $+ 70^{\circ}$ in a 100 mm. tube at 60°F .
Oil of Anise	Rotates a plane of light slightly to the left.
Oil of Eucalyptus	The optical rotation is not more than 10° in either direction in a 100 mm. tube.
Oil of Lemon	The optical rotation is not less than $+ 59^{\circ}$ in a 100 mm. tube.
Oil of Pine	The optical rotation is from $- 5^{\circ}$ to $- 10^{\circ}$ in a 100 mm. tube.
Oil of Rosemary	The optical rotation is not more than $+ 10^{\circ}$ in a 100 mm. tube.
Oil of Santal	The optical rotation is not less than $- 16^{\circ}$ nor more than $- 20^{\circ}$ in a 100 mm. tube.

BRITISH PHARMACOPOEIA - 1914

Substance	Standard
Camphor	5 gm. in enough 90% Alcohol to make 20 mls rotates light about + 10° at 15.5°C.
Oil of Pine	The optical rotation is from - 32° to - 42°.
Ajowan Oil	The optical rotation is from + 1° to + 2°.
Oil of Dill	The optical rotation is from + 70° to + 80°.
Oil of Anise	The optical rotation is from - 2° to + 1°.
Oil of Chamomile	The optical rotation is from - 1° to + 3°.
Oil of Cajaput	The optical rotation is not more than - 4°.
Oil of Caraway	The optical rotation is from + 75° to + 82°.
Oil of Cinnamon	The optical rotation is from - 0.5° to - 1°.
Oil of Capaiba	The optical rotation is from - 7° to - 35°.
Oil of Coriander	The optical rotation is from + 8° to + 14°.
Oil of Cubebs	The optical rotation is from - 25° to - 40°.
Oil of Eucalyptus	The optical rotation is from - 10° to + 10°.
Oil of Wintergreen	The optical rotation at 25°C., is from 0° to - 1°.
Oil of Lemon Grass	The optical rotation is from + 3° to - 3°.
Oil of Juniper	The optical rotation is from - 3° to - 15°.
Oil of Lavender	The optical rotation is from - 3° to - 10°.

Substance	Standard
Oil of Lemon	The optical rotation is from + 58° to + 64°.
Oil of Peppermint	The optical rotation is from - 20° to - 35°.
Oil of Spearmint	The optical rotation is from - 30° to 50°.
Oil of Nutmeg	The optical rotation is from + 13° to + 30°.
Oil of Rose	The optical rotation is from - 2° to - 4°.
Oil of Rosemary	The optical rotation is from - 2° to + 15°.
Oil of Santal Wood	The optical rotation is from - 13° to - 21°.
Oxymel	The optical rotation at 15.5° C. of not more than - 3.9° in a 200 mm. tube.
Oxymel of Squill	The optical rotation at 15.5° C of not more than - 3.9° in a 200 mm. tube.
Oxymel of Urginea	The optical rotation at 15.5° C of not more than - 3.9° in a 200 mm. tube.
Mel	The optical rotation at 15.5° C in a solution in water, containing 25 gm. in a 100 mls de- colorised by filtration with animal charcoal, in a 200 mm. tube, between 0° and - 5°.
Terebene	The optical rotation at 15.5° C is from + 1° to -1°.

SPANISH PHARMACOPOEIA - 1905

Substance	Standard
Aconitine	It is laevogyrate
Atropine	It is laevogyrate
Oil of Lemon	It is dextrogyrate
Oil of Peppermint	It is laevogyrate
Oil of Orange	It is dextrogyrate
Oil of Rosemary	It is laevogyrate
Oil of Thyme	It is laevogyrate
Oil of Turpentine	It is laevogyrate
Strychnine	It is laevogyrate
Quinine	It is laevogyrate
Morphine	It is laevogyrate

FRENCH PHARMACOPOEIA

Substance	Standard
Aconitine	2 grams of the substance dissolved in 100 cc. of absolute alcohol at 18°C., will give an optical rotation of + 12°. 2 grams of the substance dissolved in benzine, under the same conditions, will give an optical rotation of - 36°.
Aconitine Nitrate	2 grams of the substance dissolved in 100 CC. of water at 18°C., will give an optical rotation of - 35.8°.
Adrenaline	It is laevogyrate in an aqueous acid solution.
Camphor	10 grams of the substance dissolved in 100 CC. of absolute alcohol at 15°C., give an optical rotation of + 43°.
Monobrom- Camphor	It is dextrogyrate
Cocaine	The optical rotation is - (15.827 + 0.005848p) at 20°C. The solution is made in 100 CC. of chloroform, the amount of the drug not designated, although it is calculated in the final result. It is "p" in the above formula. 2 grams of the substance dissolved in 100 CC. of absolute alcohol at 18°C will give an optical rotation of - 29.4°. 2 grams of the substance dissolved in 100 CC. of benzine will give an optical rotation of - 50.6°.
Cocaine Hydrochloride	2 grams of the salt (dessicated at 100°C.) dissolved in 100 CC. of water at 20°C., give an optical rotation of - 71.94°, which corresponds to an angular deviation of - 2.87° in a 2 decimeter tube.
Codeine	2 grams of the substance dissolved in 100 CC. of 97 % alcohol at 15°C. give an optical rotation of - 135.8°.

FRENCH PHARMACOPOEIA

Substance	Standard
Colchicine	It is laevogyrate
Ergotine	.5 gram of the substance dissolved in 100CC. of 95% alcohol gives an optical rotation of + 335°. 3 grams of the substance (the alkaloid being dissolved in 6 grams of lactic acid), dissolved in 100 CC. of water, will give an angular rotation of + 70°.
Oil of Anise	It is feebly laevogyrate.
Oil of Star Anise	It is feebly laevogyrate.
Oil of Bergamot	In a 50 mm. tube at 4° C. the optical rotation is - 8°.
Oil of Cinnamon	It is feebly laevogyrate.
Oil of Lemon	It is dextrogyrate.
Oil of Eucalyptus	It is dextrogyrate
Oil of Caryophyllus	It is feebly laevogyrate.
Oil of Orange Peel	It is strongly dextrogyrate.
Oil of Rosemary	It is dextrogyrate.
Oil of Santal	It is laevogyrate.
Oil of Turpentine	Its molecular specific rotary power is - 40.32°.
Hydrastine	2½ grams of the substance dissolved in 100 CC. of chloroform at 17°C. give a optical rotation of - 67.8°. 4 grams of the acid salt(2 molecules of acid for each molecule of substance) dissolved in 100 CC. of water give an optical rotation of - 127.3°.

FRENCH PHARMACOPOEIA

Substance	Standard
Lactic Acid	It is feebly rotatory.
Lactose	5 grams of the salt, (crystallized with 1 molecule of water), dissolved in 100 CC. of water at 15°C. give an optical rotation of + 53°C. 5 grams of the anhydrous salt dissolved in 100 CC. of water at 15°C give an optical rotation of + 56°.
Menthol	10 grams of substance dissolved in 95% alcohol at 18°C give an optical rotation of - 50°.
Morphine	In an aqueous solution of Hydrochloric acid at 15°C. the optical rotation is - 124° minus twice the weight of the morphine in 100 CC. of water.
Morphine Hydrochloride	2 grams of the substance dissolved in 100 CC. of water at 18°C. give an optical rotation give an optical rotation of - 98.4°. In a more general way, at 15°C. in an aqueous solution, the angle of rotation is - 100.67° minus 1.14 times the weight of salt used in 100 CC. of solution.
Picrotoxine	4.1 grams of the substance in 100 CC. of absolute alcohol at 16°C. give an optical rotation of - 29.26°.
Pilocarpine	It is dextrogyrate.
Pilocarpine Nitrate	2 grams of the substance dissolved in 100 CC. of water at 18°C give an optical rotation of + 82.2°.
Pilocarpine Hydrochloride	2 grams of the substance dissolved in 100 CC. of water, give an optical rotation of + 91°.
Quassine	4.22 grams of the substance dissolved in 100 CC. of chloroform at 18°C give an optical rotation of + 37.8°.
Monobrom- hydrate of Quinine	1 gram of the crystallized salt dissolved in 100 CC. of water at 16°C gives an optical rotation of - 143°.

FRENCH PHARMACOPOEIA

Substance

Standard

The above amounts taken in a 2 decimeter tube will give an optical rotation of -2.86° .

Bibrom-
hydrate of
Quinine.

1 gram of the crystallized salt (crystallized with 3 molecules of water) at 17° gives an optical rotation of -186° .
The above solution in a 2 decimeter will give an optical rotation of -3.72° .

Monochlor-
hydrate of
Quinine

1 gram of the dessicated salt, (dessicated at 100°C) dissolved in 100 CC. of water at 17°C gives an optical rotation of -147.8° .

Bichlorhy-
drate of
Quinine

1 gram of dessicated salt (dessicated at 100°C) dissolved in 100 CC. of water at 15°C gives an optical rotation of -219.5° .
The above solution in a 2 decimeter tube gives an optical rotation of -4.39° .
2 grams of the dessicated salt dissolved in 100 CC. of water give a specific molecular rotatory angle of -224.6° .

Quinine
Glycero-
phosphate

2 grams of the substance dissolved in 100 CC. of absolute alcohol at 20°C . give an optical rotation of -130.75° .
In dissolving 1.5 grams of salt, dessicated at 100°C , in 20 cc. of distilled water, adding 6 drops of hydrochloric acid to 1/10 of the solution, making 50cc. of solution, the optical rotation is -216.92° at 18°C ., calculating basic dry salt.

Hydrated
Quinine

1 gram of the substance dissolved in 100 CC. of 97% alcohol at 15°C gives a specific rotary power of -144.54° .
After dessication at 100°C ., 1.64 grams of the substance in 100 CC. of absolute alcohol at 17° will give an optical rotation of -167.5° .

Quinine
Sulphate

1 gram of substance dissolved in 100 CC. of 80% alcohol at 15°C gives an optical rotation of -168.80° .

FRENCH PHARMACOPOEIA

Substance

Standard

	In dissolving 0.500 gram of salt, desiccated at 100°C in 20cc. of water, adding 2 cc. of Sulphuric Acid to each 1/10 of the solution, making 50 cc. of solution at 15°C. gives an optical rotation of - 243.5°, calculated for the basic anhydrous salt. The above solution in a 2 decimeter tube gives an optical rotation of + 4.87°.
Neutral Sulphate of Quinine	1 gram of the substance (containing 7 molecules of water), dissolved in 100 CC. of water gives an optical rotation of - 204.8°. The above solution in a 2 decimeter tube gives an optical rotation of - 4.09°.
Quinine Valerate	It is strongly laevogyrate.
Santonin	2 grams of the substance dissolved in 100 CC. of 90% alcohol at 20°C give an optical rotation of - 171.6°.
Strophanthin	2.3 grams of the substance dissolved in 100 CC. of water gives an optical rotation of + 30°.
Strychnine	1 gram of substance dissolved in 100 CC. of weakly acid (Hcl) aqueous solution at 20°C gives an optical rotation of + 134°.
Strychnine Sulphate	2.5 grams of the substance dissolved in 100 CC. of water gives an optical rotation of + 66.6°. The above solution in a 200 mm. tube gives an optical rotation of + 3.33°.
Sugar	In a 5 % to 30% aqueous solution the optical rotation is near +66.54°.
Tannin	Aqueous solution are dextrogyrate.
Tartaric Acid	Aqueous solution are dextrogyrate. In aqueous solution at 15°C. the optical rotation is + (15.06 - 0.131C)° representing the weight of acid used in 100 CC. of solution.

GERMAN PHARMACOPOEIA - 1910

Substance	Standard Unless otherwise specified all determinations are made in a 100 mm. and at 20°C.
Camphoric Acid	15 grams of substance dissolved in 100 CC. absolute alcohol give an optical rotation of + 47.35°.
Camphor	20 grams of the substance dissolved in 100 CC. of absolute alcohol give an optical rotation of +44.22°.
Oil of Anise	The optical rotation is - 2°.
Oil of Calamus	The optical rotation is from + 9° to + 31°.
Oil of Caraway	The optical rotation is from + 70° to + 80°.
Oil of Cloves	The optical rotation is - 1.25°.
Oil of Cassia	The optical rotation is - 1°.
Oil of Lemon	The optical rotation is from + 58° to + 65°.
Oil of Fennel	The optical rotation is from + 12° to + 24°.
Oil of Lavender	The optical rotation is from - 3° to - 9°.
Oil of Mace	The optical rotation is from + 7° to + 30°.
Oil of Peppermint	The optical rotation is from - 25° to - 30°.
Oil of Rose	The optical rotation is from - 1° to - 3°.
Oil of Santal	The optical rotation is from - 16° to - 20°.
Oil of Turpentine	According to its source it is dextro or laevogyrate. The optical rotation is from + 15° to -40°.
Sugar	The optical rotation of a 10% solution is +66.496°.
Scopolamine Hydrobromide	5 grams of the substance dissolved in water rotates a plane of light - 24.45°.

Substance	Standard
Camphor	A 10% solution of Spirits of Camphor in a 2 dm. tube will rotate a plane of light from $+ 6.5^{\circ}$ to $+ 7^{\circ}$.
Oil of Chaulmogra	In a solution of chloroform (1-10) the optical rotation is $+ 6.8$ to $+ 8.2$ in a 100 mm. tube.
Oil of Lemon	In a 100 mm. tube at 20°C the optical rotation is $+ 58^{\circ}$ to $+ 67^{\circ}$.
Oil of Fennel	In a 100 mm. tube the optical rotation is $+ 12^{\circ}$ to $+ 24^{\circ}$.
Oil of Rosemary	In a 100 mm. tube the optical rotation is not less than $+ 15^{\circ}$.
Oil of Santal	In a 100 mm. tube the optical rotation is $- 17^{\circ}$ to $- 20^{\circ}$.
Oil of Turpen- tine	In a 100 mm. tube the optical rotation is $- 3^{\circ}$ to $+ 15^{\circ}$. It is generally from $+ 10^{\circ}$ to $+ 14^{\circ}$.

Mellie A. Watson

August 2, 1921

APPROVED Nellie A Wakeman

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