Table II—Constants of Boiled Oils

	Clean Seed Lot 119	Dockage Seed Lot 121
Iodine number	179.8	175.7
Specific gravity	0.9416	0.943
Acid number	4.12	4.95
Refractive index	1.48 (182)	1.48 (178)
Drying time, hours	9	9.5
	Lot 120	Lot 122
Iodine number	181.4	177.4
Specific gravity	0.9394	0.9412
Acid number	3.6	4.37
Refractive index	1.48 (143)	1.48 (145)
Drying time, hours	10	11

As would be expected, the iodine number, acid number, and refractive index vary with the specific gravity of the boiled oil, but a higher iodine number persists with the oils made from clean seed and the difference in drying time is very noticeable.

Tests on Blown Oils

Further portions of the oil were made up as oils aged by blowing at temperatures ranging from 300° to 240° F. (149° to 116° C.), but to as nearly the same final specific gravity as factory conditions allow. The differences given in Table III show the effects of heat and air upon the refractive index and acid number. The refractive index is much more sensitive to heat than to oxidation and oil with a high original index will show a high final index.

Table III—Constants of Blown Raw Oils

Blowing Temperature °C.	°F.	Lot	Seed	Specific Gravity	Refractive Index	Iodine Number	Acid Number	Saponification Number
149	300	33	Clean	0.9509	1.48(330)	169.4	2.37	195.9
		41	Dockage	0.9516	1.48(289)	167.2	2.75	193.8
138	280	34	Clean	0.9515	1.48(291)	169.1	2.73	194.9
		42	Dockage	0.9504	1.48(271)	168.3	2.89	193.2
127	260	35	Clean	0.9504	1.48(263)	170.7	2.70	195.7
		43	Dockage	0.9511	1.48(260)	168.1	3.32	195.3
116	240	36	Clean	0.9511	1.48(264)	170.4	2.65	196.4
		44	Dockage	0.9506	1.48(247)	169.3	3.12	195.3

In general, further heating intensifies differences in the blown raw oils, as shown in Table IV. Tubes of oil from the eight batches were heated at the same time in an oil bath with a double bottom and tubes kept at the same distance from the sides of the bath.

Table IV—Constants of Blown Raw Oils Heated for 90 Minutes at 560–600° F. (293–316° C.)

Blowing Temperature °C.	°F.	Clean Seed Refractive Index	Clean Seed Viscosity	Dockage Seed Refractive Index	Dockage Seed Viscosity
			Poises		*Poises*
149	300	1.49(239)	57	1.49(209)	52
138	280	1.49(220)	46	1.49(111)	28
127	260	1.49(224)	55	1.49(082)	20
116	240	1.49(265)	76	1.49(150)	31

Tests on Varnish Oils

In order to make a further study of bodying qualities the remainder of the original raw oils was made into a neutral varnish oil, thoroughly bleached to produce an oil of the water-white class, and refrigerated so that it would stand in melting ice for 12 hours without showing any cloudiness. Some data concerning these varnish oils are given in Table V, and the results of varnish tests made on them in Table VI.

Table V—Constants of Varnish Oils

Constant	Clean Seed	Dockage Seed
Varnish Oil:		
Iodine number	189.8	185.6
Refractive index	1.48(033)	1.48(023)
Color	7.7 R	7.3 R
Supreme (water-white class):		
Iodine number	189.7	185.7
Refractive index	1.48(041)	1.48(026)
Color	3.3 R	3.4 R
Arctic supreme:		
Iodine number	191.6	186.7
Refractive index	1.48(046)	1.48(034)
Color	3.2 R	3.3 R

Table VI—Varnish Tests

	Clean Seed	Dockage Seed
A—LIGHT VARNISH: TIME, 90 MINUTES; HEAT, 560–600° F. (293–316° C.)		
Varnish	1.49(141)	1.49(098)
Supreme	1.49(122)	1.49(030)
Arctic supreme	1.49(067)	1.49(026)
B—HEAVY VARNISH: TIME, 150 MINUTES; HEAT, 560–600° F. (293–316° C.)		
Varnish	1.49(398)	1.49(352)
Supreme	1.49(379)	1.49(280)
Arctic supreme	1.49(294)	1.49(274)

Table VI suggests an interesting relationship between the viscosity of a heat-treated oil as shown by the refractive index and the higher melting point fats and the iodine number of the original oil. It indicates that of two oils with the same proportion of high melting point fats the one with the higher iodine number will body faster.

Conclusion

The investigation shows the variations which may be expected in oils made from the same crop from the same district, if greater or less amounts of dockage seeds are allowed to remain mixed with the flaxseed at the time of crushing, and further, that these variations cause differences which will affect the processes of the linseed-oil consumer. Thus far all the writers' work with pure linseed oils and linseed oils containing a proportion of dockage oil demonstrates that there is an appreciable difference in their constants, that these differences are maintained in the refined oils made from them and are often magnified in later blowing and heat treatments.

Absorption of Ultra-Violet Light by Paint Vehicles

By George F. A. Stutz

New Jersey Zinc Company, Palmerton, Pa.

In a recent paper[1] the results are given of an investigation of the action of ultra-violet radiations on wet paint vehicles. Included is a determination of the degree to which various paint vehicles absorb the ultra-violet light. In the present paper this absorption determination is extended to the case of the dry films of a number of vehicles. The nature and amount of this absorption is of particular importance, because of the action of the ultra-violet portion of sunlight in "weathering," or decomposing, vehicle films; and also because of the growing use of strong sources of ultra-violet light in accelerated weathering apparatus. To further aid in this study, the change in the absorption caused by exposure of the films to sunlight and the mercury arc is also determined.

Method

Because of the relatively high opacity of all vehicles to ultra-violet light, it is necessary to examine them in very thin films. A film thickness of 0.02 mm. or less is required in most cases in order that sufficient light will be transmitted to make accurate measurements possible. Most satisfactory results were obtained by flowing out thin films of the vehicles on transparent plates. For this purpose plates of fused quartz and Corning glass G 980 A were used. The vehicles were allowed to dry in diffused daylight in the laboratory

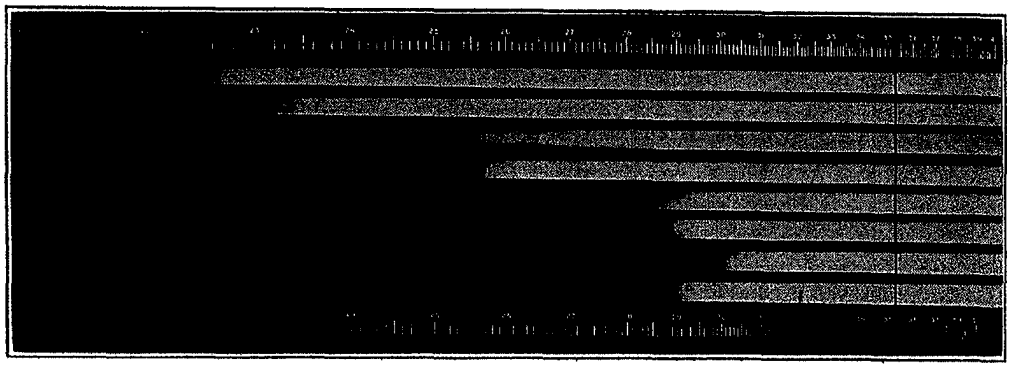
[1] Stutz, This Journal, 18, 1235 (1926).

and no attempt was made to control the humidity conditions. The film thickness was determined by means of a Randall-Stickney micrometer thickness gage. This measurement is only accurate to within about 10 per cent, the extreme thinness, as well as the non-uniformity, of the films making a more accurate determination impossible.

The quartz spectrophotometer described in the previous paper was used to measure the ultra-violet transmission of the films. At least four different thicknesses of each film were used. The degree of absorption was calculated using the relationship

$$I = I_0 10^{-kt}$$

where I = intensity of transmitted light
I_0 = intensity of incident light
t = film thickness in centimeters
k = coefficient of absorption



Clear arc
Raw linseed oil, wet film
Raw linseed oil, dry film
Heat-bodied linseed oil, wet film
Heat-bodied linseed oil, dry film
Air-blown linseed oil, wet film
Air-blown linseed oil, dry film
Acetone-insoluble portion of heat-bodied oil, wet

Figure 1—Spectrograms of Tungsten Spark under Water, Taken through Films of Vehicle Approximately 0.02 mm. Thick

Table I—Ultra-Violet Absorption by Oils

Age Days	Exposure[a] Hours	Transmission at 0.01 mm. Thickness in Per Cent at Wave Length: 3655	3131	3023	2968	2804	2655	2536	2400	2300
					RAW LINSEED					
Wet film		98.7	92.7	89.3	86.3	76.3	73.5	70.8	42.2	35.0
5	...	98.5	87.0	85.0	80.0	63.0	54.9	37.1	27.5	25.1
115	...	76.7	48.5	43.2	39.8	29.1	27.0	21.1	17.8	15.5
115	5 U. V.	91.6	72.4	66.0	60.9	44.7	38.4	31.5	26.9	24.5
					RAW LINSEED + 5 PER CENT LIQUID DRIER					
Wet film		97.9	86.1	80.5	80.0	67.2	57.2	51.1	34.4	29.4
5	...	98.4	74.1	71.2	69.0	45.7	35.5	20.7	18.2	18.0
115	...	72.4	34.6	32.3	30.9	21.4	15.1	12.6	10.9	10.9
115	5 U. V.	86.1	62.4	53.5	51.9	31.6	27.0	20.0	17.0	15.8
					RAW LINSEED + 5 PER CENT LIQUID DRIER					
40	...	75.7	35.2	29.5	29.5	13.7	8.0	7.8	6.0	5.8
40	16 Sun.	98.0	68.0	51.2	48.0	21.5	13.8	11.5	10.0	10.0
					RAW LINSEED + 5 PER CENT LIQUID DRIER					
2 years	...	10.9	3.0	2.4	2.1	1.2	1.0	0.85	0.65	0.52
2 years	22 U. V.	35.5	14.1	12.3	10.9	6.5	5.1	4.9	3.2	2.5
					ALKALINE-REFINED (REFRIGERATED) LINSEED + 5 PER CENT DRIER					
Wet film		97.5	85.7	84.2	81.6	65.1	60.8	51.6	27.5	23.4
5	...	97.5	74.0	61.5	60.0	39.8	21.1	15.8	14.9	14.4
115	...	69.1	32.5	24.2	22.8	18.2	15.1	14.0	12.5	11.8
115	5 U. V.	87.1	65.1	57.0	53.4	39.3	32.0	27.1	23.0	21.6
40	...	64.1	26.7	19.0	19.0	9.2	7.1	4.7	3.0	2.3
40	16 Sun.	88.3	55.0	44.0	43.0	18.9	11.1	8.5	6.2	5.3
					ACID-REFINED LINSEED + 5 PER CENT LIQUID DRIER					
Wet film		94.0	83.0	79.2	78.5	65.6	64.0	56.6	34.9	33.5
5	...	98.4	84.1	70.8	70.0	50.7	37.2	30.6	22.1	19.3
115	...	76.7	53.7	43.0	37.8	28.0	24.5	21.0	17.8	15.5
115	5 U. V.	91.8	78.5	69.1	66.1	49.0	42.0	38.0	34.3	29.2
					AIR-BLOWN BODIED LINSEED, VISCOSITY 9 POISES					
Wet film		72.0	25.1	22.6	16.2	8.1	3.2	0.60	0.50	0.50
5	...	72.4	34.7	24.3	17.0	8.0	3.1	0.51	0.2	0.2
115	...	70.8	25.4	17.8	14.2	6.5	2.55	0.43	0.2	0.2
115	5 U. V.	80.3	44.6	30.0	26.3	17.0	8.32	7.2	7.0	6.8
3 years	...	10.6	2.13	1.72	1.36	0.77	0.59	0.55	0.41	0.48
3 years	22 U. V.	50.9	25.4	22.1	17.2	10.9	9.6	6.9	4.5	3.9
					HEAT-BODIED LINSEED, VISCOSITY 4 POISES					
Wet film		98.0	80.0	76.1	72.1	38.2	19.1	7.5	3.7	3.5
5	...	93.8	58.3	36.0	31.0	10.1	6.0	4.0	3.5	3.2
115	...	65.2	29.2	18.0	11.6	7.1	4.6	3.5	2.9	2.8
115	5 U. V.	74.1	32.4	16.6	10.0	6.1	4.4	3.5	2.7	2.8
3 years	...	27.0	5.9	4.8	4.2	2.9	2.4	0.4	0.2	0.2
3 years	22 U. V.	44.7	13.8	12.6	10.7	4.4	3.1	1.4	1.3	0.90
					HEAT-BODIED LINSEED, VISCOSITY 9 POISES					
5	...	84.5	46.4	43.0	32.2	14.9	5.95	0.80	0.70	0.80
5	48 U. V.	73.5	30.9	24.4	21.4	5.90	2.00	1.10	0.64	0.41
					CHINA WOOD OIL WITH DRIER					
5	...	88.1	45.7	41.7	34.3	16.3	5.25	3.05	1.62	1.49
	48 U. V.	88.9	49.6	45.0	38.5	21.5	12.5	7.60	6.50	5.75
					PERILLA OIL					
5	...	85.5	46.8	39.6	28.5	8.6	3.2	1.8	1.72	1.68
	48 U. V.	91.8	60.5	54.0	44.2	22.1	13.6	9.60	8.50	5.95
					TREATED POPPYSEED OIL					
5	...	88.1	71.6	68.1	52.2	21.6	16.9	8.50	2.04	0.50
	48 U. V.	85.7	59.3	54.8	51.6	41.0	33.4	29.3	22.4	19.5
					TREATED SOY BEAN OIL					
5	...	94.4	76.5	64.1	55.0	29.0	20.9	16.3	9.9	2.0
	48 U. V.	95.3	68.4	62.0	57.4	49.0	44.7	42.8	33.0	28.4

[a] U. V.—ultra-violet; Sun.—sunlight.

From the average value of k, determined at the several thicknesses, the percentage transmission of a film 0.01 mm. thick was calculated. These values are recorded as a measure of the transparency of the films. The figures are given at a film thickness of 0.01 mm., because the differences existing between the several vehicles are best shown at this thickness.

The exposure of the films to ultra-violet light was carried out in a cabinet held at 40° C. by blowing through it a current of cool air. The films were placed 30 cm. (12 inches) from a 15-cm. (6-inch) Cooper-Hewitt quartz Uviarc. The exposures to sunlight were made on clear days in August, 1926.

Results

To show that the ultra-violet absorption by oil films is continuous, the spectrograms shown in Figure 1 were taken. The source of light is a tungsten spark under water, giving a continuous spectrum down to 2140 Å.[2] The light from this source was passed through a film of the vehicle approximately 0.02 mm. thick and dispersed in a Hilger E-4 quartz spectrograph. The increase in opacity of linseed oil on drying is shown, as well as the relative opacities of raw, heat-bodied, and air-blown oils.

The transmission values, as determined with the quartz spectrophotometer, for linseed and other oils, are recorded in Table I. Values for the wet films of several of the oils are also given, corresponding to the results previously recorded.

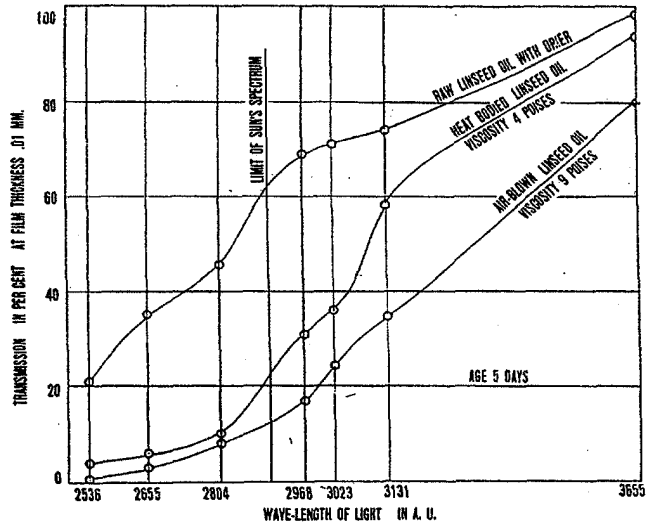
Note—The values of K recorded in the previous paper are relatively high in some cases, owing to an inaccuracy in the determination of the thickness of the wet films.

Curve 1 shows the transmission of three typical linseed oils. Curve 2 gives the transmission of several other paint oils. Different samples of any one kind of oil vary somewhat in ultra-violet transparency. The results given are characteristic of oils of the several classes and types named.

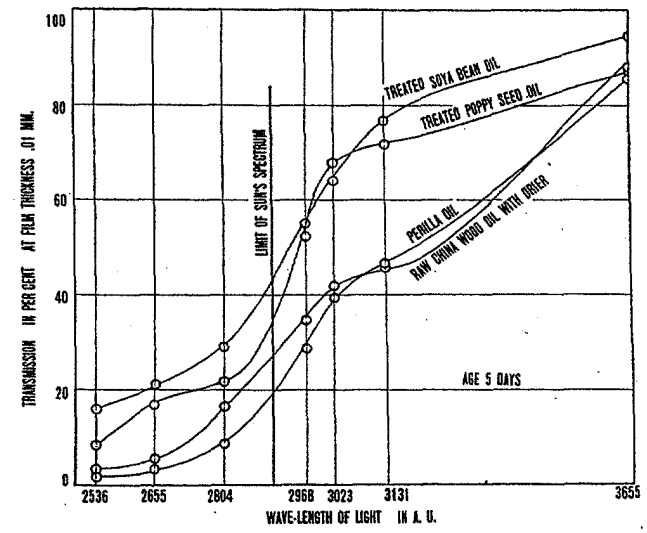
The results for varnishes are recorded in Table II, and Curve 3 shows the transmission of several of these varnishes. The seven varnishes used are the ones on which Nelson and Schmutz have reported accelerated weathering results.[3]

[2] Fulweiler and Barnes, *J. Franklin Inst.*, **194**, 83 (1922).

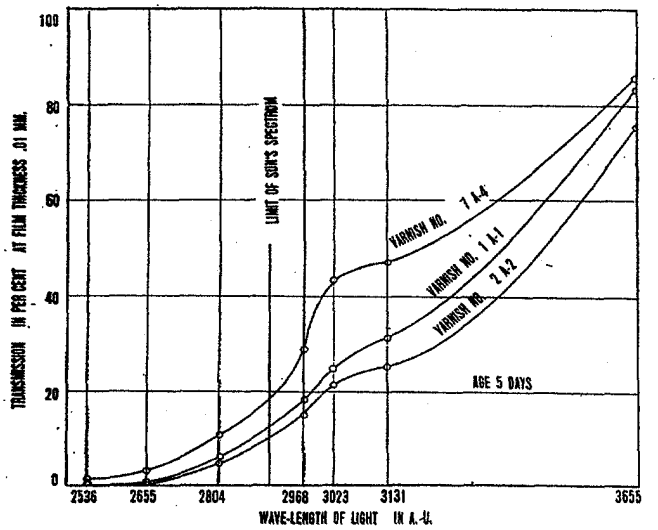
[3] Nelson and Schmutz, *Proc. Am. Soc. Testing Materials*, **24**, Pt. II, 920 (1924).



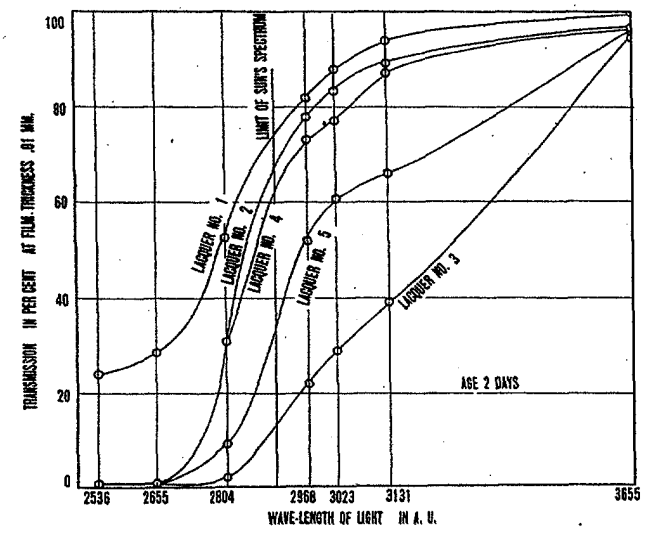
Curve 1—Transmission Curves for Dry Linseed Oil Films, Age 5 Days



Curve 2—Transmission Curves for Dry Oil Films, Age 5 Days



Curve 3—Transmission Curves for Dry Varnish Films, Age 5 Days



Curve 4—Transmission Curves for Dry Lacquer Films, Age 2 Days

Table II—Ultra-Violet Absorption by Varnishes

No.	Gum	Age	Length in Oil[a]		U. V.	Transmission at 0.01 mm. Thickness in Per Cent at Wave Length:								
			Tung	Linseed	Exposure	3655	3131	3023	2968	2804	2655	2536	2400	2300
		Days			*Hours*									
A-1	Limed rosin	5	7	10	..	83.2	31.3	24.8	18.0	6.3	0.73	0.19	0.17	0.20
		7			48	59.4	15.7	13.3	9.8	2.6	0.56	0.20	0.16	0.16
A-2	Limed rosin 50%; Congo 50%	5	10	0	..	75.3	25.4	21.6	14.3	4.90	0.40	0.05	0.03	0.04
		7			48	54.5	18.3	14.6	10.1	2.7	0.44	0.08	0.05	0.05
A-5	Ester 50%; Kauri 50%	5	1	5	..	79.4	25.1	21.6	12.0	3.6	0.23	0.08	0.07	0.06
		7			48	58.6	15.7	10.6	7.6	1.6	0.18	0.03	0.03	0.03
A-3	No. 1 Kauri	5	0	25	..	75.8	37.1	29.8	23.4	9.2	1.3	0.28	0.20	0.20
		7			48	67.6	31.8	23.8	17.1	7.2	2.1	0.9	0.35	0.40
A-7	Ester 50%; Congo 50%	5	14	35	..	75.8	29.5	25.1	16.4	6.1	0.20	0.02	0.03	0.03
		7			48	70.8	28.2	22.0	14.1	3.6	1.0	0.36	0.16	0.15
A-6	Limed rosin	5	72	28	..	75.2	25.1	20.5	13.1	4.3	0.33	0.04	0.06	0.05
		7			48	55.8	17.5	14.4	10.0	4.5	1.40	0.67	0.36	0.25
A-4	Ester	5	36	0	..	85.8	47.3	43.3	28.8	10.7	2.3	0.23	0.40	0.23
		7			48	66.5	22.6	21.1	15.1	4.93	1.32	0.40	0.18	0.10

[a] By length in oil is meant the number of gallons of oil per 100 pounds of gum.

Table III—Ultra-Violet Absorption by Lacquers

No.	Composition	U. V. Exposure	Transmission at 0.01 mm. Thickness in Per Cent at Wave Length:						
			3655	3131	3023	2968	2804	2655	2536
		Hours							
1	17% ½ sec. R. S.[a] cotton, 83% solvents	..	100.0	94.0	88.0	82.0	52.7	28.5	24.5
		48	45.5	10.5	7.5	6.5	3.4	1.0	0.32
2	14.1% ½ sec. R. S. cotton, 16.6% tricresyl phosphate, 69.3% solvents	..	97.0	89.5	83.6	78.0	31.0	0.51	0.50
		48	16.1	1.70	1.60	1.45	0.04	0.03	0.03
3	10.7% ½ sec. R. S. cotton, 12.7% tricresyl phosphate, 10.9% ester gum, 65.7% solvents	..	94.4	38.9	29.0	21.9	2.00	0.53	0.50
		48	8.80	0.31	0.18	0.10	0.02	0.01	0.01
4	9.8% ½ sec. R. S. cotton, 11.5% tricresyl phosphate, 9.6% dammar gum, 69.1% solvents	..	96.6	87.1	80.3	73.3	30.5	0.4	0.3
		48	18.6	2.1	1.7	1.3	0.35	0.07	0.06
5	10.3% ½ sec. R. S. cotton, 12.1% tricresyl phosphate, 5.2% dammar, 5.2% ester, 67.2% solvents	..	96.0	66.8	60.8	52.0	8.9	0.32	0.32
		48	14.6	1.66	1.35	0.95	0.25	0.10	0.10
6	Commercial brushing	..	86.6	39.1	28.0	17.4	5.19	2.48	3.08
		48	22.4	3.13	2.43	2.07	1.08	0.56	0.70
7	Commercial brushing	..	81.4	54.8	49.0	36.1	16.2	1.12	0.83
		48	12.4	1.08	1.01	0.64	0.16	0.11	0.10
8	Same as No. 3 with sample of pale ester gum	..	93.1	59.2	49.9	31.5	5.75	1.53	1.33
		48	20.3	1.86	1.32	1.22	0.41	0.05	0.05
9	Same as No. 3 with sample of dark ester gum	..	70.9	38.5	34.2	24.0	5.13	1.88	1.80
		48	26.0	3.35	2.60	1.32	0.70	0.61	0.35

[a] R. S.—regularly soluble.

Results for lacquer films are given in Table III and Curve 4. Lacquers No. 6 and No. 7 are clear brushing lacquers furnished through the courtesy of Mr. Hopkins, of the Murphy Varnish Company. Mr. Hopkins also furnished the samples of pale and dark ester gum used in lacquers No. 8 and No. 9.

Discussion

Several conclusions may be drawn from the results on oils. A raw or untreated linseed oil is quite transparent. A heat-bodied oil is more opaque. A heavy-bodied, air-blown oil is still more opaque. In general, then, in the case of a bodied oil the ultra-violet light is absorbed almost entirely at the surface. A raw linseed oil, however, allows the light to penetrate a considerable distance before it is completely absorbed.

On exposure to the mercury arc, or to sunlight, a film of raw linseed oil becomes more transparent (bleaches). A film of air-blown oil also bleaches, though not so much as the raw oil film. A heat-bodied oil film, however, shows but little change and may even become more opaque on exposure to the ultra-violet light. This leads to the conclusion that, in the case of a raw oil, a material is produced on drying and aging, which is acted on by ultra-violet light in such a way as to convert it into some other material more transparent to ultra-violet light. In the case of a heat-treated oil an opaque material is produced on drying and aging, which is not changed to a more transparent form when acted on by ultra-violet. Instead, the ultra-violet light may accelerate the formation of the opaque material. An air-blown oil would seem to contain some of each of these materials since it is rendered somewhat more transparent by exposure to the ultra-violet light.

Perilla oil becomes more transparent on exposure to the ultra-violet light. China wood oil also becomes slightly more transparent. Poppy and soy bean oils become more opaque in the near ultra-violet and more transparent in the far ultra-violet.

All the varnishes measured are quite opaque. Moreover, on exposure to ultra-violet light they become more opaque (yellow). The tendency to yellow is least in the case of a long oil varnish high in linseed oil and is greatest in the case of a short oil varnish high in China wood oil. Apparently the gums present are largely responsible for the yellowing of the varnish as well as its high initial opacity.

The results for lacquers show that clear nitrocotton is quite transparent. The addition of a plasticizer renders it more opaque at the shorter wave lengths. This is true of all the plasticizers commonly used. The further addition of gum renders the lacquer still more opaque. Also, ester gum is much more opaque than dammar. Exposure of the lacquer film to ultra-violet light or sunlight results in the formation of a deep yellow color and a corresponding tremendous increase in opacity to ultra-violet light.

It will be noticed that practically all vehicles have high absorption at the shorter wave lengths, below the limit of the sun's spectrum. Therefore, whenever a vehicle film is exposed to a source of short ultra-violet radiations (2800 Å. or less) the energy is practically all absorbed at the surface. This accelerates decomposition, hardening, and similar reactions at the surface only, the underlying film not being affected.

On the contrary, when exposed to sunlight, the radiations, being above 2900 Å., are sometimes able to penetrate a considerable distance into the film before being completely absorbed. This difference should be considered in interpreting accelerated weathering results where the light source used is one rich in the short wave lengths beyond the limit of the sun's spectrum.

Acknowledgment

The author wishes to acknowledge the assistance and criticisms of the members of the Research Division of the New Jersey Zinc Company, and the aid rendered by his assistant, C. Hall, in making the observations.

Action of Cathode Rays on Drying Oils

By J. S. Long and C. N. Moore

LEHIGH UNIVERSITY, BETHLEHEM, PA., AND GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

THE production of high-voltage cathode rays outside of the generating tube has been described by Coolidge[1] and some experiments with these rays outside of the generating tube are described by Coolidge and Moore.[2] In a description of this work[3] it was mentioned that castor oil exposed to the rays was changed to a solid.

The relations which occur when drying oils are thickened by heating are quite different than those when the oil is thickened by the action of ultra-violet light, and these differ from the actions when the oil is oxidized by blowing. It was believed that this thickening by the action of high-voltage cathode rays might be of service in indicating the types of reactions occurring in the process of thickening and that during raying there might be actions which did not take place in other methods of bodying.

Accordingly, series of samples of linseed, perilla, and China wood oils were prepared as described. Some or all of the constants—specific gravity, refractive index, iodine number, molecular weight, and hexabromide number—were determined on these samples. The samples were than rayed and the constants again determined. The results produced by the raying are given in Table I to III.

Table I—Effect of Time of Exposure to Cathode Rays on Linseed and Perilla Oils

Exposure *Minutes*	Refractive Index	Iodine Number	Molecular Weight	Hexabromide Number
		SET 1—LINSEED OIL		
0	1.4776	187.6	762	37.6
1	1.4778	187.4	781	22.6
2	1.4780	187.4	832	22.3
3	1.4782	187.6	870	24.3
5	1.4786	185.5	883	19.5
10	1.4799	181.0	967	21.6
		SET 5—PERILLA OIL		
0	1.4804	205.5	785	47.8
1	1.4805	205.5	810	42.2
2	1.4806	202.6	817	41.1
3	1.4808	202.3	834	38.8
5	1.4812	198.7	878	37.0
10	1.4819	195.3	925	31.2

Table II—Linseed Oil—50 Seconds' Exposure to Cathode Rays

After Heating *Hours*	Refractive Index Before	Refractive Index After	Molecular Weight Before	Molecular Weight After	Iodine Number Before	Iodine Number After
			SET 2—HEATED AT 293° C.			
[a]	1.4776	1.4810	970	856	177.2	...
1	1.4836	1.4842	1096	1132	148	147
2	1.4890	1.4895	1728	1989	117.5	112.6
2.5	1.4903	...	2330	Insoluble gel		
			SET 3—BLOWN AT 138° C.			
[a]	1.4781	1.4788	788	818	184.0	183.7
3	1.4790	1.4800	833	929	175.6	173.2
9	1.4796	1.4820	893	1025	160.5	159.3
			SET 4—HEATED AT 293° C. WITH UMBER			
[a]	1.4825	1.4830	1038	1046	155.2	144.2
0.5	1.4855	1.4857	1209	1220	142.2	128.8
1.0	1.4886	1.4892	1540	1571	135.9	120.3
1.25	1.4901	1.4904	1617	1658	132.0	114.7
1.5	1.4910	1.4915	1840	1904	...	103.2
1.75				Gel	129.8	

[a] Time required to raise oil to temperature used.

Table III—Perilla and China Wood Oils—50 Seconds' Exposure to Cathode Rays

After Heating *Hours*	Refractive Index Before	Refractive Index After	Molecular Weight Before	Molecular Weight After	Iodine Number Before	Iodine Number After
			SET 6—PERILLA OIL HEATED AT 293° C.			
[a]	1.4806	1.4811	790	891	201.4	196.6
1.25	1.4869	1.4873	1123	1207	157.4	155.3
1.75	1.4900	1.4906	1388	1527	143.4	142.5
2.25	1.4917	1.4920	1719	1959	134.1	Gel
2.75			Solidified			
			SET 7—PERILLA OIL AIR-BLOWN AT 293° C.			
[a]	1.4808	1.4812	785	864	200	195.7
0.5	1.4850	1.4852	1078	1131	161.2	162.5
0.92	1.4888	1.4892	1440	1524	151.6	142.1
1.10	1.4906	1.4910	1753	1857	131.7	131.8
1.24			Solidified			
			SET 8—CHINA WOOD OIL HEATED AT 190° C.			
[a]	1.5148	1.5144	873	888	...	157
0.5	1.5134	1.5132	991	1020	...	157
1.0	1.5116	1.5114	1098	1160	155.1	153.8
1.5	1.5103	1.5100	1371	1453	146.1	145.6
2			1994	Gel		

[a] Time required to raise oil to temperature used.

Materials

Perilla oil of suitable purity for research work was kindly furnished by Maximilian Toch. It had the following characteristics when used in this work:

Specific gravity at 15.5°/15.5° C.	0.9358
Refractive index at 25° C.	1.4804
Iodine number, Wijs (30 minutes)	205
Hexabromide number	47.8
Acid value	3.08
Molecular weight	765

Linseed oil derived from selected northwest seed was treated to remove the break, chilled to 6.6° C. to separate part of the saturated glycerides, and filtered cold. This oil showed the following characteristics when used in this work:

Specific gravity at 15.5°/15.5° C.	0.9355
Refractive index at 25° C.	1.4776
Iodine number, Wijs (30 minutes)	187.6
Hexabromide number	37.6
Acid value	4.38
Molecular weight	760

The *China wood oil* had the following characteristics:

Specific gravity at 15.5°/15.5° C.	0.9405
Refractive index at 25° C.	1.5160
Iodine number, Wijs	163
Browne heat test minutes	9.5

Preparation of Sets of Samples

SET 1—Two and a half cubic centimeters of linseed oil were placed in a glass Petri dish of 10 cm. diameter. The dish was fastened to a shaft inclined at an angle of 27 degrees and rotated at about 60 r. p. m. The center of the Petri dish was 5 cm. from the window of the cathode ray tube. In all cases the tube was operated at 250,000 volts (maximum) and 1 MA. The oil spread itself quite evenly over the bottom of the Petri dish in a layer about 0.3 mm. thick. Five samples were exposed 1, 2, 3, 5, and 10 minutes.

SET 2—Six hundred grams of linseed oil were heated at 293° C. in a 1000-cc. three-neck Pyrex flask with mechanical stirring at 200 r. p. m. Air carrying moisture equivalent to 62.6 per cent relative humidity at 25° C. was passed over

[1] *J. Franklin Inst.*, **202**, 693 (1926).
[2] *Ibid.*, **202**, 722 (1926).
[3] *J. Chem. Educ.*, **3**, 1369 (1926).