Secondly linolenic acid does not dry while linolenin does in 4 days or so. Why should the glyceride dry and not the free acid? The only explanation that presents itself is that the parallel groups of the linolenic acid in linolenin combine with the oxygen at their unsaturated groups to form rings (six and eight).

Leaving the discussion of linoxyn itself and "Polyolin" to a future paper, I think I may claim to have established the following points. (1) In the oxidation of a drying oil in air the amount of oxygen absorbed in dry air is in the ratio of 2 I to 2 O, but if the air be moist the peroxides thus formed are decomposed with production of volatile compounds—aldehydes and acids. (2) That the free acids of linseed and other oils only absorb half the amount of that absorbed by their glycerides. The same remarks also apply to their ethyl salts, these only absorbing one atom of oxygen for every 2 atoms of iodine absorbed.

DISCUSSION.

Mr. G. WARD said that in works using paints in large quantities care was usually taken to keep a moderately dry atmosphere and slightly higher temperature than normal since it was known that humidity interfered with the drying of oils. Baltic oil was considered the best, possibly because the seed from which it was obtained was more thoroughly cleaned from foreign seeds before crushing. These seeds gave soft oils, and a small percentage of such an oil would materially affect drying qualities.

Mr. F. W. RICHARDSON said that it often seemed impossible to get consistent results for the iodine value of fatty acids, because it gradually decreased and the refractive index gradually increased with the time occupied in drying such fatty acids in the boiling water bath or in the hot oven. He suggested that standard methods and specific conditions should be adopted to exclude oxygen in the drying process. It might then be hoped that concordant results would be obtained by different analysts. The fatty acids should be dried as quickly as possible.

Dr. H. INGLE said that owing to oxidation during the preparation of the fatty acids in the soaps formed and also of their ethyl esters, the iodine value was reduced below the theoretical value, and referred to Fahrion's work on rosin. The conditions of experiment had probably not been of the best and, if repeating these experiments, he should perform the saponifications in an atmosphere of coal gas.

Dr. L. L. LLOYD thought it curious that the iodine value and oxygen absorbed were in equivalent masses. Did oleic acid readily absorb oxygen under conditions similar to the absorption of oxygen by oils or their fatty acids? Sulphur dioxide and oxygen in presence of oleic acid (iodine value 89.7) gave no sulphuric acid, even on standing six months, but with the fatty acids from olive oil, treated under similar conditions, sulphuric acid was produced. Similar results were obtained with ricinoleic acid and the fatty acids obtained from castor oil. If drying oils were treated under similar conditions, relatively large quantities of sulphuric acid were produced. From these results he assumed that only oxidisable oils, those containing more than one double bond, were capable of acting as oxygen carriers to form sulphuric acid, and from that it followed that there were acids in olive and castor oils that contained more than one double bond. Perhaps the absorption of oxygen by fatty acids was due to the presence of the manganese drier, which acted as a catalytic agent. If fatty acids did not oxidise so readily as oils, why did they often give rise to firing, although in this case moisture aided the production of heat?

Dr. H. INGLE said the iodine value must be taken to represent the amount of double bonds, and it must be assumed that all oils which absorbed iodine would absorb oxygen also. The conditions were different when oxidising olein, which was present as mixed glycerides, from those when dealing with oleic acid, but it must be assumed, as proved in the paper, that the latter absorbed oxygen. When the maximum points of oxidation were reached the oils began to decompose spontaneously giving acrolein, aldehydes, and acids of these, and finally carbon dioxide. He did not think that there was any doubt that oleic and ricinoleic acids contained only one double bond.

Mr. F. W. RICHARDSON said it was too commonly assumed that olive oil was a non-drying oil, but frequently

the viscosity increased in proportion to the time of heating. The so-called oleic acid from olive oil was not pure oleic acid.

Mr. T. FAIRLEY referred to Dr. Lloyd's paper delivered before this Section on the bleaching of fibres by sulphur dioxide. It was there proved that this treatment was injurious to the fibres owing to the formation of sulphuric acid which caused rotting. He had thought that many natural oils must probably contain small quantities of substances which carried oxygen from the air and handed it over to the oil. The weak point in the work described that night was that it had been done on natural mixtures which were in unknown proportions and varied from season to season and according to the climate. As a consequence a complex series of results was obtained. A simple test for safety in use was very much required. The only trustworthy one at present was based on Mr. Mackey's plan, but the Insurance Committees would prefer that it should be done on the same kind of fibre as was used with the oil. Hitherto cotton fibre had been used in the laboratory but it did not follow that it was the best for getting really valuable results.

Mr. W. McD. MACKEY's experience of spreading olive oil on cotton fibre at high temperatures was that fatty acids showed remarkable firing qualities, although the free fatty acids of olive oil did not show much oxygen absorption. Olive oils containing a good deal of fatty acids browned tops, which appeared to be contrary to Dr. Ingle's contention. Water vapour increased the liability to firing. Where tops were in contact with leakages of steam from steam pipes, fires had often originated. It was quite feasible to do firing tests on any kind of fibre, but cotton wool could always be got of uniform quality.

Dr. H. INGLE thought that the browning and firing of tops, etc., treated with cloth oils might in part be due to traces of sulphuric acid carried over by the steam distillation of the "cracked suds" from which "oleines" were in the Yorkshire district mainly obtained. Free fatty acids at a high temperature might cause browning and even charring of the fibre and this action might be increased by the action of steam (especially if cottonseed soaps were used). The rate of the oxygen absorption depended on the double bonds as measured by the iodine value, and he placed great value on this test. These points were not really pertinent to the subject matter of the paper, which dealt mainly with drying oils. Mr. Fairley's remarks on the fact that he had dealt only with natural products were true enough, but that was the object in view. He had no doubt that Mr. Mackey's oil tester gave very satisfactory results as to the heating of oils on fibres, but that again was not pertinent to the paper. The Chairman had spoken about Baltic seed being freer from non-drying oleaginous seeds than others; that was not his experience. The quality of Baltic oil depended on the linseed itself (Ingle; *Transvaal Agric. J.*, Oct. 1902) and that largely on the soil and climate. The rotting of the fibres in Dr. Lloyd's experiments on the action of sulphurous acid on goods was doubtless due to the oxidation of this by the peroxides of the oils to sulphuric acid. Many years ago he had come across a similar case where oil stains on blankets in bleaching with SO_2 produced similar results.

Meeting held at Leeds on Monday, May 5th, 1913.

MR. GEORGE WARD IN THE CHAIR.

THE FASTNESS TO LIGHT AND OTHER AGENCIES OF AZO-SALICYLIC AND AZO-HYDROXY-NAPHTHOIC ACID DYES.

BY ANUKUL CHANDRA SIRCAR AND EDWIN ROY WATSON.

In two previous papers (this J., 1912, 31, 968—971; and "Azo-dyes derived from 2.3-hydroxy-naphthoic acid") the preparation has been described of a series of azo-salicylic, azo-*o*-hydroxy-naphthoic and azo-2.3-hydroxy-naphthoic acid dyes. They were prepared with the

definite object of obtaining dyes of different shades of colour, especially red, violet, blue and black, and possessing the good all round fastness of benzene-azo-salicylic acid. The object of the investigation has been attained in so far as dyes of various shades, including red, violet and black have been produced. Their fastness to various agencies has now been examined systematically by methods already described (this J., 1911, 20, 196) and the results are given in the following table. The dyeings were made

acid series the chroming has so little effect that it is doubtful whether the mordant can produce any real fixation.

All the dyeings have excellent fastness to acid.

From a practical point of view the chief interest lies in the derivatives of 2,3-hydroxy-naphthoic acid, as these only give the shades of colour which it was desired to obtain. Several of them satisfy all requirements except as regards fastness to soaping and alkali.

	Fastness to light on British Association Committee's scale.	Intensity of shade after soaping expressed as percentage of original intensity.	Intensity of shade after alkali test expressed as percentage of original intensity.	Intensity of shade after acid test expressed as percentage of original intensity.
<i>m</i> -Xylene-azo-salicylic acid	V	<25	<25	unchanged
Ditto Chrome mordant	V	unchanged	unchanged	..
Benzene-azo-benzene-azo-salicylic acid	III	25	75	..
Ditto Chrome mordant	III	unchanged	unchanged	..
Disulpho-naphthalene-azo-naphthalene-azo-salicylic acid	II	<25	<25	..
Ditto Chrome mordant	IV	unchanged	unchanged	..
<i>m</i> -Xylene-1-azo-4-hydroxy-3-naphthoic acid	II	50	75	..
Ditto Chrome mordant	I	75	80	..
Ethoxy-benzene-1-azo-4-hydroxy-3-naphthoic acid	II	33	75	..
Ditto Chrome mordant	II	unchanged	unchanged	..
Benzene-azo-benzene-1-azo-4-hydroxy-3-naphthoic acid	II	<25	50	..
Ditto Chrome mordant	I	unchanged	unchanged	..
Disulpho-naphthalene-azo-naphthalene-1-azo-4-hydroxy-3-naphthoic acid	II	<25	33	..
Ditto Chrome mordant	II	unchanged	unchanged	..
Benzidine-bis-(1-azo-4-hydroxy-3-naphthoic acid)	I	0	5-10	..
Ditto Chrome mordant	I	<25	<25	..
Naphthalene-1-azo-2-hydroxy-3-naphthoic acid ..	II	<25	<25	..
Ditto Chrome mordant	II	unchanged	50	..
<i>m</i> -Xylene-1-azo-2-hydroxy-3-naphthoic acid	III	<25	<25	..
Ditto Chrome mordant	III	85	25	..
<i>p</i> -Ethoxy-benzene-1-azo-2-hydroxy-3-naphthoic acid	IV	<25	<25	..
Ditto Chrome mordant	III	66	66	..
<i>m</i> -Nitro-benzene-1-azo-2-hydroxy-3-naphthoic acid	III	<25	<25	..
Ditto Chrome mordant	III-IV	33	33	..
<i>p</i> -Nitrobenzene-1-azo-2-hydroxy-3-naphthoic acid ..	V	<25	0	..
Ditto Chrome mordant	V	<25	<25	..
Benzene-azo-benzene-1-azo-2-hydroxy-3-naphthoic acid ..	V	0	<25	..
Ditto Chrome mordant	V	0	<25	..
Disulpho-naphthalene- <i>p</i> -azo-naphthalene-1-azo-2-hydroxy-3-naphthoic acid	V	66	85	..
Ditto Chrome mordant	V	80	66	..
Benzidine-bis-(1-azo-2-hydroxy-3-naphthoic acid) ..	V	<25	0	..
Ditto Chrome mordant	IV	33	25	..

on wool from an acid bath, using 2 per cent. dye reckoned on the weight of wool. Owing to the insolubility of many of the dyes in neutral solvents they were only obtained in a condition suitable for dyeing by dissolving in cold strong sulphuric acid and precipitating by water. Fuller shades can be obtained by using a larger quantity of dyestuff (up to 4 per cent. reckoned on weight of wool). Very good effects can also be obtained by producing the dyestuffs direct on the fibre.

DISCUSSION OF RESULTS.

As expected, the azo-salicylic acid dyes on chrome mordant have excellent fastness to light. There is a marked difference between the derivatives of α -hydroxy-naphthoic and 2,3-hydroxy-naphthoic acids, the derivatives of the former being all fugitive whilst the majority of the derivatives of the latter have very good fastness. The effect of chrome mordanting is in the majority of cases either beneficial or not harmful, but there are one or two cases in which the chrome mordanting actually decreases the fastness to light.

All the salicylic acid and hydroxy-naphthoic acid derivatives, excepting the benzidine compound, give dyeings on chrome mordant fast to soaping and alkalis. The derivatives of 2,3-hydroxy-naphthoic acid are not so good. The beneficial effect of the chrome mordant is well-marked in the salicylic and α -hydroxy-naphthoic acid series, the presence of sulphonic acid groups not destroying the effect. But in the 2,3-hydroxy-naphthoic

AZO DYES DERIVED FROM 2,3-HYDROXY-NAPHTHOIC ACID.

BY ANUKUL CHANDRA SIRCAR AND EDWIN ROY WATSON.

In a previous paper (this J., 1912, 31, 968—971) some attempts were described to prepare dyestuffs of similar constitution to benzene-azo-salicylic acid which would possess the same all-round fastness as this dye but with the colour deepened to red, violet, blue or black. These attempts were not, however, successful as the colour was deepened towards maroon and brown instead of towards violet and blue as desired.

In view of the red, violet, blue and black shades of many azo-dyes of not more complicated structure than those described it seemed remarkable that no better success was attained. A list of the well-known azo-dyes prepared from naphthol sulphonic acids was examined in order to see whether the relative positions of the hydroxyl and sulphonic acid groups had any obvious effect on the colour. This examination seemed to indicate that it was rather the relative positions of the hydroxyl and chromophore groups which was the determining factor, the *o*-position favouring red, violet and blue shades and the *p*-position giving brownish shades. This led to the preparation of the dyes described in this paper, as the coupling of a diazo-salt with 2,3-hydroxy-naphthoic acid produces azo-dyes with the hydroxyl-group in the *o*-position to the azo-group. 2,1-Hydroxy-naphthoic