Studies in Indanthren Colours

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We have extended our studies upon Indanthren colours, which were hitherto restricted to Indanthren Blue GCD and RS, to a number of other products some of which exhaust much more slowly, and this characteristic shows itself very plainly in the curves. The first curves which we give below show the exhaustion in the ordinary dyebath, the exhaustion being first controlled every 10 minutes and then during the second half of the dyeing every 15 minutes by the determination of the total reduction value. Beneath the curve in each figure which represents the total reduction value, we have plotted the curve of the excess of hydrosulphite in the form of a dotted curve. The former investigations have shown that this curve runs practically as a straight line, so that the upper curve gives in the main a correct picture of the exhaustion. We have noted under each figure the dyeing recipe so that no further description is necessary (Figures 1 and 2).

In the case of Indanthren Orange RRTS we attempted to follow the exhaustion in vats of varying concentration and found, as was to be expected, that exhaustion proceeds much more rapidly in the stronger vats. It is therefore to be recommended to add the dyestuff to the vat in small portions at a time in order to produce level dyeings. (Fig. 3 and 4.)

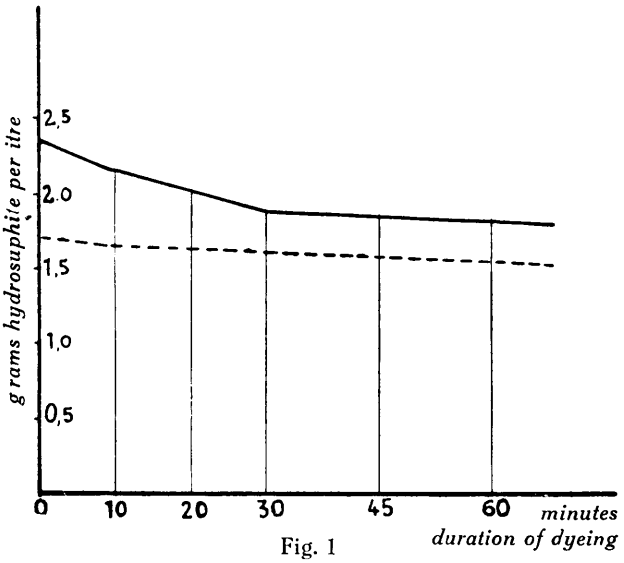

Fig. 1

Curve for Indanthren Yellow GK

1 litre vat contained:

0.575 grams Indanthren Yellow GK powder
3.25 „ Hydrosulphite
5 ccm caustic soda 40° Bé
2 „ Turkey red oil 50%
10 grams salt
dyed for one hour at 30° C

——— total reduction

..... excess of hydrosulphite

Apart from this exhaustion of the dyestuffs in dyeing according to the usual recipes, it was also of interest to control the recipes as such. For this purpose we made a dyeing in which we took 6 ccm and 48 ccm caustic soda 40° Bé per litre instead of the 12 ccm prescribed, but in this case did not show the results as curves. It was found that exhaustion proceeds slowest with the use of the normal 12 ccm caustic soda, that it is quite noticeably speeded up with 48 ccm, and that it is increased at a catastrophic rate when too little, say 6 ccm, is taken.

This would seem to indicate disturbances in the state of solution of the vat acid soda which are slight when the quantity of lye is markedly increased, but make the vat useless when too little caustic is added to the vat.

It is much more difficult to follow the behaviour of the vat when the quantity of hydrosulphite added is varied. We used Indanthren Orange RRTS in powder for all our experiments and the vat was set with the following quantities per litre:

1 gram Indanthren Orange RRTS powder
12 ccm caustic soda 40° Bé
4 grams hydrosulphite
2 ccm Turkey red oil 50%

In order to test the influence of the hydrosulphite content, vats were set according to this recipe with 2 grams, 4 grams, and 16 grams hydrosulphite per litre. The influence of the oxidation upon the decrease of the excess of hydrosulphite is here so preponderating that the figures of the analysis gave no information. It was also not possible by means of the dyeings produced to evaluate the influence of the varying quantities of hydrosulphite, which proves how desirable it is to be able to determine the dyestuff content analytically. Besides the composition of the vat, the temperature also has a decisive influence upon the exhaustion, and two curves show the behaviour of Indanthren Brown R and Indanthren

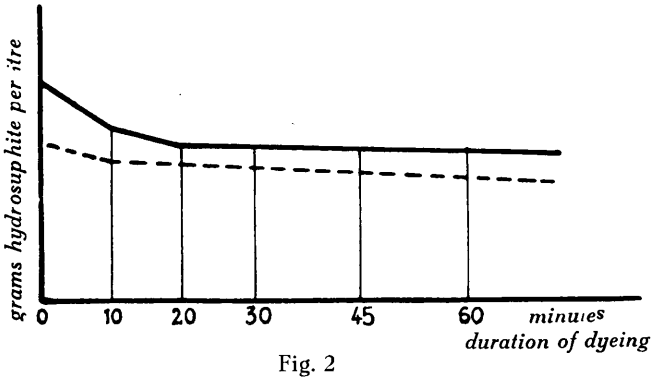

Fig. 2

Curve for Indanthren Brown R

1 litre vat contained:
0.625 grams Indanthren Brown R powder
1.75 „ Hydrosulphite
5 ccm caustic soda 40° Bé
1 „ Turkey red oil 50%
5 grams salt
dyed for one hour at from 25—30° C

———— total reduction

..... excess of hydrosulphite

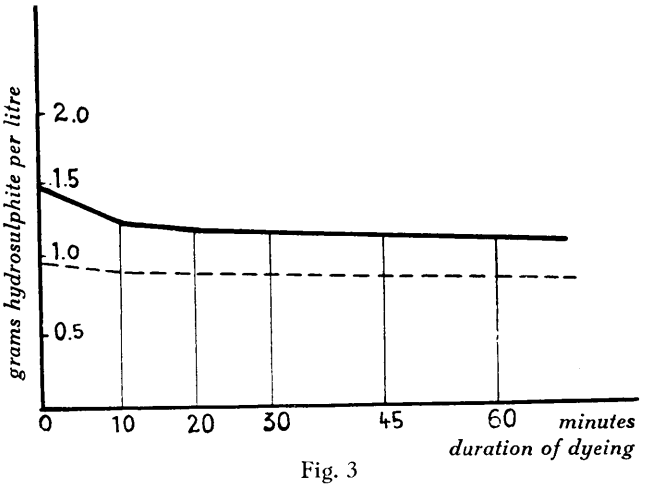

Fig. 3

5% Indanthren Orange RRTS powder

1 litre vat contained:
0.5 grams Indanthren Orange RRTS powder
2 „ Hydrosulphite
12 ccm caustic soda 40° Bé
1 „ Turkey red oil 50%
dyed for one hour at 60° C

———— total reduction

..... excess of hydrosulphite

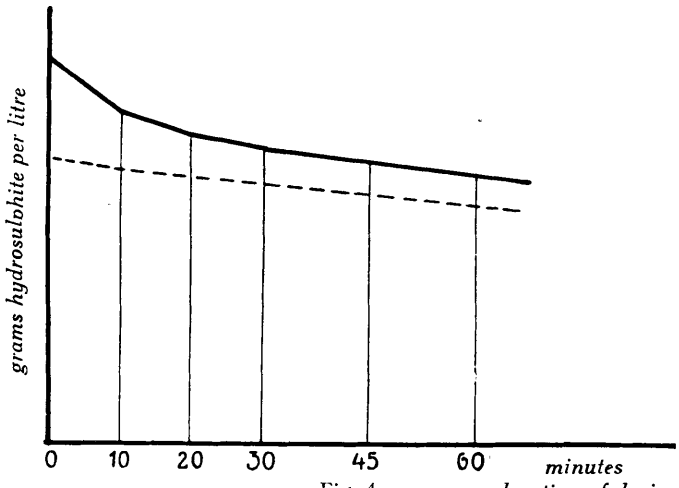

Fig. 4

25% Indanthren Orange RRTS powder

1 litre vat contained:
2.5 grams Indanthren Orange RRTS powder
4 „ Hydrosulphite
12 ccm caustic soda 40° Bé
1 „ Turkey red oil 50%
dyed for one hour at from 55—60 C

———— total reduction

..... excess of hydrosulphite

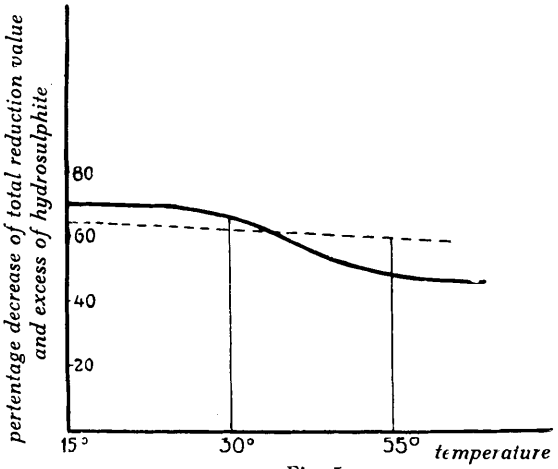

Fig. 5

Temperature curve of Indanthren Brown R

1 litre vat contained:
1.25 gram Indanthren Brown R powder
3.50 „ hydrosulphite
7 ccm caustic soda 40° Bé
1 „ Turkey red oil 50%
5 grams salt
dyed for fifteen minutes

———— total reduction

..... excess of hydrosulphite

Orange RRTS at different temperatures. The effect is evidently greater with products that are dyed warm and they exhaust to a much greater extent at a high temperature. The curve for products dyed cold runs flatter, but a stronger exhaustion is found here also when heat is applied (Figures 5 and 6). (The ordinates in Figures 5 and 6 represent the percentage decrease in the total reduction value and in the excess of hydrosulphite.) We have plotted in these diagrams also a curve showing the excess of hydrosulphite which shows clearly that the hydrosulphite oxidation also rises with a rise in temperature.

The dependence of the oxidation of the hydrosulphite is influenced by quite a number of circumstances and we give the following figures in this connection.

(1) Influence of the concentration of the hydrosulphite solution. When the solution was allowed to stand for one hour in an ordinary porcelain dye beaker, one vat lost the following percentage quantities of hydrosulphite at 55° C:

12	grams	per	litre	vat	25 %
5	„	„	„	„	15.4%
0.5	„	„	„	„	39 %

The vat contained the usual quantities of caustic soda and Turkey red oil besides hydrosulphite. It can be seen that the quantities given in the recipes are the most favourable, while the loss rises proportionately when the hydrosulphite content is raised or lowered. It was to be surmised that stirring the surface would accelerate the oxidation. A test with 5 grams hydrosulphite per litre which lost 15.4% of the Hydrosulphite content at 55° C, lost 29% when stirred, which is practically twice as much.

(2) The influence of the temperature upon the oxidation of the hydrosulphite is shown in the foregoing curves given above but the following figures should still be given:

12	grams	hydrosulphite	50° C,	reduction	25 %
12	„	„	20° C,	„	11.7%
5	„	„	55° C,	„	15.4%
5	„	„	20° C,	„	11.7%

It is evident from these investigations that dyestuffs which dye in the cold use less hydro-

sulphite than others which require heat, and that it is most advisable to keep to the quantities given in the recipes, for too much hydrosulphite in the vat will merely lead to a useless loss. This loss of hydrosulphite means also a loss of caustic soda, because hydrosulphite forms products with an acid reaction during the oxidation. When completely oxidized, 1 kilo hydrosulphite binds 460 grams caustic soda or 952 ccm of chemically pure caustic soda of 40° Bé. Practically speaking in round figures each kilo of hydrosulphite consumes 1 litre caustic soda of 40° Bé. Full consideration must be paid to these conditions, particularly in piece dyeing on the jigger, where a strong oxidation of the hydrosulphite cannot be avoided. We would especially draw the attention of anyone who desires to use the analytic processes worked out by us to the fact that they are technically empirical, so that comparable figures can only be secured by strictly adhering to the original conditions, and even then some practice will be required till reliable figures are obtained.

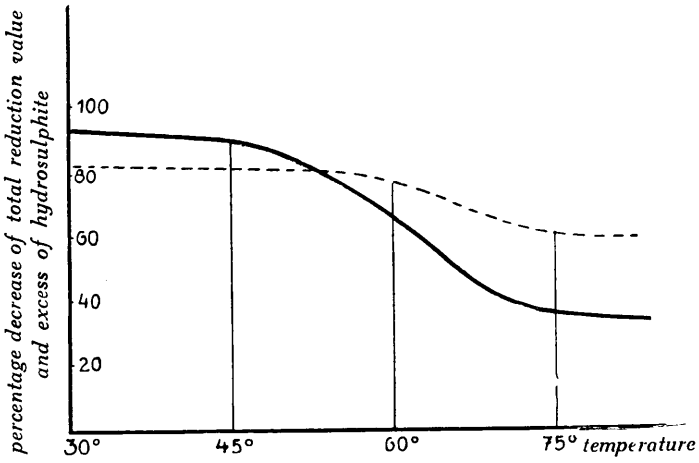

Fig. 6

Temperature curve of Indanthren Orange RRTS

1 litre vat contained:
2 grams Indanthren Orange RRTS
3.5 „ Hydrosulphite
12 ccm caustic soda 40° Bé
1 „ Turkey red oil 50 %
dyed for fifteen minutes

——— total reduction

..... excess of hydrosulphite