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THERMOGRAVIMETRIC STUDY OF SOME DISPERSE DYESTUFFS

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Two disperse dyestuffs, though exhibiting similar behaviour upon TG-DTG-DTA, have different dyeing properties. Thermoanalytical investigations are not sufficient to predict dyeing characteristics and fastness.

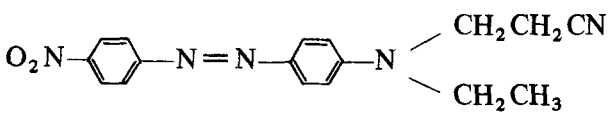
The use of dry heat to dye polyester fibres with disperse dystuffs is a widespread technology, not only because of the short time required, but also because of the setting of the fibres at the same time as the dyeing. The dyestuffs used for this technology have to be fast up to high temperature (200–220°) and to have good sublimation properties. In the present work we have studied the possibility of using thermogravimetry to predict the behaviour of dyestuffs both during the dyeing and on the substrates (during ironing, for example).

Experimental

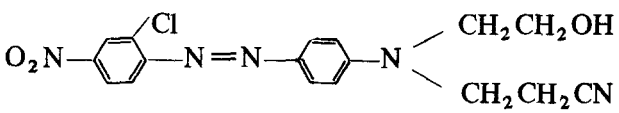
Materials: Two disperse dyestuffs, C.I. Disperse Orange 25 and C.I. Disperse Red 54, were purified to constant weight by filtration and crystallization from acetone (5 to 6 crystallizations).

Their chemical structures are:

C.I. Disperse Orange 25:



C.I. Disperse Red 54:



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These two dyestuffs were used to dye a polyester fabric, at a liquor rate of 40/1 and a concentration of 2 wt.%.

Apparatus: A Q–1500 D derivatograph, MOM, Budapest, with a heating rate of 10 deg min^{-1}, platinum crucibles, alumina as reference material and air atmosphere, was used to record DTA, TG and DTG curves. The polyester fabrics were dyed in Linitest equipment. The fastness to ironing was investigated by means of a Thermoset, and the staining of cotton and viscose and the changing of the shade on the original polyester fabric were taken into consideration.

Results and discussions

It appears from the thermal curves given in Figs 1 and 2 that the two dyestuffs exhibit similar thermal destruction curves, sublimation being recorded at about the same temperatures. This may be due to their closely related structures. Since the sublimation temperature is quite low (155–160°), both dyestuffs are suitable for the dry heat dyeing technology.

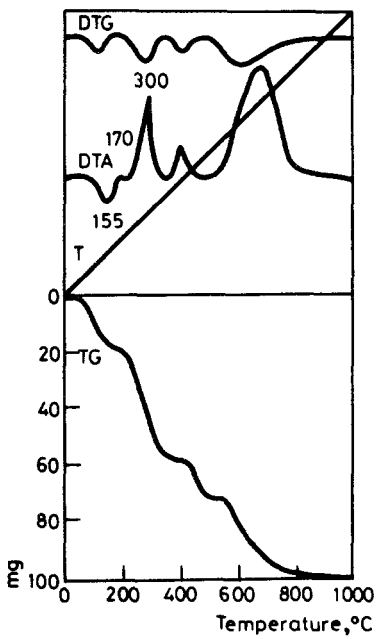

Fig. 1 TG, DTG and DTA curves of C. I. Disperse Orange 25. Heating rate 10 deg min^{-1}

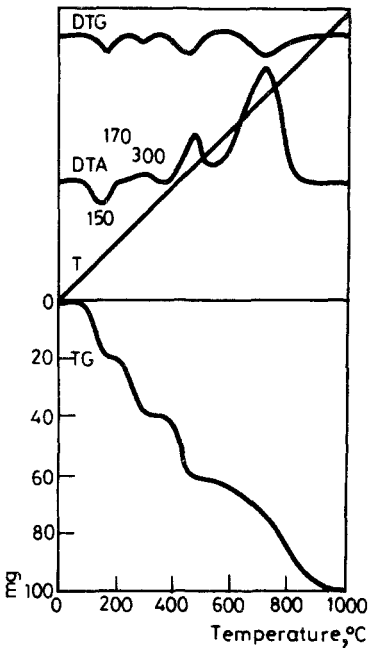

Fig. 2 TG, DTG and DTA curves of C. I–Disperse Red 54. Heating rate 10 deg min^{-1}

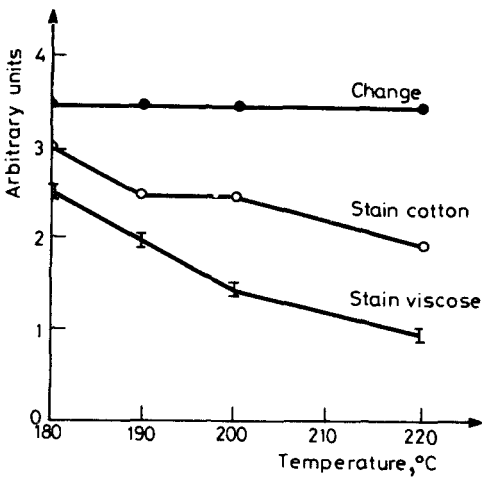

Fig. 3 The fastness to ironing of C. I. Disperse Orange 25

The staining of viscose and cotton, together with the change in the shade, are shown in Figs 3 and 4. The more stained the adjacent fabric, or the more changed the shade, the lower the corresponding point in these diagrams. The fastnesses of the two dyestuffs appear to be very different, in spite of their similar chemical structures and similar sublimation temperatures. The increase in the molecular weight (from 323 to 373.5) leads to a higher dyestuff fixation (less staining for C.I. Disperse Red 54), but the stability of the shade to high temperature may be affected.

To summarize, the results of the two TG-DTG-DTA diagrams cannot be used to predict the behaviour of the dyestuffs on the dyed materials.

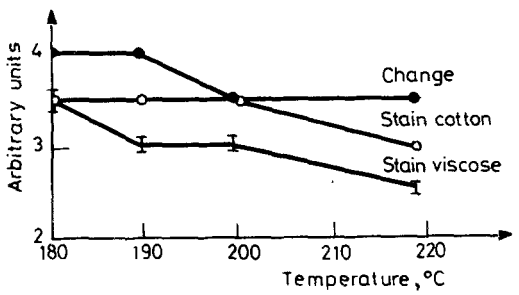

Fig. 4 The fastness to ironing of C. I. Disperse Red 54

Conclusions

The thermogravimetric study of two disperse dyestuffs (C.I. Disperse Orange 25 and C.I. Disperse Red 54) offers an indication of the best technology to be used for dyeing, but is not enough to predict the dyeing fastness. In the dyeing of polyester fabrics with disperse dyestuffs, many variables have to be taken into consideration [1–4], among which the thermal behaviour revealed by the TG, DTA and DTG curves is only one.

References

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2 S. Sunthankar, Colourage, 9 (1969) 90.
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4. H. Stern, Textilveredlung, 6 (1971) 74.

Zusammenfassung – Zwei Dispersionsfarbstoffe, die sich bei der TG-DTG-DTA ähnlich verhalten, zeigen unterschiedliche Färbeeigenschaften. Thermoanalytische Untersuchungen sind nicht ausreichend, um Färbeeigenschaften und die Farbechteheit vorherzusagen.

РЕЗЮМЕ — Два дисперсных органических красителя, несмотря на одинаковый характер их ТГ, ДТГ и ДТА кривых, обладают различными красящими свойствами. Проведенные термоаналитические исследования являются недостаточными для определения их красящих характеристик и прочности.