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# THERMAL ANALYSIS IN TEXTILE INDUSTRY

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## ABSTRACT

The thermal behaviour of cotton and wool fibres dyed with direct, and acid dyes respectivelly, has been investigated using the techniques of thermogravimetry and differential thermal analysis. The studies were carried out on dyed fibres, undyed fibres and a mechanical mixture dye-fibre and the results were compared.

## INTRODUCTION

Thermal analysis methods have a wide extent in textile industry, among their often uses being the determination of thermal effects of certain finishing products onto textile materials, or the thermal behaviour of the textiles. Papers deal with the decomposition products of the heating of fibres and with the influence of certain chemicals on them. Thus it has been put in evidence the flame retardant effect of zirconium and titanium salts on wool fibre /1/. The thermal behaviour of various synthetical fibres and the decomposition products has been also investigated /2/.

This paper propose the enlargement of thermal analysis field in textile industry by analysisng the interactions between dyes and fibre.

## EXPERIMENTAL

Substances: cotton and wool as textile support were used. The choosed dyes have been the direct ones for cotton

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namely C.I.Direct Yellow 12 and C.I.Direct Brown 95 and acid dyes for wool, namely C.I.Acid Blue 129 and C.I.Acid Red 97. The dyeing process has been the usual one.

Apparatus: an Ahiba dyeing apparatus to dye the samples and a Derivatograph MOM Budapest, Paulik, Paulik and Erdey type to get the thermal destruction curves were used.

Operating way: the TG, DTG and DTA curves were recorded for temperature running from 25°C to 1000°C, with heating rate of 10 K/min and sensitivities (DTA and DTG) of 1/15. There were recorded curves for cotton (fig.1), wool (fig.2) dyes (fig.3-6), dyed materials (fig.7-10) and mechanical mixtures dyes-fibres (fig.11-14). The inert references has been alumina and the crucibles have been platinium ones.

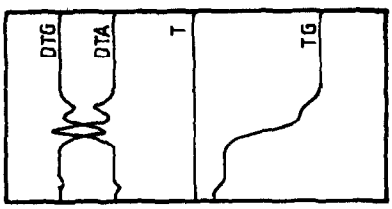


Fig 1 Cotton

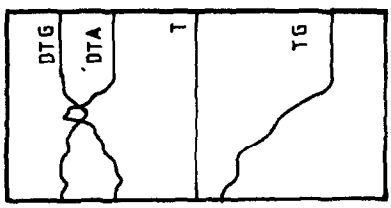


Fig 2 Wool

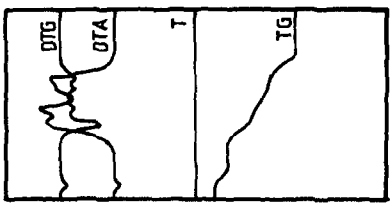


Fig 3 C.I Direct Yellow 12

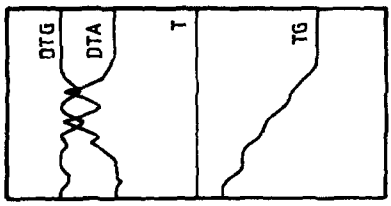


Fig 4 C I Acid Blue 129

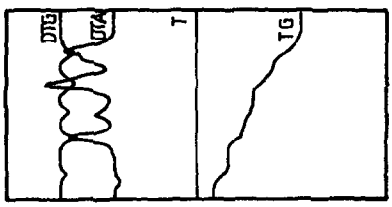


Fig. 5 C I Direct Brown 95

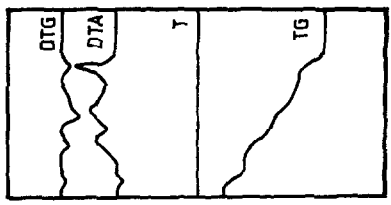


Fig. 6 C I Acid Red 97

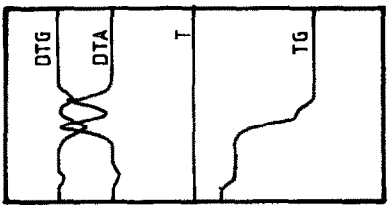


Fig 7 Direct Yellow cotton

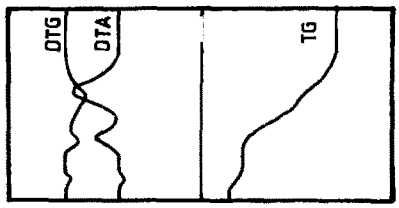


Fig 8 Acid Blue wool

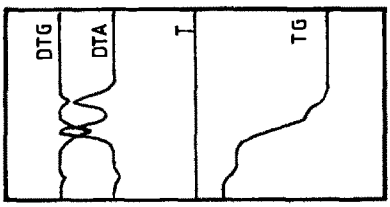


Fig 9 Direct Brown cotton

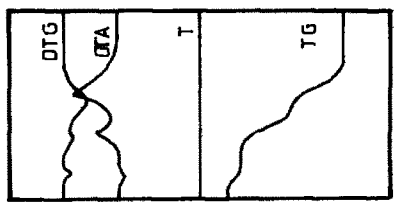


Fig 10 Acid Red wool

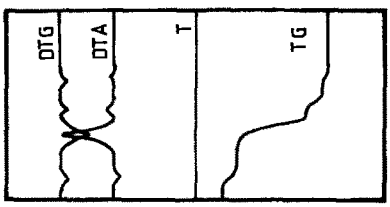


Fig.11 Direct Yellow + cotton

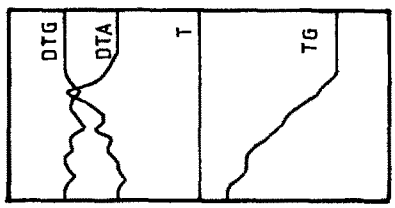


Fig 12 Acid Red + wool

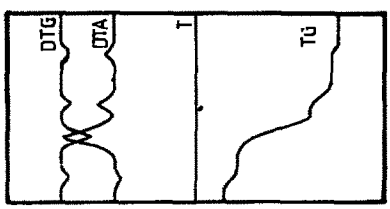


Fig 13 Direct Brown + cotton

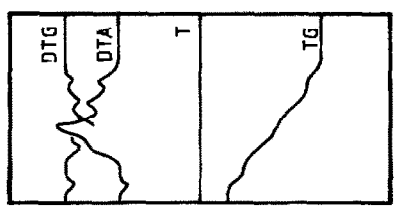


Fig 14 Acid Blue + wool

## RESULTS AND DISCUSSIONS

As it is observed only DTA curves have practical meaning appearing to be a "Thermal Print"(TP) of each fibre, undergoing certain and reproductive changes when the fibre is dyed with a certain dyes class. The DTA curves of dyed fibres exhibit some differences with respect to the thermograms of the dyed fibre and mechanical mixtures. They are not a simple superposition of thermograms for the fibre and for the dye, but a change of the thermogram for the fibre itself. These DTA curves allow to recognize the fibre. The change in the size corresponding to the last exothermal effect (which is twice greater than for undyed fibre) of the cotton can be asigned to the dyeing with direct dyes, whilst an "envelope" effect can be noticed when woll fibre is dyed with acid dyes.

## CONCLUSIONS

It appears that through a derivatographic study on a fibre is possible to identify the nature of the fibre and the class of the dye which has been used for dyeing. Some other correlations, e.g. between the fastness of the dyeing and the thermal behaviour of the dyed fibre, or between the depth of the shade and the peak size could not be obtained, probably because of the small intensity of the effects.

## REFERENCES

1 P.J.Beck, P.G.Gordon, P.E.Ingham, Text.Res.J.,46(1976)478
2 C.Vasile et al. "The Thermal Behaviour of Polymers" (in romanian),Ed.Academiei, Bucharest, 1980