SYNOPSIS

The thesis comprises the synthesis of O-glycidyl epoxy resins from some uncommon hydroxyl compounds (diols/polyols). Among the hydroxyl compounds some are used for synthesising various disazo dyes. Hence the entire subject matter of the thesis is divided into two parts.

Part A reports the synthesis, characterization and evaluation of O-glycidyl epoxy resins.

Part B throws light on the synthetic and characterization aspects of various disazodisperse dyes and their applications on nylon and polyester fibres.

Part A:

Epoxy resins have gained increasing importance due to wide range of applications such as adhesives [1], binding, construction materials [2], composites, coatings [3], mouldings, arero and space craft applications [4]. The most common epoxy resin DGEBA though widely used have certain drawbacks like lower flexibility, lower mechanical strength and lower thermal stability. In order to overcome these difficulties various modifications have been made in the resin structure and several new resins are also introduced [5]. In the present investigation following five new epoxy resins have been synthesized in order to get better mechanical and heat resistant properties.

1) 1,1,2,2-Tetrakis-(4-glycidyloxyphenyl) ethane
2) Diglycidyl ether of thiobisphenol
3) Diglycidyl ether of 2,7-dihydroxy naphthalene
4) Diglycidyl ether of 7,7'-dihydroxy - 4,4,4',4'-tetramethyl- 2,2'-spirobi (benzo chroman)
5) Diglycidyl ether of 2,9-di (2-dimethyl-p-hydroxybenzyl) 5a, 10b-dihydro benzofuro [2,3-b] benzofuran.

All these epoxy resins were characterized by their epoxy equivalent weight, viscosity, gas permeable chromatography and spectral study.

The curing kinetics of epoxy resins were studied by differential scanning calorimetry using various amines as curing agents. The kinetic parameters associated with the curing reaction such as activation energy, order of reaction and pre-exponential factor were evaluated using different methods namely Borchardt - Daniels, Freeman - Carroll and Barrett relation.
The thermal stability of the cured products were studied by thermogravimetric analysis. The weight loss data obtained from TGA as a function of temperature were processed further to obtain the activation energy for degradation employing the well known Broidos relations.

Glass fibre reinforced epoxy laminates were fabricated from some selected resins in combination of conventional epoxy resin DGEBA. All the laminates prepared were characterized according to ASTM standards which include mechanical properties (like flexural strength, interlaminar shear strength and shore-D hardness), physical properties (like density, % resin content, % void content), dielectric properties (like dielectric constant, dielectric loss and loss tangent) and chemical resistant properties.

**Part B:**

In early days, the majority of the dyes were prepared from benzene and naphthalene derived intermediates. However, intensive efforts have been made in the investigation of azo dyes in which a heterocyclic system replaces one of the usual carbocyclic system. Some of the heterocyclic azo dyes have unobtainable shades like blues and greens with excellent brightness, intensity and fastness properties compared to their benzenoid counter parts [6] and it has increased even further commercial importance of azo dyes. Many different heterocyclic diazo components have been studied, especially the derivatives of thiazole, isothiazole, thiophene and thiadiazole, owing to the marked bathochromic effect of such groups when compared with the corresponding benzenoid compound [7].

Advances have also been made in the synthesis and use of heterocyclic coupling components such as pyrazolones, hydroxypyridones, aminopyridines and aminothiazoles [8]. Some of the dyes having these coupling component show excellent brightness, intensity and fastness properties compared to their benzenoid counter part.

In view to getting disperse dyes with improved properties, in the present investigation the following two heterocyclic diols

1) 7,7'-dihydroxy - 4,4,4',4'-tetramethyl-2,2'spirobi (benzochroman)
2) 2,9-di (2-dimethyl-p-hydroxy benzyl) -5a, 10b-dihydro benzofuro [2,3-b] benzofuran

were used as novel heterocyclic coupling components in the preparation of various heterocyclic disazo disperse dyes and coloured polyesters (polymeric dyes) (Table-1 & Table-2):
Table - 1: List of aminocompounds utilized for preparation of disazo disperse dyes.

1. Aniline 13. Fast red B-base
2. o-Chloro aniline 14. Fast scarlet GG base
3. o-Nitro aniline 15. Fast red 3G base
4. m-Chloro aniline 16. Fast scarlet TR base
5. m-Nitro aniline 17. Fast violet B base
6. m-Toluidine 18. Fast blue BB base
7. p-Nitro aniline 19. 2-Amino thiazole
8. p-Toluidine 20. 2-Amino-4-methyl-5-Acetyl thiazole
9. p-Anisidine 21. 2-Amino-3,5-diethoxy carbonyl-4-methyl thiophene
10. Fast red RL base 22. 3-Amino-5-nitro-2,1-benzisothiozole
11. Fast red KB base 23. 2-Amino-3-ethoxy carbonyl benzthiophene
12. Fast Bordeux GP base 24. 2-Amino-5-methoxy-3, 1-benzthiazole

All the disazo disperse dyes were characterized by their elemental analysis, UV-Visible spectra and IR-spectra. The dyeing performance (washing, rubbing, light, perspiration and sublimation fastness) of these dyes on nylon and polyester fabric has been assessed.

All the dyed fabrics showed fair to good light fastness and very good to excellent washing, rubbing, perspiration and sublimation fastness properties.

Table - 2: List of fast bases utilized for preparation of monomeric / polymeric dyes.

2. Fast Red KB base 5. Fast Red 3G base
3. Fast Bordeux GP base

The coloured polyesters (polymeric dyes) were characterized by viscosity, UV-Vis spectra, IR spectra, GPC, TGA and bleeding test. The dyeing performance of polymeric dyes have been examined on nylon and polyester fabrics. Their
fastness properties like light, washing, rubbing, perspiration, and sublimation were assessed.

All the bisazodiols (monomeric dyes) were also characterized by their elemental analysis, UV-Vis spectra and IR spectra. The dyeing performance of the monomeric dyes have been examined on nylon and polyester fabrics. The fastness properties were also assessed.

REFERENCES:

(2) R. Hinderwaldner, Adhesion, 33, 16 (1989).
(3) V.V. Puranik, Paint India, 39, 21 (1989)
(8) H.R. Schwander; Dyes and Pigments, 3, 133 (1982).