CHAPTER V

CONCLUSIONS

The present study dealt with the effect of linear polyhydroxy alcohols, namely, diethylene glycol, polyethylene glycol-200 and polyethylene glycol-400 along with melamine formaldehyde finish on cotton. The changes in the wrinkle recovery and tensile strength of finished fabrics at different treatments were reported. The analysis of total, free and liberated formaldehyde was included, The changes in physical properties were also reported in relation with formaldehyde content.

The following general conclusions were drawn from the results of the study.

1. The results of the finishing treatments at different curing conditions indicated that polyhydroxy compounds required higher temperature curing (160°C) to improve wrinkle recovery.
2. Melamine formaldehyde alone treated samples have shown total wrinkle recovery of 212°, where as samples treated with polyhydroxy compounds along with melamine formaldehyde have shown total wrinkle recovery between 252 to 275. The improvement in wrinkle recovery was attributed to reaction mechanism of polyhydroxy compounds.

3. The effect of polyhydroxy compounds, along with melamine formaldehyde showed minimum further loss of tensile strength compared to melamine formaldehyde alone treated samples. No specific differences in elongation at break were observed with samples treated with polyhydroxy compounds along with melamine formaldehyde. However greater differences in elongation at intermediate loads were observed which indicated chemical reaction of polyhydroxy compounds in the fiber.

4. Samples treated with polyhydroxy compounds along with melamine formaldehyde, in general showed trends in lowering of free formaldehyde. Melamine formaldehyde alone treated samples showed 4,150 ppm of free formaldehyde where as samples treated polyethylene glycol-400 along with melamine formaldehyde showed 3,100 ppm. of free formaldehyde content. The lowering of free formaldehyde also indicated the reaction of polyhydroxy compounds in the treatments.

5. Melamine formaldehyde alone treated samples have shown total formaldehyde content of 1.6 percent. The samples treated with polyhydroxy compounds along with melamine formaldehyde have shown higher amount of formaldehyde ranging from 2.0 to 2.4 percent. This indicated greater degree of reaction in the presence of polyhydroxy compounds.

6. The general formaldehyde liberation is reduced in the presence of polyhydroxy compounds. Considerable decrease in the liberated formaldehyde has been noticed with samples treated with polyethylene glycol-400 along with melamine formaldehyde (T_{3MF} - 9.5 percent), compared to melamine formaldehyde alone treated samples (T_{MF} - 17.5 percent).
7. The relationship between wrinkle recovery and percent formaldehyde showed that wrinkle recovery increased gradually with increase in percent formaldehyde. The results further indicated that polyethylene glycol compounds retained more formaldehyde.
8. The relationship between tensile strength and percent formaldehyde indicated loss of strength with resin finish as expected. However samples treated with polyethylene glycols along with melamine formaldehyde did not show further loss in strength inspite of more percent formaldehyde.
9. The relationship between wrinkle recovery and tensile strength showed that the improvement in wrinkle recovery and loss of strength go together upto certain limits. however the samples treated with polyhydroxy compounds along with melamine formaldehyde have not caused further loss in strength.
10. The role of formaldehyde was explained as follows :
    (a) The formation of three dimensional polymeric network with melamine formaldehyde.

(b) The formation of short oxy-methylene ($-O-CH_2-$) linkages between cellulose chains.

(c) The formation of amidomethyl ether between unreacted methylol groups of resin and end hydroxyl groups of polyethylene-glycols.

(d) The formation of linear polymeric acetal resin with polyethylene glycols and formaldehyde.

Considering the various above factors it is concluded that polyhydroxy compounds can be effectively used to bring modifications in the treated samples. Specifically, polyethylene glycols can be used in the pad bath mixture along with formaldehyde containing thermosetting resin to achieve wrinkle recovery as well as to reduce free and liberated formaldehyde. The application is simple and no special changes in process equipment are required.