CHAPTER 5
CONCLUSIONS

⇒ Optimized extraction conditions for dyes show that the optimized MLR in all the cases was 1:10. The optimized temperature for all the dyes was 100°C except for Babool dye at 80°C. The optimized extraction time for many dyes was 90 minutes and 60 minutes for Annatto, Babool, and Pomegranate dyes.

⇒ Optimization of dyeing parameters and finding the Common dyeing conditions: It was found that optimized conditions for all the dyes were at the near neutral pH, temperature - 65°C to 95°C and time – 60 mins to 90 mins. The common conditions obtained were pH – 7, temperature- 82.8°C, and time – 88 mins. The common dyeing conditions were used for the dyeing of binary mixtures, tertiary mixtures, and primary dye samples.

⇒ Different methods for compatibility assessment showed different compatibility aspects for the particular mixture, and others provided comprehensive compatibility assessment. Compatibility factors and visual ratings provide a comprehensive evaluation, and other methods provide various aspects of compatibility.

⇒ In the case of change in hue angle method for binary mixtures, it was observed that that the hue angle varied more by varying the time and temperature than by concentration change. It was also observed that in some cases, initial samples (no. 7 and 8) of set II samples are yellower than others. It showed that Pomegranate and Marigold had higher affinity than few other dyes.

⇒ In the case of plots for -dL vs. dC, -dL vs. K/S, da vs. K/S, and db vs. K/S method, it was visible from the plots that both the curves of set I and set II were not represented by a single curve. Generally, both curves were distinct, and the set II curve joined the set I curve. Both curves took the common path toward the end of the curves. This was true for binary and tertiary mixtures.

⇒ In the db vs. K/S plot for binary mixtures, it was observed that in some cases, initial samples (no. 7 and 8) of set II samples were yellower than others.

⇒ A summary of the results of different methods and the overall rating for binary and tertiary mixtures was developed. It is visible that compatibility assessment varies for different methods for a particular mixture. This may be due to the various compatibility aspects covered in methods. The mixtures were given ratings based on the compatibility behavior shown for a specific method. These were highly compatible, compatible, partially compatible, and non-compatible mixtures. Thus, an overall rating was also given for each mixture based on the ratings obtained in all methods.

⇒ In the case of binary mixtures, Marigold/Katha, Pomegranate/Babool, Katha/Annatto, Marigold/Babool, and Marigold/Madder were found as compatible mixtures. Pomegranate/Madder, Katha/Madder, and Pomegranate/Katha were found to be partially compatible mixtures. Other mixtures, Babool/Annatto, Babool/Madder, Marigold/Annatto, and Pomegranate/Annatto, were found as non-compatible mixtures.

⇒ In the case of tertiary mixtures, Marigold/Babool/Madder (MBD), Marigold/Katha/Annatto (MKA), Marigold/Katha/Madder (MKD), and Pomegranate/Katha/Madder (PKD) were found to be compatible mixtures. Pomegranate/Babool/Madder (PBD) and Pomegranate/Katha/Annatto (PKA) were seen as partially compatible mixtures. Other mixtures of Marigold/Babool/Annatto (MBA) and Pomegranate/Babool/Annatto (PBA) were found to be non-compatible.

⇒ The compatible mixtures found in tertiary mixture assessment were analysed with binary combinations. The first tertiary mixture Marigold/Katha/Madder (MKD) was found compatible. The compatibility was checked for its possible binary combinations Marigold/Katha (MK), Katha/Madder (KD) and Marigold/Madder (MD) from previous results. Marigold/Katha (MK), and Marigold/Madder (MD) were compatible mixtures while Katha/Madder (KD) was found to be partially compatible mixture. It may be concluded from this that the three dyes Marigold, Katha, and Madder are compatible amongst themselves in all types of combinations.

⇒ The second tertiary mixture Marigold/Babool/Madder (MBD) was found compatible. The compatibility was checked for its possible binary combinations Marigold/Babool

(MB), Babool/Madder (BD) and Marigold/Madder (MD) from previous results. Marigold/Babool (MB), and Marigold/Madder (MD) were compatible mixtures while Babool/Madder (BD) was found to be non-compatible mixture. It may be concluded from this that the three dyes Marigold, Babool, and Madder are compatible amongst themselves in all types of combinations except binary combination of Babool/Madder (BD).

⇒ The third tertiary Marigold/Katha/Annatto (MKA) was found compatible. The compatibility was checked for its possible binary combinations Marigold/Katha (MK), Katha/Annatto (KA) and Marigold/Annatto (MA) from previous results. Marigold/Katha (MK), and Katha/Annatto (KA) were compatible mixtures while Marigold/Annatto (MA) was found to be non-compatible mixture. It may be concluded from this that the three dyes Marigold, Katha, and Annatto are compatible amongst themselves in all types of combinations except binary combination of Marigold/Annatto (MA).

⇒ Another tertiary Pomegranate/Katha/Madder (PKD) was found compatible. The compatibility was checked for its possible binary combinations Pomegranate/Katha (PK), Katha/Madder (KD), and Pomegranate/Madder (PD) from previous results. All the binary combinations were found to be partially compatible mixtures. It may be concluded from this that the three dyes Pomegranate, Katha, and Madder are compatible amongst themselves in all types of combinations keeping in mind about the partial compatibility in binary mixtures.

⇒ **Data Preparation for Recipe Prediction**: Dyeing of each of the six selected dyes was done at varied percentages to prepare the spectral data on the spectrophotometer for recipe prediction. The data of primary dyes was stored successfully in a spectrophotometer for recipe prediction.

⇒ The recipe was predicted for several chosen standards from the PANTONE – Cotton planner using computer color-matching equipment. A compatible, suitable recipe option was selected from the obtained options. Colorimetric and color difference parameters were recorded for the standard and dyed samples using two CIE standard illuminants, D65 and A. The L*, a*, b*, C*, and h values were obtained for standard

and sample in both light sources. The color difference parameters dE, dL*, dC*, dh, and metamerism index were also calculated.

⇒ As per the color match and its analysis, it was established that the color matching could be done successfully. However, in some cases, the selected recipe may not be suitable and have to be revised. This will help the dyer to select the appropriate combination and recipe. This also accomplishes the objective of the study to obtain newer shades. However, the dyes chosen in this study are limited, and hence, the color matching can be done for that gamut only.

⇒ Color fastness to washing, color fastness to light, and color fastness to rubbing were done and found that dyes had average to very good fastness properties. It was also observed that in the case of wash fastness, the Madder stained nylon fibers and almost no staining on any other fiber by any other dye.

⇒ It was observed that the color fastness properties (wash, light, and rubbing) for mixtures were in accordance with the fastness of component dyes in most cases. However, in some instances, the mixture's fastness was found to be lower or higher than the component dyes. By examining the results, it was visible that there was no relation between compatibility/non-compatibility and color fastness.