ABSTRACT

As the scope of organic and natural products is increasing, the use of natural dyes in textiles is also picking up pace. Many researchers are trying to simplify the process of natural dyeing in many possible ways. However, the reports on combining natural dyes and their compatibility are very scanty. There is a well-established method for computerized color matching for synthetic dyes, but such studies are not found in the literature for natural dyes. Readily available reports on compatible dyes will make it easier for natural dye users to produce a variety of mixed shades. Computerized prediction of recipes would further smooth the task of natural dyers.

Against this background, it is likely to provide information on natural dye compatibility for selected dyes to the people working in large or small sectors and the researchers working in this field to make it easier for them to get mixed shades using natural dyes. Combinations of natural dyes in compound shades will provide a variety of newer or less common shades. This study will attempt to find the gamut of compatible natural dyes, producing spectral data for recipe prediction and shade matching on cotton fabric.

The study's objectives include optimizing the extraction and dyeing parameters of the selected natural dyes. Another objective is assessing compatibility for binary and tertiary mixtures of dyes using various methods. The other objective of the study is to create a spectral database for recipe prediction and shade matching using a spectrophotometer.

Marigold, Pomegranate, Madder, Annatto, Babool (Acacia nilotica), Sappanwood, Rhubarb, and Katha (Catechu) dyes were taken for the study. A total of 12 and 8 mixtures are studied for binary and tertiary mixtures, respectively. Two sets of samples were prepared for each mixture, *viz.* sets I and II. For set I, six samples were dyed at an equal increment of dye concentration, and set II samples were dyed at increasing time and temperature conditions. The CIELAB coordinates L*, a*, b*, C*, h*, and K/S values were measured for these mixtures, and compatibility was checked based on various methods. These methods include a change in hue angle, change in lightness/darkness with respect to chroma and K/S, change in a* and b* coordinates with respect to K/S, compatibility factor, and visual assessment. The color fastness tests were also done for primary and mixtures of dyes.

The study results showed that the compatibility assessment varies for different methods for a particular mixture. This may be due to the various compatibility aspects covered in these methods. The mixtures are given ratings based on their compatibility behavior. These are highly compatible, compatible, partially compatible, and non-compatible mixtures. Thus, an overall rating is also given for each mixture based on the ratings obtained in all the methods.

In the case of binary and tertiary mixtures, some of the mixtures found are compatible, and others are partial or non-compatible. In the case of binary mixtures, Marigold/Katha, Pomegranate/Babool, Katha/Annatto, Marigold/Babool, and Marigold/Madder were found to be 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 to be non-compatible mixtures. Similar results were obtained in tertiary mixtures. It was also found that the compatible tertiary mixture can contain compatible/partial-compatible/non-compatible binary mixtures.

The data of primary dyes was stored successfully in a spectrophotometer for recipe prediction. From the shade match and its analysis, it was established that the color matching could also be done successfully. However, in some cases, the selected recipe may not be suitable and have to be revised. The understanding of compatibility, recipe prediction and shade matching accomplishes the objective of the study to obtain newer shades.

Color fastness to washing, light, and rubbing were done, and it was found that dyes had average to very good fastness properties. 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.