

Prospects of Fabric Dyeing Using Biochromes

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The enormous usage of synthetic dyes in various industries, chiefly textiles and paper industries, has posed a considerable health and environmental hazard. This dictates the need for amendment in the textile coloration technology by using natural origin pigments to replace the existing toxic, mutagenic and teratogenic dyes. Therefore, the scientists have recently focused their attention on applications of natural pigments for fabric dyeing as they depict eco-friendly, biodegradable and environmental compatibility properties [1]. Furthermore, the application of biochromes in textile dyeing is free from disposal problems as well. Several micro-organisms, plant systems as well as some animal sources have portrayed the potential of production of biochromes that can be extracted with ease and be used for coloration technology including textile dyeing.

However, the concept of textile dyeing with natural biochromes is not new. Until the mid-19th century majority of the dyestuffs were obtained from natural materials which included plants and animal matter. The well known ancient dyes include the indigo dye obtained from the leaves of *Indigofera tinctoria*, yellow pigment from saffron plant and turmeric, madder (red dye) from *Rubia tinctorum*, Tyrian purple obtained from shellfish, etc. However, the plant systems posed several drawbacks for pigment production; the important ones include requirement of large land area and vulnerability to climatic conditions. Therefore, there arose a need for identification of other natural sources for biochromes. The microbial system, mainly certain bacteria and fungi are known to produce natural pigments for their own physiological purposes. However, their usage for dyeing fabrics has received recent attention due to the advantages like ease of pigment extraction, no large land area requirement and pigment production remains unaffected by climatic variations.

The microbial colorants applied for fabric dyeing includes several bacteria as well as fungi [1]. Certain mushroom species has also investigated for their pigments for fabric dyeing. Pathak and Madamwar [2] have reported the application of bio-indigo from *Pseudomonas sp.* HOB1 for dyeing of cotton fabrics. The dyeing ability of bio-indigo has been comparable to that of the synthetic indigo dye. However, the fastness properties of the same need some consideration. Alihosseini et al. [3] and Ahmad et al. [4] have reported the application of prodigiosin pigment (pink biochrome) from *Vibrio sp.* KSJ45 and *Serratia marcescens* respectively for dyeing of cotton and wool fabrics with agreeable fastness properties. Siva et al. [5] also reported that the prodigiosin pigment from *Serratia rubidaea* binds with plastic (acrylic), paper as well as fibers (yarns); thus depicting its potential in coloration technology. Poorniamal et al. [6] depicted the application of a yellow pigment from a fungus named *Thermomyces sp.* for dyeing of cotton, silk and wool fabrics. Sharma et al. [7] have depicted the extraction of purple colored pigment from three fungus *Trichoderma virens*, *Culvunaria lunata* and *Alternaria alternata* for application in fabric dyeing. They also demonstrated that fabric dyeing using these natural origin pigments; contrary to synthetic pigments; had no adverse effects on the tensile strength of the fabric. Moreover, the fabrics dyed with these natural pigments did not show any undesirable effect on human skin.

The colour imparting ability of the natural dyes is usually comparable to that of the synthetic dyes. Moreover, these biochromes do possess the ability to form different shades/hues same as that of the synthetic dyes. Besides, recently, the researchers are also focusing on improvement of the fastness properties for biochromes. Thus, natural dyes are creating a competing scenario with the usage of synthetic dyes. Owing to certain limitations like colour yield, stability, complex dyeing procedures and reproduction of shades; natural dyes may not entirely replace synthetic dyes, however, they do have their own hold in the textile market.

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