

## **Dyeing of Textile Using Different Mordants, Mordanting Techniques and Their Effects On Fastness Properties**

Qistina Haziqah Ramli, Rodiah Mohd Hassan and Norakma Mohd Nor

Department of Science and Biotechnology, Faculty of Engineering and Life Sciences, Universiti Selangor,  
Jalan Timur Tambahan, 45600 Bestari Jaya, Selangor  
farrah\_nazuha@unisel.edu.my

### **Abstract**

The uses of synthetic dyes in textile industries give a negative impact to the environment and causing many pollutions, hence to avoid it, natural dyes are used instead. Many researches study on natural dyes as substitute to synthetic dyes in textile the industry. Natural dyes usually connect with mordant as it helps in dye take-up and increases in colour fastness. Most commonly used metal mordant in natural dye are aluminium potassium sulphate ( $KAl(SO_4)_2 \cdot 12H_2O$ ), ferrous sulphate ( $FeSO_4 \cdot 7H_2O$ ), and copper sulphate ( $CuSO_4 \cdot 5H_2O$ ). The uses of different types of mordant on natural dyes give a variety of shades, colour and also increase the fastness properties in fabric dyeing. The process can be done in three techniques of mordanting, which are pre-mordanting, post-mordanting and meta-mordanting or known as (simultaneously mordanting). There are several studies that show an improvement on the scoring of fastness properties from moderate to excellent ranging (3 - 5) by using mordant compared to the result of un-mordanted fabric. It can be concluded, that the best mordanting techniques being employed in most studies are pre-mordanting technique and ferrous sulphate is shown to have the best impact on most of the fastness properties.

**Keywords:** Fastness properties; mordant, mordanting; natural dyes; synthetic dyes

### **INTRODUCTION**

Many countries now pursue an eco-friendly approach, and significant effort are taken to prevent pollution and preserve the environment. Furthermore, the textile industries are becoming one of the world's most important industries, contributing to a variety of pollutants in the environment that could really harm the bio-system. Yasassri et al., [1] claims that there is no perfect method for removing dangerous poisonous synthetic colours from wastes.

Dye derived from natural resources, on the other hand, is a viable alternative to synthetic dyes. Natural dyes have been reintroduced for dyeing textile in order to avoid the environmental issues

associated with synthetic dyes. Typically, natural dyes in textile dyeing will be used in combination with mordanting methods like pre-mordanting, simultaneous-mordanting and post-mordanting to fix a dye to fibres. The procedure of mordanting has been used for years and has evolved into chemical that is used to fix a dye to fibres. Mordants on the other hand, used in dyeing to promote dye take-up and colour fastness, and different mordants on natural dye can produced varied colours and hues. Metallic salts of aluminium, chrome, copper, tin, and iron, tanning agents, wood ash, and other components, are used as mordants [2]. Each mordant creates a unique dye complex, resulting in totally different colours and fastness properties. Depending on natural dye resources and mordant type, pre-mordanting and post-mordanting methods can resulted in darker colours.

This study aims to focus on the mordant and mordanting technique and the fastness properties of natural dyes on varieties of textile fabric. Therefore, in this review, the method used for mordanting techniques on dyeing properties using natural dyes were briefly discussed. Three methods that are pre-mordanting, post-mordanting and meta-mordanting were identified as widely been applied in research studies. The impacts of mordants and mordanting techniques towards fastness properties and colour strength were also discussed and summarized.

## RESULT AND DISCUSSION

### Mordanting and type of mordanting used

Each mordanting technique poses its results towards fastness properties and the type of mordant used to dye on the fabric. Similarly, pre-mordanting, meta-mordanting (simultaneous mordanting), and post-mordanting are popular mordanting techniques used in dyeing processes. To obtain the desired shades and fastness properties, it is vital to select the appropriate mordanting technique. Yassasri et al., [1] researched towards the dyeing of fabric with natural dye with three different mordanting techniques for the extraction of dye. However, from the results shown, that the pre-mordanting technique outperformed the other two techniques. Frequently, it was observed that in the pre-mordanted method, the dye uptake was highest.

### Effect of Pre-Mordanting Method on Fastness Properties

Bukhari et al., [4] employed on different metal salts mordants and pre-mordanting techniques to investigate the brown naphthoquinone colourant derived from *Juglans regia L* dyeing and fastness characteristics on plant natural protein fibre. The results showed that utilising a mordant as part of the pre-treatment technique considerably improved the colorimetric and fastness qualities of wool fibres dyed with walnut bark extract. Pre-mordanting technique and using any metal mordant were most used in natural dyeing onto woolen yarn fabric and often showed satisfaction result.

Besides that, Naveed et al., [5] studied on the pre-mordanting technique that was used to extract an environmentally friendly natural dye from pomegranate peel, which was then applied to tencel fabrics with three different mordants which are stannous chloride, alum and ferrous sulphate. The study's findings revealed that the solvent extraction method used in combination with the pre-mordanting technique produced greater colour shading and fastness properties effects on tencel fabrics. As a result, this pre-mordanting technique was used in this study.

## Effects of Mordant on Fastness Properties

For dyeing tests and fastness properties on wool fibres, Bukhari et al., [4] used three different types of metal salts mordants: aluminium potassium sulphate, ferrous sulphate, and stannous chloride. Ferrous sulphate, including alum, has a positive effect on colour in wash fastness result in this study. Furthermore, colour fastness to crock was discovered to be in the range of three to five, indicating that all coloured fabric samples were of fair to great quality. Regardless of metal mordant, most of the dyed woolen yarn samples exhibited a good to excellent in light fastness ratings. Other than that, alum is the most common mordant used for wool fabric, however too much of alum will make the wool to be sticky.

Yasassri et al., [1] was experimenting with natural dye taken from floral components to colour cotton fabric. The experiment uses five different mordants with three mordanting techniques and the effects on fastness properties were observed. The result obtained showed an excellent wash fastness grade of four to five on the grey scale. Furthermore, the dry rubbing fastness on fabric samples was better than wet rubbing, with a grey scale grade of 5 for colour alterations. All dyed showed a very good fastness for washing test and staining with a range of four to five. The light fastness was found to be good to moderate. Tannic acid is the most common mordant for cotton fabrics since cotton has a limited affinity for natural dyes.

Next, Naveed et al., [5] published a study towards the extraction of an environmentally friendly natural dye from pomegranate peel and its application on tencel fabric using three different types of mordants which are stannous chloride, ferrous sulphate, and alum to examine the effect of different colour hues and fastness properties. The fabric dyed with mordants had an excellent effect on colour shades, according to the result obtained. The fabric samples exhibit an excellent washing fastness ranging (4 - 5), light fastness (5 - 6), rubbing fastness (4 - 5) and as well as perspiration fastness ranging from (4 - 5).

To summarize altogether, using a variety of metal salt mordants will result in a wide range of beautiful hues with good colour and improved fastness properties (light, wash, and rub fastness properties).

## CONCLUSION

In conclusion, in mordanting technique, pre-mordanting was considered as the simplest and best technique. Pre-mordanted mostly showed the best results for mordanting natural dyeing on textile fabric and showed an excellent improvement on colour fastness properties. Hence, pre-mordanting techniques were applied in most of the studies. Ferrous sulphate, an excellent metallic mordant utilized in most research, showed excellent outcomes on fastness properties, particularly washing fastness, and colour strength was also increased. The use of mordant not only fixed the natural dye colour on the fabric, but also improved the fabric's fastness properties (washing, light, and rubbing).

Plant propagation techniques are clearly required in agriculture. Consequently, high-breed-value genotypes tend to multiply quickly in tissue culture. Quality plant material ensures disease-free plants. These findings are significant because they may improve shoot and root regeneration in tissue culture systems, thereby improving plant micropropagation. Hence, *M. charantia* has been used for hundreds of years to assist with diabetic symptoms and diseases.

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