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Pharmaceutical drugs in coloration of textiles

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ABSTRACT

Novel methods of dyeing have been introduced to get better results as compared to conventional dyeing. The present study was carried out for dyeing cellulosic fabric using bi-functional reactive dye and analysing the dye fixing ability of the reactive dyeing in presence of Tetracycline 250mg. The results were compared with the conventional dyeing methods. It is observed that the dye fixing in presence of pharmaceutical drugs gives better results as compared to conventional dyeing. A tetracycline is a group of broad-spectrum antibiotics whose general usefulness has been reduced with the onset of antibiotic resistance. The tetracycline consists of a polycyclic ring with different side chain and a broad spectrum class of antibiotics against aerobes and anaerobes. Tetracyclines are primarily bacteriostatic and exert their antimicrobial effect by inhibition of protein synthesis. Tetracycline is about 65% bound to plasma protein. The protein binding for intermediate and long lasting analogy is usually greater. Tetracycline is slightly soluble in water, freely soluble in acid and alkali, sparingly soluble in alcohol. Tetracycline is used to treat a wide variety of infections, including acne. It is an antibiotic that works by stopping the growth of bacteria. This antibiotic treats only bacterial infections. It will not work for viral infections (such as common cold, flu). Using any antibiotic when it is not needed can cause it to not work for future infections. Tetracycline can also be used in combination with anti-ulcer medications to treat certain types of stomach ulcers. Tetracycline is a yellow, odorless, crystalline powder. Tetracycline is stable in air but exposure to strong sunlight causes it to darken. Its potency is affected in solutions of pH below 2 and is rapidly destroyed by alkali hydroxide solutions. The work depicts a successful attempt to provide an antimicrobial finish to the cotton fabric with outdated Tetracycline drugs. This method of unused medicines valorisation can solve two major environmental and economic problems: limitation of environmental pollution with pharmaceutically active compounds and reduction of the disposal costs of expired drugs.

Keywords— Anti-biotic, Tetracycline hydrochloride, Expired drugs, Cotton

1. INTRODUCTION

The process of applying colour to fibre stock, yarn or fabric is called as dyeing. A dye, which is capable of reacting with the substrate to form covalent dye substrate linkage, is known as a reactive dye. Here the dye contains a reactive group and this reactive group makes a covalent bond with the fibre polymer and act as an integral part of the fibre. This covalent bond is formed between the dye molecules and terminal -OH group of cellulosic fibres and between the dye molecules and a terminal NH₂ group of polyamide fibres. [1]

Reactive dyes first appeared commercially in 1956, after their invention by Rattee and Stepheness at the imperial chemical industry (ICI)

Reactive dyeing mechanism: There are 3 stages in reactive dyeing:

1. Exhaustion of dye in presence of electrolyte or dye absorption.
2. Fixation under the influence of alkali.
3. Washing off the unfixed dye from the material surface.

Pharmaceutical drugs focus mainly on slow or controlled delivery system in order to achieve an optimal therapeutic effect. The unused pharmaceutical drugs were used as it has a greater approach in textiles. Over the years, wearing comfort and quality of textiles have improved. Besides the material itself, the structure is important. While depending on the fabrication process, the textile material is often permeable, breathing structures and usually treated to have an absorptive capacity. The pharmaceutical drugs used for the study are Tetracycline 250mg. A tetracycline is a group of broad spectrum antibiotics whose general usefulness has been reduced with the onset of antibiotic resistance. The tetracycline consists of a polycyclic ring with different side chain and a broad spectrum class of antibiotics against aerobes and anaerobes. Tetracyclines are primarily bacteriostatic and exert their antimicrobial

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 effect by inhibition of protein synthesis. Tetracycline is about 65% bound to plasma protein. The protein binding for intermediate and long lasting analogy is usually greater. Tetracycline is slightly soluble in water, freely soluble in acid and alkali, sparingly soluble in alcohol. [2] [3]

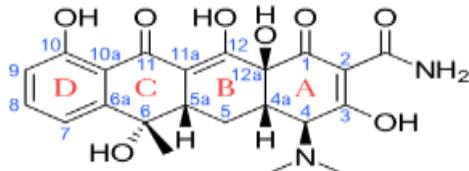


Fig 1: Skeletal structure of Tetracycline hydrochloride

2. SCOPE AND OBJECTIVE

Reactive dye has been widely studied in terms of the application of dyeing, printing and without their chromophore for finishing agent against UV protection and also for OBA finishes. The chemical structure of reactive dye has to post ample challenges. So the researchers modify the dye and also its application.

Hence in this project, we have tried to enhance the fixation of the reactive dye on cotton by various process modifications. The cotton fibre was conventionally dyed with the reactive dyes in a regular fashion with low salt addition followed by fixation with pharmaceutical drugs. The unused pharmaceutical drugs were recycled which were popular antibiotics. Thus dyeing and finishing were simultaneously obtained. The antibiotic imparts antibacterial finish on the fabric.

3. EXPERIMENTAL

Materials used:

a) Substrate: 100% cotton woven and cotton hank RFD

GSM: 120

b) Chemicals used:

Dyes used: Procion fast yellow HE

Procion red HE

Chemicals: Tetracycline hydrochloride (250mg), Glauber's salt (15gpl), Non-ionic soap (10gpl)

4. METHODOLOGY

Machines used: Rota dyer is used for dyeing (ROSSARI), Stenter for drying, curing machine, spectrophotometer.

Fixation of reactive dyeing using pharmaceutical drugs.

Performance properties of reactive dyeing on cotton fabric in presence of TCH.

The proper scoured and the bleached fabric is used for dyeing. 100% cotton woven fabric and hanks are used as a substrate for dyeing. The percentage shade used for dyeing is 0.5 % and 1% for both the dyes. The dyeing was started with the conventional method. Glauber's salt is added in the start of the dyeing and it is dyed at 85° for 30 minutes. Instead of alkali tetracycline hydrochloride is added to the dye bath. 1gpl concentration is made. The fabric is further kept for dyeing at 85° for 1 hr. The soaping is given with non-ionic soap. After treatment is given with hot wash, cold wash and dry. [5][6]

5. CHARACTERIZATION

UV Absorption: After dyeing the samples are tested through the UV spectrophotometer for the fixation of dye into the fabric through UV spectra. Also, the k/s values are determined through 5100 spectra machine through CCM. The results are compared. The difference is always calculated between the conventional dyeing and the dyeing in presence of TCH. The fixation of the dye is observed through the following results. [7]

6. RESULTS AND DISCUSSIONS

Reactive dyes are dyed on cotton by exhaust dyeing process. The main objective of the process is to fix the dye efficiently and economically at the outside. The conventional method used for dyeing as given above both 2 gm. fabric and hank by exhaust method using Glauber's salt for exhaustion followed by washing with acetic acid. The dye was then fixed in presence of Tetracycline hydrochloride with concentrations as 0.5, 1% shade.

6.1 In this set of experiment conventional dyeing was carried out with a concentration of 0.5% and 1% shade. Performance properties of reactive dyed cotton fabric and hank by conventional dyeing. The results are given below in table 1 and 2.[8][9]

Table 1: Performance properties of reactive dyed cotton fabric by conventional dyeing

Dye name	Concentration	Wt. of sample	UV absorption	k/s	Wash fastness	Light fastness
P. Fast yellow	0.5%	2	2.054	6.611	4	4
	1%	2	2.345	6.383	4	4
P. red	0.5%	2	1.497	7.793	4	5
	1%	2	1.234	7.221	4	5

Table 2: Performance properties of reactive dyed cotton hank by conventional dyeing

Dye name	Concentration	Wt. of sample	UV absorption	k/s	Wash fastness	Light fastness
P. Fast yellow	0.5%	2	2.351	5.432	4	4
	1%	2	2.541	4.512	4	4
P. red	0.5%	2	2.112	5.416	4	5
	1%	2	2.754	5.662	4	5

6.2 In this set of the experiment, the alkali was replaced by TCH with a concentration of 0.5% and 1% shade. Performance properties of reactive dyed cotton fabric and hank in presence of TCH. The results are given below in table 3 and table 4.[8][9][10]

Table 3: Performance properties of reactive dyed cotton fabric in presence of TCH

Dye name	Concentration	Wt. of sample	UV absorption	k/s	Wash fastness	Light fastness	Difference between conventional and this in k/s
P. Fast yellow	0.5%	2	0.621	3.260	4	4	3.351
	1%	2	0.363	4.210	3	4	2.173
P. red	0.5%	2	0.541	3.755	3	4	4.038
	1%	2	0.355	5.240	4	4	1.981

Table 4: Performance properties of reactive dyed cotton hank in presence of TCH

Dye name	Concentration	Wt. of sample	UV absorption	k/s	Wash fastness	Light fastness	Difference between conventional and this dyeing
P. Fast yellow	0.5%	2	4.000	5.214	4	4	0.218
	1%	2	1.767	4.000	3	4	0.512
P. red	0.5%	2	3.267	4.874	4	4	0.542
	1%	2	1.214	4.471	3	4	1.191

The conventional method gives an increase in k/s values before soaping, but values after soaping were very low since the % fixation is low for both hanks and fabric. It is interesting to note that the amount of the dye remaining in the fabric before soaping is lesser in presence of TCH. But after soaping the dye is 50 % more than the conventional in presence of TCH. This is indicative of fixation of the dye of different color and different shade as given in Table 3 and table 4.

The reason for this increase in the fixation of the dye is the pH which is acidic in nature and hence creates larger anions on the fabric for the formation of the covalent bond with a reactive dye which is already adsorbed on the fabric. In case of conventional dyeing after soaping this dye is washed out. Hence poor results after soaping. Acetic acid is used for neutralization.

7. CONCLUSION

Reactive dyes are known for their good washing and light fastness properties. They are extensively used in industries due to their outstanding properties. The pharmaceutical drugs which are expired can be recycled through its use in dyeing by alkali replacement. It shows a better fixation of the dye in presence of tetracycline hydrochloride (TCH). There is also shows better fastness to washing and light in presence of pharmaceutical drugs.

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