

# Antibiotic for Antimicrobial Finishing of the 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 Amoxicillin 250mg. The results were compared with the conventional dyeing methods. It is observed that the dye fixing in presence of antibiotics gives better results as compared to conventional dyeing. Amoxicillin is an antibiotic useful for the treatment of bacterial infections. It is a moderate spectrum, bacteriolytic,  $\beta$ -lactum antibiotic in the aminopenicillin family used to treat susceptible gram positive and gram negative bacteria. Antibiotics which play important role in treating several diseases become a colossal problem during disposal for various reasons. Amoxicillin is susceptible to degradation by  $\beta$ -lactamase-producing bacteria, which are resistant to a broad spectrum of  $\beta$ -lactam antibiotics, such as penicillin; for this reason, it is often combined with clavulanic acid, a  $\beta$ -lactamase inhibitor. This increases effectiveness by reducing its susceptibility to  $\beta$ -lactamase resistance. Amoxicillin has two ionizable groups in the physiological range (the amino group in  $\alpha$ -position to the amide carbonyl group and the carboxyl group). Amoxicillin has a good pharmacokinetics profile with bioavailability of 95% if taken orally, its half-life is 61.3 minutes and it is excreted by the renal and less than 30 % bio-transformed in the liver. So in the present study we are using expired antibiotic drugs instead of alkali for fixation of reactive dye in dyeing. The work depicts a successful attempt to provide antimicrobial finish to the cotton fabric with outdated antibiotic amoxicillin. 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 antibiotics.

**Keywords:** Anti-biotic, Amoxicillin, 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 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 fibre. This covalent bond is formed between the dye molecules and terminal -OH group of cellulosic fibres and between the dye molecules and terminal  $\text{NH}_2$  group of polyamide fibres. [1]

Reactive dyes first appeared commercially in 1956, after their invention by Rattee and Stephenson 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 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 depended on the fabrication process, textile material is often permeable, breathing structures and usually treated to have an absorptive capacity. Amoxicillin is an antibiotic useful for the treatment of bacterial infections. It is a moderate spectrum, bacteriolytic,  $\beta$ -lactum antibiotic in the aminopenicillin family used to treat susceptible gram positive and gram negative bacteria. Antibiotics which play important role in treating several diseases become a colossal

problem during disposal for various reasons. The common practice is to dispose it to the landfill or in garbage. Thus disposing such drugs is major issue. The present study uses the discarded drugs in textile processing. [4]

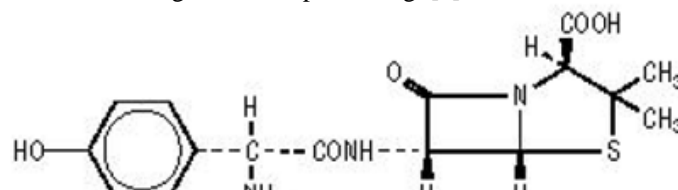


Figure 2: Skeletal structure of Amoxicillin

### Scope and objective

Reactive dye has been widely studied in terms of 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 post ample challenges. So the researches 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 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 was simultaneously obtained. The antibiotic imparts antibacterial finish on the fabric.

### 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: Amoxicillin (250 mg), Glauber's salt (15gpl),  
 Non-ionic soap (10gpl)

## 2. 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 amoxicillin:

The proper scoured and 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 conventional method. Glauber's salt is added in the start of the dyeing and it is dyed at 85° for 30minutes. Instead of alkali amoxicillin 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]

### 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 amoxicillin. The fixation of the dye is observed through the following results. [7]

## 3. Results and Discussions

Reactive dyes are dyed on cotton by exhaust dyeing process. The main objective of the process being 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 amoxicillin with concentrations as 0.5, 1% shade.

a) In this set of experiment conventional dyeing was carried out with 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 the table 1.1 and 1.2.[8][9][10]

**Table 1.1:** 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 1.2:** 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

b) In this set of experiment the alkali was replaced by amoxicillin with concentration of 0.5% and 1% shade. Performance properties of reactive dyed cotton fabric and hank in presence of amoxicillin. The results are given below in the table 3.1 and 3.2.[11][12]

**Table 3.1:** Performance properties of reactive dyed cotton fabric in presence of amoxicillin

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	0.863	0.942	3	4	5.671
	1%	2	0.848	1.677	3	4	4.713
P. red	0.5%	2	2.293	3.274	3	4	4.519
	1%	2	1.275	3.934	3	4	3.287

**Table 3.2:** Performance properties of reactive dyed cotton hank in presence of amoxicillin

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	2.744	4.917	4	3	0.515
	1%	2	1.894	4.043	3	3	0.469
P. red	0.5%	2	1.504	4.077	4	3	1.339
	1%	2	1.234	4.768	3	3	0.894

The conventional method gives 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 amoxicillin. But after soaping the dye is 50 % more than the conventional in presence of amoxicillin. This is indicative of fixation of the

dye of different colour and different shade as given in Table 3.1 and 3.2. [11][12]

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 formation of the covalent bond with 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.

The pharmaceutical drugs which are expired can be recycled and used in reactive dyeing for better fixation, good fastness properties as well as its antimicrobial nature on the fabric.[13][14]

#### 4. 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 Amoxicillin. There is also shows better fastness to washing and light in presence of pharmaceutical drugs.

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#### References

- [1] Nithyanandan, R. and M. Subramanian, *Salt & Alkali Free Reactive Dyeing*, p. 1-5.
- [2] Broadbent and A.D, *Basic Principle of Textile Coloration*.A.S.T.M, 2001. 1(2): p. 337.
- [3] International journal of green pharmacy: Sunil S Jalalpure, nitin Agarwal, M.B.Patil, R.Chimkode.
- [4] Indian journal of fibres and textile research vol.26
- [5] <http://www.japsonline.com> journal of applied pharmaceutical science. Vol 2.
- [6] [www.researchgate.net/pub/31765867](http://www.researchgate.net/pub/31765867). International journal of current microbiology and applied science.
- [7] Prashant Gangawane, Usha Sayed (2013), Dyeing of Nylon with discarded tetracycline hydrochloride drug, *International Journal of Textile and Fashion Technology*, 3(1), 49-54
- [8] Balaji Narshimhan, Accurate models in controlled drug delivery systems, *Handbook of Pharmaceutical Controlled Release Technology*, Donlad L. Wise, New York & Basel.
- [9] *Handbook on renewable materials for coloration and finishing by mohd yusuf*.
- [10] *Journal of biotechnology and biomaterials*. Author: arinjoy datta, chandi patra.
- [11] *International journal of advance research in science and engineering* [www.ijarse.com](http://www.ijarse.com) vol no.4
- [12] [www.globalresearchonline.net](http://www.globalresearchonline.net) international journal of pharmaceutical science review and research. Author – S.Devsenam, N.Hajara beevi, S.S.Jayanthi.
- [13] [www.mdpi.com/journal/molecules](http://www.mdpi.com/journal/molecules) author - susan azizi, mahanaz mahdavi shahri and rosfarizan Mohamad.
- [14] [www.elsevier.com](http://www.elsevier.com) author- S.Venkat kum, S.Rajeshkumar.([www.sciencedirect.nic.in](http://www.sciencedirect.nic.in))

[15] International journal of chemical science ([www.sadgurupublication.com](http://www.sadgurupublication.com)).

[16] Farook, Y., *Textile Dyeing and Printing Technology*. Textile Today, 1997. 2(3): p. 178-190.