

## **DYEING OF NYLON WITH DISCARDED TETRACYCLINE HYDROCHLORIDE DRUG**

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### **ABSTRACT**

Drugs lose their potency beyond their expiration date. Therefore their effectiveness and their ability to function is lost. Expired Tetracycline (an antibiotic) was known to be responsible for kidney impairment. Hence the possibility of using tetracycline hydrochloride other than for medication is a good research problem.

The present study reveals that Tetracycline hydrochloride drug can be use to dye Nylon fabric by the exhaust process The performance properties are medium to good. Tetracycline Hydrochloride drug being a non-toxic in nature can be worn next to skin. The End-use can be in various sectors in apparels, kid's garments, technical textile, medical textile etc.

**KEYWORDS:** Tetracycline Hydrochloride, Expired Drugs, Apparels, Kid's Garments, Technical Textile, Medical Textile, Nylon

### **INTRODUCTION**

Most drugs simply lose potency and are nontoxic after the expiration date. Human toxicity related to taking expired drugs has only been linked to degraded tetracycline. There have been rare reports of renal tubular dysfunction or Fanconi-like syndrome associated with ingestion of outdated tetracycline.<sup>1-6</sup> The majority of the cases were reported in the 1960s.

Degradation products of tetracycline (i.e., anhydrotetracycline and epi-anhydrotetracycline) accumulate within mitochondria of renal cells and interfere with oxidative phosphorylation and can potentially cause nausea, vomiting, lethargy, polydipsia, polyuria, glycosuria, aminoaciduria, phosphaturia, proteinuria, acidosis, and hypokalemia.<sup>6</sup> Therefore, our study was focused on the usage of expired drugs or unused drugs because of patient's non-compliance that contain in their composition active substances with inhibitory properties. In our previous study, silk have been successfully dyed with Tetracycline hydrochloride by exhaust process.<sup>7</sup> This method of unused medicines valorization can solve two major environmental and economical problems: limitation of environmental pollution with pharmaceutically active compounds and reduction of the disposal costs of expired drugs.

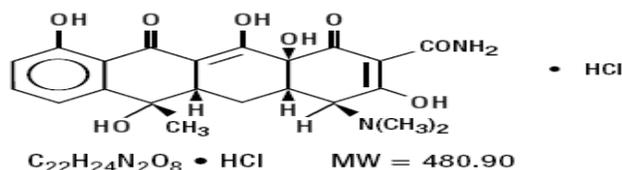
### **MATERIAL AND METHODS**

#### **Material**

Commercially available ready for dye (RFD) Nylon fabric was used for the study.

#### **Drug Used**

Tetracycline Hydrochloride (TCH) by Piramal Healthcare Limited, Gujrat, (Batch No. 1558, Mfd. Jun 2010, Exp.- May 2012)



### Chemicals

Hydrochloric Acid(HCL) , Ammonium Acetate (CH<sub>3</sub>COONH<sub>4</sub>), L Histidine hydrochloride monohydrate, Sodium Chloride, Disodium hydrogen phosphate. All chemicals are supplied by S.D. Fine Chem. Ltd.and are of AR grade.

### Methods

#### Dyeing of Nylon

1% stock solution of Tetracycline Hydrochloride was prepared for dyeing. Nylon was dyed with Tetracycline hydrochloride keeping liquor ratio of 20:1, at 100<sup>o</sup>C for 60 min. Then rinsed and dried.

#### Colour Measurement

Dyed samples were evaluated for the depth of the colour by determining K/S values using a Spectraflash® SF 300, Computer Colour Matching System supplied by Data color International, U.S.A. An average of four readings taken at four different sample areas, was used to calculate the reflectance values, and Kubelka Munk K/S function which is given by:

$$\frac{K}{S} = \frac{(1 - R)^2}{2R}$$

Where,

"R" is the reflectance at complete opacity.

"K" is the absorption coefficient.

"S" is the scattering coefficient.

Tone of the Colour is also measured on the same machine Tone of the Colour in terms of CIE L\*a\* and b\* values.

Washing Fastness was carried out by ISO 105-CO1.

Light Fastness was carried out by ISO 105-B02.

Rubbing Fastness was carried out by ISO 105-X12.

Perspiration Fastness was carried out by ISO 105 – E04.

### RESULTS AND DISCUSSIONS

Drugs lose their potency beyond their expiration date, and therefore their effectiveness and their ability to dissolve can be affected. For patients who rely on medications to stay alive, like heart medications, expired drugs can be dangerous because they may not be getting the full effectiveness of the drug. It depends on the medication. Expired Tetracycline (an antibiotic) was known to be responsible for kidney impairment.

In this work an approach which was an innovative method was experimented where Tetracycline Hydrochloride were used to apply on the synthetic fibers namely Nylon.

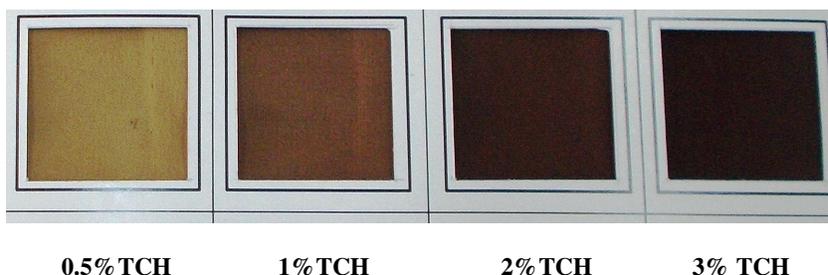
The dyeing of Nylon was carried out at 100°C for 60 min and the concentration was varied between 0.5% to 3% and the results are shown in Table 1 and Figure 1, 2 and 3 and 4.

**Table 1: Colorant Strength Calculation Values of Nylon Substrate Dyed with TCH Dissolved in Dilute Hydrochloric Acid at Varies Concentration**

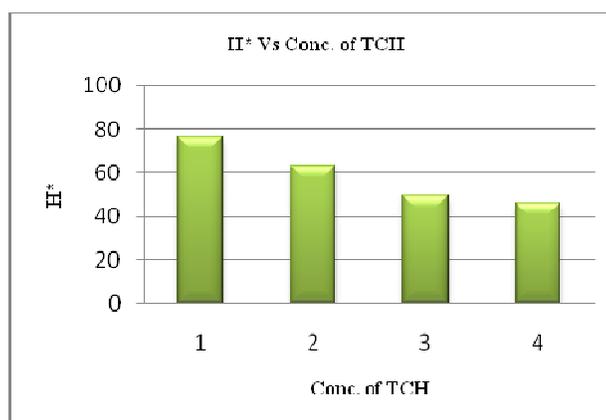
Sr No.	TCH Conc.%	L*	a*	b*	C*	H*	Colour Strength (%)	K/S
1	0.5	54.98	6.382	26.11	26.88	76.24	100	4.1578
2	1	48.74	8.521	16.88	18.91	63.19	211.35	8.7874
3	2	44.84	9.84	11.51	15.14	49.45	378.238	15.726
4	3	43.99	10.09	10.5	14.56	46.11	473.993	19.707

**Table 2: Fastness Properties of Nylon Substrate Dyed with TCH Drug Dissolve in Carious Dilute Acids**

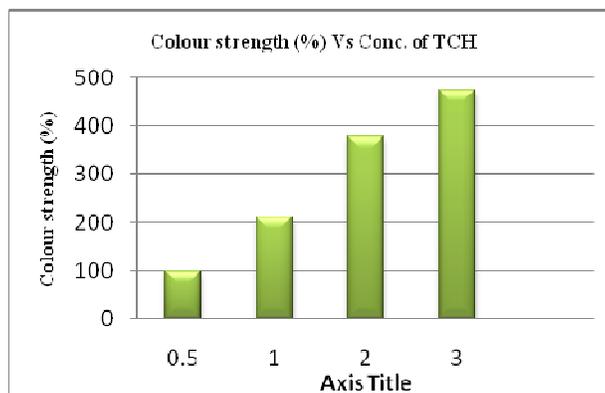
Sr.No.	TCH % Shade	Washing Fastness	Light Fastness	Rubbing Fastness		Fastness to Perspiration	
				Dry	Wet	Alkaline	Acidic
1	0.5%	3-4	4	3-4	3-4	3-4	4
2	1%	3-4	5	3-4	3-4	3-4	4
3	2%	3-4	5	3-4	3-4	3-4	4
4	3%	3-4	5	3-4	3-4	3-4	4



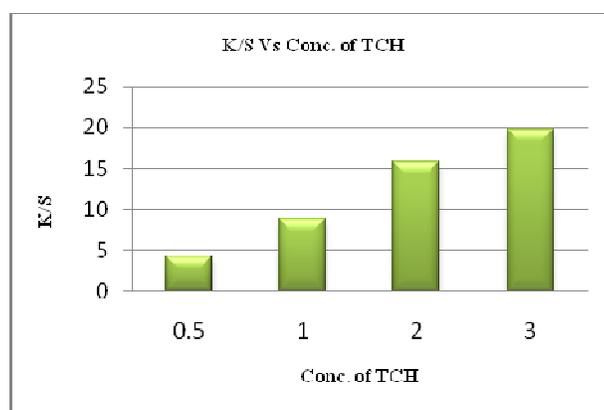
**Figure 1: Shade Card of Dyeing of Nylon with Tetracycline Hydrochloride at Various Concentration**



**Figure 2: H\* Vs Concentration of Tetracycline Hydrochloride in %**



**Figure 3: Colour Strength (%) Vs Concentration of Tetracycline Hydrochloride in %**



**Figure 4: K/S Vs Concentration of Tetracycline Hydrochloride in %**

The drug is yellow in color with the brown cast powder, acidic in nature and freely soluble in dilute Hydrochloric acids. It has been found that Nylon fabric dyed with Tetracycline Hydrochloride and exhibits a wide gamut of colour shade. Also shows uniformity and levelness. Table 1 indicates that the L value decreasing from 0.5 % to 3% hence as the concentration of Tetracycline Hydrochloride increases the darkness increases. The value of a\* found to be increasing as the concentration increases hence it can be observe from figure 1 that as the concentration increases the Redness characteristics increases. The value of b\* decreased from 0.5% to 3% which indicate that yellowness decreases as increase in %shade and its minimum at 3%. At 3% shade Nylon fabric become maximum Redder and bluer as compare to all other shades. From the table 1 it has been observed that the Colour Strength increases and maximum at 3%. The K/S values also increases with the increase in concentration. Thus Tetracycline Hydrochloride drug can be used to dye Nylon fabric by the exhaust process. TCH ionizes into chloride groups and hence can easily form ionic bonds with the cationic amino groups of Nylon. And therefore as seen in table 1 and figure 1 with increase in concentration of tetracycline hydrochloride , the colour strength increases and K/S values was also increases. Since in the acidic pH the protonation of Nylon increases and hence the increase ionic concentration of the drug is able to capture more sites and form bonds resulting in higher uptake. The mechanism is very similar to that of an acid dye used for dyeing of Nylon. The wash fastness , the light fastness , the rubbing fastness as well as the perspiration fastness as seen in table 2 are good , indicating ionic bond linkage which are faster to light, wash and perspiration with increase in % shade there is increase in fastness properties. The figure 1,2,3 and 4 again indicate the above mechanism. The successful dyeing of Nylon by using a drug which has expired potency for human consumption can be recycled to dye the Nylon fabric instead of polluting the effluent and the whole process is environmental friendly and a very good alternative for the use of the expired tetracycline hydrochloride drug. Such a dyed

fabric was also found to be antimicrobial in nature and can also be use in apparels, kid ware and any other end use which required hygienic atmosphere.

## CONCLUSIONS

The above experimentation has exhibited the uniform level dyeing of Nylon possessing antimicrobial properties can be achieved by using expired TCH as an acid dye for dyeing of Nylon with a wide gamut of colours with increasing concentration. Such an innovative experimentation on expired drug has been studied for the first time in the Textile processing.

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