

## “Implementation of working procedure on semi skill workers in textile industry for recovery of wastage by Taguchi method”

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### ABSTRACT

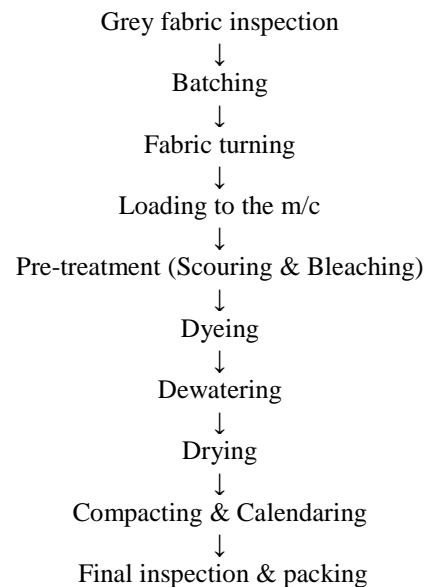
In the textile industry waste includes a large variety of dyes and chemical additions that make environmental challenge for textile. it is not only as liquid waste but also in its chemical composition. The main pollution in textile wastewater come from dyeing and finishing process and these process require the input of a wide range of chemicals and dyestuffs, which generally are organic compounds of complex structure. In this paper, we utilize Taguchi methods to obtain the optimum conditions of a dyeing process at XYZ Company and to gain the percentages of contributions of each parameter. Taguchi’s method was for experimentation. Taguchi was applied to evaluate the effect of these parameter and Signal to noise data used for compute the importance & there effect on the response parameter. The Cochorus (Tossa) variety of jute fibre was collected from the company. About 60cm from the bottom of the fiber was discard and then 30cm was taken. This portion was washed with 6.5g soda and 3.5g soap flake per liter at 75°C for 30min. The washed jute was then bleached with sodium chlorite solution of strength of 0.5% at pH 4 & 85-90°C for 90 min. Then the bleached jute fiber was dried at 85°C & was taken as the experimental material.

**Keywords:** *Taguchi Method, Dyeing Process, Textile Industry*

### 1. INTRODUCTION

Knit dyeing is a technique of dyeing the knitted fabrics. The dyeing of knitted fabrics occurs in the exhaust method or in batch-wise process. Knit dyeing process is near similar to yarn dyeing process but there is some difference in quality measurement<sup>[1]</sup>. Generally all types of single jersey, double jersey and their derivatives are dyed by different way. Flowchart of knit fabric dyeing describes shortly<sup>[3]</sup>.

### Sequence of Operation for Knit Fabric Dyeing:



### 2. EXPERIMENTAL DESIGN DATA

Material used in this experiment is 100% cotton knit fabric that had undergo scouring process and preparation of material done by cutting the cotton knit fabric<sup>[1]</sup>.

Table 1: Control Parameters

Control Parameter & Their Levels					
Parameter	Code	Level			Unit
		1	2	3	
Evection Red	A	3	3.5	4	%
Na <sub>2</sub> SO <sub>4</sub> Concentration	B	70	80	90	g/l
Na <sub>2</sub> CO <sub>3</sub> Concentration	C	4.8	5.8	6.8	g/l
Temperature	D	80	90	100	°C

**2.1 Signal to Noise Ratio (SNR) Calculator** is an online statistics tool to calculate how much a signal may corrupt by unwanted noise and contains meaningful information<sup>[6]</sup>. Signal-to-noise ratio is also called as SNR or S/N, is defined as the ratio of signal power to the noise power which measures the original signal corruption. It's a defining factor when it comes to measure the quality of signal in communication channels or mediums<sup>[8]</sup>. A higher SNR guarantees the clear acquisitions with low distortions and artifacts caused by unwanted noise. The better ratio of SNR cause the better signal stand out, makes the better quality of original signal or transmitted information signals<sup>[10]</sup>. S/R ratio measurement is commonly used in the field of science and engineering fields. A ratio higher than 1 indicates more signal strength<sup>[18]</sup>. The below mathematical formula used in statistics to calculate the signal to noise (S/N) ratio to find the quality of signal<sup>[16]</sup>

$$SNR = P_{\text{signal}}/P_{\text{noise}} = \mu/\sigma$$

where

$\mu$  = signal mean or expected value

$\sigma$  = standard deviation calculation\_of the noise

Response of this experiment is the color strength that was measured by the reflectance (R) that was adopted from Kubelka-Munk theory<sup>[19]</sup>.

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

Where

K = Absorption coefficient

S= Scattering Coefficient

R=Surface of reflectance

Table 2: Data collected by observation in textile industry (by Orthogonal Array)

Observation	Parameter Code				Data collection		
	A	B	C	D	R1	R2	R3
<b>1</b>	1	1	1	1	13.2	13.75	12.5
<b>2</b>	1	2	2	2	17.03	17.4	17.95
<b>3</b>	1	3	3	3	17.06	16.5	16.42
<b>4</b>	2	1	2	3	18	18.4	18.54
<b>5</b>	2	2	3	1	18.2	18.85	18.7
<b>6</b>	2	3	1	2	20	20.34	20.85
<b>7</b>	3	1	3	2	20.56	20.29	19.8
<b>8</b>	3	2	1	3	19.85	19.42	19.5
<b>9</b>	3	3	2	1	18.9	19.54	18.32

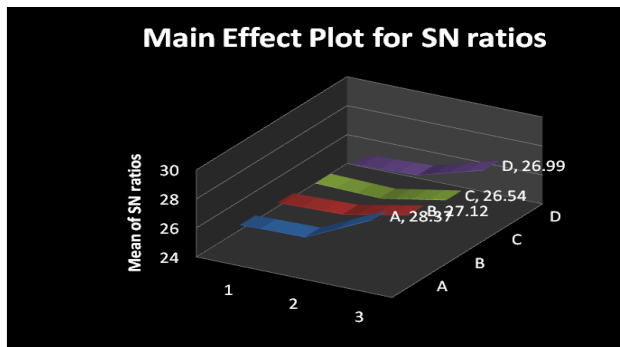
Table 3: Mean & S/N Ratio

Mean & S/N Ratio					
Observation	R1	R2	R3	Mean	S/N Ratio = (-10log(1/square of mean))
<b>1</b>	13.2	13.75	12.5	13.15	22.37
<b>2</b>	17.03	17.4	17.95	17.46	24.84
<b>3</b>	17.06	16.5	16.42	16.66	24.43
<b>4</b>	18	18.4	18.54	18.31	25.25
<b>5</b>	18.2	18.85	18.7	18.58	25.38
<b>6</b>	20	20.34	20.85	20.4	26.19
<b>7</b>	20.56	20.29	19.8	20.22	26.11
<b>8</b>	19.85	19.42	19.5	19.59	25.84
<b>9</b>	18.9	19.54	18.32	18.92	25.53

### 3. RESULTS

As mentioned before, the character of S/N Ratio used in this paper is the larger the better. Therefore, the greater the delta value of a parameter is the better. The optimum conditions on this approach obtained by sorting the delta in an order of significantly affecting the process. The higher the delta values signify the more effect its parameter contributes.

Optimum condition by Utilizing S/N Ratio				
	A	B	C	D
Level 1	26.19	26.11	25.84	25.53
Level 2	26.28	26.24	25.73	25.72
Level 3	28.37	27.12	26.54	26.99
Delta	2.18	1.01	0.7	1.46
Rank	1	3	4	2
Optimum	A3	B3	C3	D3



### 4. CONCLUSION

By using Taguchi method obtained result of optimum conditions. The following are the parameter and level in order of significantly affecting the dye process at XYZ company. The predicted result compared to the experiments is verified. Therefore the obtained optimum conditions are proven to be effective. The optimization process that performed by Taguchi method brings out of the best conditions to be used in a dyeing process that could actualize a friendly environmental process in a textile industry.

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