ISSN: 1999-1630

SEU Journal of Science and Engineering, Vol. 12, No. 1, June 2018

Automated and Manual Dye Measurement in Dyeing Laboratory

A. B. M. Foisal*, Most. Shobnom Poly, Mohammad Shohel Rana and M. Mahfuzur Rahman

Department of Textile Engineering, Southeast University, Dhaka, Bangladesh

Abstract

The aim of this work was to investigate the comparison between Manual and Auto lab dispensing systems of dye solution. In this work the discussion was about Automatic and Manual pipetting in addition to dyeing of knit fabric samples and results of the effective deviation in both methods. The samples are dyed with 0.5%, 1.0%, 2% and 3% recipe for both cases. The color difference value (DE*), color fastness to wash, rubbing and water were determined to provide a better discrepancies between them. This work has been done at Anlima Textile Ltd. Savar Dhaka during January 2018 to June 2018.

Keywords: *AUTOLAB Dispenser, AUTOLAB SPS, Manual Pipetting, Sample Dyeing, Spectrophotometer*

I. Introduction

Dyeing laboratory is an imperative part of Textile sector. Manual dye dispensing system is mostly used since the early stages of Textile industries in Bangladesh. Traditional laboratory dispenser system requires a substantial amount of time to maintain and to keep the system clean, subsequently leading to increased downtime. On the other hand automated stock solution make up is a rapid method which can save considerable time over manual methods. It offers the ability to obtain greater efficiency in the laboratory (G. R. Turner 1990).

Datacolor AUTOLAB SPS and AUTOLAB TF-40 can run stand alone or can be optimized to operate as an integrated part of the Datacolor SPECTRUM™ solution for controlling all aspects of color management Traditional manual dispensing systems are often associated with potential errors that can be eliminated with the automation process in place. This will help companies with faster innovation, having to ensure consistent color quality, reduction in the cost of production, and accelerate their production process ensuring higher efficiency. Automated solution maker of dyes can make the repeatable dye solutions precisely. It ensures solutions are made consistently prepared with a uniform method and also applying correct water temperature as opposed to having potential human error in manual system. Auto Dispensers are known as touch less or no-touch color and chemical systems. It dispenses a controlled amount of color and chemical solutions, which are often used in conjunction with automatic pipetting in the modern Dyeing Lab (Data Color; UMT; M. Morshed 2015; H. N. Harvey and J. Park, 1989; B. C. Burdett and W. A. Straw, 1968).

However, in this work, it is discussed on the automated and manual methods of solution making of dyes for the sample productions in the knit fabric dyeing laboratory and comparison has been done on various parameters.

II. Materials and Methods

Working Procedure

First of all, the recipe was predicted according to the standard samples by the spectrophotometer. The stock solution was prepared by AUTOLAB SPS and kept it in the AUTOLAB TF-40 dispenser for pipetting. For manual pipetting stock solution was also prepared by hand. Then 5gm 100% cotton scoured-bleached wetted samples were taken into each of the dyeing pots. The required amount of dyes and chemicals were added into the dyeing pots from the AUTOLAB dispenser and manually. The dyeing program of the sample dyeing machine according the required

* **Corresponding Author:** A.B.M. Foisal, Department of Textile Engineering, Southeast University, Tejgaon, Dhaka 1208, Bangladesh. E-mail: *foisal_text@yahoo.com*

parameter was selected. After dyeing the samples were washed, dried and ironed properly.

Comparison on Shade Differences:

The shade of the dyed knit fabric samples are compared under light box in D65, TL84 light sources.

Determination of DE* Value

Datacolor Spectrophotometer was used for recipe calculation, find out the values of DL*, Da* and Db* and to calculate the Total Color Difference between Std. and the Batch. This Total Color Difference is called delta E and it represented by symbol DE*. DE* can be calculated using this equation.

$$DE^* = [(DL^*)^2 + (Da^*)^2 + (Db^*)^2]^{1/2}$$

Determination of Color Fastness to Wash, Water and Rubbing

Color fastness to wash was determined according to the test method ISO 105 C06. Color Fastness to Water has determined according to test standard ISO 105 E01:2002. For determination of color fastness to Rubbing Crock Meter was used. Color Fastness to Rubbing was followed according to test standard ISO 105 X12:2002.

III. Results and Discussions

Comparison on shade difference

Table 1 show that the shades 0.5%, 1%, 2% and 3% of the dyed samples S-1, S-2, S-3 and S-4 respectively were almost same to the standard samples. In both cases Manual and AUTOLAB Dispenser reference pictures were comparatively closer to the standards.

Color difference between dyed samples and standard samples

The color difference was measured by Spectrophotometer using DL*, Da* and Db* values in the presence of both D65 and TL84 light sources for both Manual Pipetting and AUTOLAB Dispensing samples. The Spectrophotometer values were stated in Table 2.

Table 1: The shade differences of the knit dyed fabric samples

Samples	Shade%	Manual pipetting	Standard	Auto lab dispenser
S-1	0.5			
S-2	1			
S-3	2			
S-4	3			

Table 2: Spectrophotometric results of Manual Pipetting and AUTOLAB Dispenser

Sample	Method	Light source	DL*	Da*	Db*	Dc*	DH*	CMC DE*
S-1	Manual Pipetting	D65	0.85	0.26	-0.33	-0.2	-0.37	0.57
		TL84	0.83	0.45	-0.31	-0.12	-0.53	0.68
	AUTOLAB Dispenser	D65	0.84	0.1	-0.67	-0.57	-0.35	0.62
		TL84	0.81	0.24	-0.66	-0.53	-0.46	0.66
S-2	Manual Pipetting	D65	-0.62	-0.11	0.49	0.34	0.38	0.64
		TL84	-0.61	-0.18	0.53	0.37	0.43	0.66
	AUTOLAB Dispenser	D65	0.19	-0.47	-0.5	-0.68	0.09	0.4
		TL84	0.15	-0.47	-0.57	-0.73	0.11	0.41
S-3	Manual Pipetting	D65	0.67	1.31	0.63	1.45	-0.11	0.65
		TL84	0.75	1.36	0.73	1.53	-0.2	0.71
	AUTOLAB Dispenser	D65	0.89	0.64	0.64	0.87	0.23	0.57
		TL84	0.93	0.67	0.63	0.91	0.11	0.57
S-4	Manual Pipetting	D65	0.3	0.48	-0.33	0.08	-0.57	0.47
		TL84	0.33	0.42	-0.31	0.02	-0.52	0.45
	AUTOLAB Dispenser	D65	-0.58	0.02	-0.56	-0.4	-0.39	0.41
		TL84	-0.61	0.22	-0.55	-0.29	-0.51	0.5

From the table 2 it was seen that in most cases, both Manual Pipetting and AUTOLAB Dispenser DL* is positive (i.e.; Lighter), Da* is positive value which indicates the samples are Redder except the samples S-2 and Db* is negative (i.e.; Bluer or Less yellow). Chroma difference is referred by DC*. In most of cases for AUTOLAB Dispenser Dc is negative which indicate that the samples are duller than the standard sample except the sample S-3. The angular difference is also represented by

DH*. Angular difference i.e.; DH* is very nearer to standard for both two cases. In both cases color difference value was less than 1 (one) in both D65-10 Deg. & TL84-10Deg light sources. We know that the acceptable range of DE* is less than 1. So all the test specimen is "PASS". On the other hand DE* values for AUTOLAB Dispenser is comparatively closer to zero (i.e.; the standard). So to say, AUTOLAB Dispenser is more precise than Manual Pipetting.

Color Fastness to Wash, water and Rubbing

Table 3 shows that the colour fastness (CF) of the samples S-1, S-2, S-3 and S-4 to wash, water and dry and wet rubbing. The assessment of Color fastness to wash was good to Excellent in grey scale rating 4-5 and 5. In most cases Color Fastness to Water rating was 5 (i.e.; Excellent) except the sample S-4 the rating was 4. All the dry Rubbing result was Excellent with rating 5 and the. wet rubbing result was excellent for sample S-1, Sample S-2 was very good with rating 4-5, sample S-3 was good with rating 4 and sample S-4 was moderate with rating 3

Table 3: Color Fastness (CF) to Wash, water and Rubbing

Sample no.	CF to wash	CF to water	CF to rubbing	
			Dry rubbing	Wet rubbing
S-1	5	5	5	5
S-2	5	5	5	4-5
S-3	4-5	5	5	4
S-4	4-5	4	5	3

IV. Conclusion

In comparison between Manual Pipetting and AUTOLAB Dispensing, it was noticed that the automatic system was better than Manual Pipetting due to the fact that the accuracy of pipetting in AUTOLAB Dispenser is more precise than Manual pipetting. This efficient system also helps to increase the production in laboratory and reduce time consumption in addition to cutting labor cost. As a result

companies are using automatic agitation with Manual or electronic pipet which increase their flexibility and productivity as well as low price. Some companies are replacing Automatic Dispensing machine for their flexibility, productivity, repeatability and confidence enhancement. It has a 0.001 g readable electric balance and tube less pipetting that provides more accurate results minimizing human errors. The main drawback of the automatic dispensing system is that it is very expensive and requires technical operators often demanding higher salaries. Due to the shortage of expert operators in the country,manual method is more common than AUTOLAB Dispenser in Bangladesh. The findings of this work show that although the shade matching in wet processing laboratory by manual dispensing of dyes is most common in our country but automated dispensing system of dyes have better results and more effective.

Acknowledgement

We would like to thank the management of the ANLIMA TEXTILE LTD. for giving us the opportunity to complete the Project successfully and also for their valuable suggestion. Our deepest gratitude goes to Senior Vice President Md. Shah Alam, Vice President Rasheda Sarker (Fancy), Assistant Vice President Debabrata Podder (Noyon), Anlima Textile Ltd.

References

G. R. Turner, Automated Dye measurement, Textile Chemist and Colorist, Vol.22. No. 12, December 1990, p 21-23.

Data Color: https://www.datacolor.com/business-solutions/product-overview/datacolor-autolab/

Color: http://colorexpert.co.th/wp-content/uploads/2016/09/AutolabTF_Leaflet_EN.pdf

TEC: http://www.tec-color.com/downloads/TF%20Autolab%20Dispensing%20Machine.pdf

Eric Alho, Seven Steps to Superior Color Control in the Dyehouse: The Blending of Theory and Practice, Automation and Skill,

UMT: http://admin.umt.edu.pk/Media/Site/STD1FileManager/OsamaArticle/color%20control.pdf

M. Morshed, RFT Dyeing & Its Effect, International Journal of Textile Science 2015, 4(1): 20-26, DOI: 10.5923/j.textile.20150401.03

H. N. Harvey, J. Park, Automation in the dyeing laboratory and its influence on accuracy in batch dyeing, Coloration Technology, Volume105, Issue 5-6, May 1989, Pages 207-211

B. C. Burdett , W. A. Straw, Mechanisation in the Laboratory, Coloration Technology Volume 84, Issue 2, February 1968, Pages 137-146.