FACULTYOF ENGINEERING
DEPARTMENT OF GINNING AND TEXTILE ENGINEERING

FINAL YEAR PROJECT REPORT

REDUCTION OF FABRIC SHADE VARIATION USING FAILURE MODE AND EFFECT ANALYSIS IN DYEING PROCESS

BY

OKWERAGEOFFREY

BU/UG/2012/240

EMAIL: geoffreyokwera7@gmail.com

CASE STUDY: **SOUTHERN RANGE NYANZA LIMITED (SRNL)**

SUPERVISORS

MAIN SUPERVISOR: **WANDERA GEORGE**

CO-SUPERVISOR: **DR ILDEPHONSE NIBIKORA**

A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF TEXTILE AND GINNING ENGINEERING IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF A DEGREE OF BACHELOR OF SCIENCE IN TEXTILE ENGINEERING OF BUSITEMA UNIVERSITY 13 MAY 2016

ABSTRACT

There are many problems of shade variation in the piece dyed fabrics in the textile industry and this is caused by various factors such as man, machines, methods and materials

These factors includes steam pressure variation, temperature, PH, auxiliary chemicals, liquor ratio, This research project presents a methodology to reduce shade variation defects in the fabrics dyeing process on jet dyeing machines in the Southern Range Nyanza textile industry Shade variation is the most prevalent defect found in the textile industry which leads to huge reduction of profit of Textile Company. Failure Mode and Effect Analysis (FMEA) and Fishbone diagram are used to analyze root causes and prioritize the causes. The pretreatment process and the dyeing laboratory are the early steps of dyeing process. The improvement in these stages has significant effects on reducing process variation which leads to Colour variation defects.

DEDICATION

This report is dedicated to Mr. Alfonse LANGOYA and Mr. Joel KOMACHECH for always being there for me along the way of life. You have and are continually assets to my life, my mentors and above all the best life coaches ever may the ALMIGHTY YAHWEH continually increase your wisdom

ACKNOWLEDGEMENT

I thank GOD for the far HE Himself has enabled me reached with his unwavering faithfulness.

Thanks to my supervisors **WANDERA GEORGE** and **DR ILDEPHONSE NIBIKORA** for their continual support and encouragement during the time of my project. Not forgetting those that I may not be able to mention whose advice and contribution has enabled me improve my skill in writing and editing this work.

To my colleagues and friends whose support I shall not be able to easily forget, am grateful for the time, advice, ideas, encouragements and above all prayers that you individuals have accorded to me. The truth is I may not be able to mention all of you individually but I believe you are God sent at a time like this to release the potential that he has placed in you that has helped me greatly.

DECLARATION

I **OKWERA Geoffrey** declare to the best of my knowledge that the work presented in here is my own unless otherwise indicated and has never been submitted to any institution for any award.

SIGNATURE: .....

DATE: 15 - 5 - 2016

APPROVAL

This final Year Research project report titled **''Reduction of fabric shade variation using failure mode and effect analysis in dyeing process''** has been submitted for examination with the approval of my supervisors.

Mr. WANDERA GEORGE

Signed: .....

Date: .....

DR ILDEPHONSE NIBIKORA

Signed: .....

Date: .....

Table of Contents

LIST OF FIGURES

LIST OF TABLES

SYMBOLS AND ACRONYMS

FMEA = failure mode and effect analysis

SRNL= southern range Nyanza textile limited

AIAG = Automotive Industry Action Group

RPN = risk priority number

%age = percentage

S = Severity

O = Occurrence

D = Detection

DPU = Defect per unit

CHAPTER ONE

1.1. BACK GROUND OF THE STUDY

Dyeing Process is a value-added treatment for textile materials. It is the transference of dyes from the aqueous solution onto a fiber surface, where it then diffuses into the fiber (Pawadeetanaset & Rukijkanpanich 2015) In the weaving and knitting departments, for some qualities, fabrics are woven and knitted from the dyed yarn (yarn dyed quality) and for other qualities, fabrics are prepared from grey or bleached yarn and colouring is carried out in the dyeing department (piece dyed quality) (Kolkata et al. n.d.)Piece dyeing is the most productive method for dyeing the textile fabric. Shade variation is found in the case of piece dyed, which literary means not meeting the customer's expectation regarding that particular shade(Kolkata et al. n.d.). Dyes may be defined as substances that, when applied to a substrate provide colour by a process that alters, at least temporarily, any crystal structure of the colored substances. (Maria et al. n.d.) Day by day the customers are going to be more conscious about quality of clothing items and as a result it becomes more challenging to the manufacturer due different kind of cost.(Lecturer et al. 2011)

Failure mode and effect analysis was initiated by the United Stated Army in 1949 and is firstly introduced into the aerospace industry in 1960s. FMEA is then improved by automotive industries for designing and developing products and processes. Moreover, some re-searches have integrated different analysis tools with FMEA to support more effective analysis especially fishbone diagram(Pawadeetanaset & Rukijkanpanich 2015). Failure mode is "the way or manner in which a product or process could fail to meet process requirements and the potential impact of a failure are defined as the effects of the failure mode

Failure mode and effect analysis (FMEA) is an engineering analysis done early in the product development process and finds and corrects weaknesses (defects) before the product gets into the hands of the customer. it will result in significant improvements to reliability, safety, quality, delivery, and cost if effectively used (Fundamental & Fmeas 2012).

REFERENCES

1. A, P.J.D. et al., 2013. Detail Study of Different Dyeing Processes. , 3(9), pp.537–540.
2. Automotive Industry Action Group (AIAG), 2008. Potential Failure Mode and Effects Analysis. , 4th ed.
3. Carlson, C.S., 2012. *Effective FMEAs*, John Wiley & Sons.
4. Crow, K., 2014. Failure modes and effects. , december.
5. Emmanuel, A., 2014. Maximization of utilization rate of CNC machines. *nternational Journal on Mechanical Engineering and Robotics*, 2(4), pp.38–43.
6. Fundamental, T.H.E. & Fmeas, C.O.F., 2012. Failure Mode and Effects Analysis (FMEA) UNDERSTANDING THE FUNDAMENTAL DEFINITIONS AND.
7. Ishikawa, K., Cause and Effect Analysis using the Ishikawa Fishbone. , 44(0), pp.1–4.
8. Kenol, J.E., Failure mode and effect analysis (fmea) the basics of fmea.
9. Kolkata, R., Sigma, S. & Improvement, P., An Application of Six Sigma Methodology to Reduce lot-to-lot Shade Variation of Linen Fabrics. , 36(3).
10. Krishnan, R. V & Bhaumik, S.K., 2005. *of Engineering Structures Case Histories*,
11. Lecturer, S. et al., 2011. Process for level dyeing of 100% cotton knit fabrics with reactive dye. , 3(August 2009), pp.1–8.
12. Maria, F. et al., Textile Dyes : Dyeing Process and Environmental Impact.
13. Pawadeetanaset, S. & Rukijkanpanich, J., 2015. REDUCTION OF COLOR VARIATION DEFECTS IN. , (April), pp.27–32.
14. Romana, P., 2010. APPLICATION OF FISHBONE DIAGRAM TO DETERMINE THE RISK OF AN EVENT WITH MULTIPLE CAUSES. , 2(1), pp.1–20.
15. S. H. Ding, N. A. Muhamud, N. H. Zulkurnaini, A.N. & Kamaruddin, K. and S., 2012. Application of Integrated FMEA and Fish Bone Analysis – A Case Study in Semiconductor Industry. In *International Conference on Industrial Engineering and Operations Management Istanbul*. pp. 1233–1238.
16. Zamanzadeh, M., Larkin, E. & Gibbon, D., 2004. A Re-Examination of Failure Analysis and Root Cause Determination.
17. Wheeler, D. J. and Chambers, D. S., 1992, *Understanding Statistical Process Control*, SPC Press, Knoxville, TN

18. Gordon, R. 2006. The preparation, dyeing and finishing of cotton knit goods. Nearchimica S.p.A. textile auxiliaries. P-22
19. Teal, S, R.T.Ervin and R.D. Mehta, 2002. Economic analysis of cotton textile finishing processes, Part 2-
After treatments, Texas Tech University, Lubbock, Texas, USA pp-15-20.
20. C. J. Laio and C. C. Ho, "Risk management for outsourcing biomedical waste disposal-Using the failure mode and effects analysis," Waste management, vol.34, pp.1324-1329, 2014
21. A. Scipioni, G. Saccarola, A. Centazzo and F. Arena, "FMEA methodology design, implementation and integration with HACCP system in a food company," Food Control, vol. 13, pp. 495-501, December. 2002.
22. P. Kaewsom and N. Rojanarowan, "The application of FMEA to reduce defective rate from broken filament defects in the Direct Spin Drawing process," IOSR Journal of Engineering, vol. 04, no. 05, pp. 55-58, May 2014
23. N. Somsuk and P. Pongpanich,"The Application of FMEA in Defect Reduction for the Spindle Motor Assembly Process for Hard Disk Drives," in Proceeding 2008 IEEE International Conference on Management of Innovation & Technology, Bangkok, 2008, pp. 704-709.
24. Hoerl, R. (2004). One Perspective on the Future of Six Sigma, International Journal of Six Sigma and Competitive Advantage, 1(1): 112–119.
25. Tyrone, L. (1994). Textile Processing and Properties, Elsevier, Amsterdam, London
26. AmitSaha, AnupSaha, PallabSutradhar, Tanvir Ahmed, MD.FazleRabbi Vol. 3, Issue. 4, Jul - Aug. 2013 pp-2434-2441. Comparative study on Garments dyeing process and Fabric dyeing process on various parameters
27. Teal, S, R.T.Ervin and R.D. Mehta, 2002. Economic analysis of cotton textile finishing processes, Part 2 After treatments, Texas Tech University, Lubbock, Texas, USA pp-15-20