DETERMINING THE MOST FREQUENT DEFECTS FOR CIRCULAR WEFT KNITTING FABRIC MACHINES: A CASE STUDY

A.K.M.M. HOSSAIN, C.J. MOIN, A.K.M. MAHABUBUZZAMAN

DETERMINING THE MOST FREQUENT DEFECTS FOR CIRCULAR WEFT KNITTING FABRIC MACHINES: A CASE STUDY

A.K.M.M. HOSSAIN[1], C.J. MOIN[1], A.K.M. MAHABUBUZZAMAN[2]

[1]Department of Textile Technology, Ahsanullah University of Science and Technology, Dhaka, Bangladesh; [2]Bangladesh Jute Research Institute.

Corresponding author & address: A.K.M. Mobarok Hossain, E-mail: mobarok_textech@yahoo.com

ABSTRACT

Hossain AKMM, Moin CJ, Mahabubuzzaman AKM (2011) Determining the most frequent defects for circular weft knitting fabric machines: A case study. *J. Innov. Dev. Strategy* 5(2), 10-17.

For a garment item, quality of the fabric is a vital requirement. If the fabric contains objectionable number of defects, there is a high possibility of fabric rejection. Buyers may also refuse to accept garments due to poor fabric quality. So maintaining proper quality of knitted fabric is an urgent need for knitwear manufacturers. Greige fabric containing defects of unacceptable range is an indication of poor knitting operation and management. In this work grey weft-knitted fabric defects and their frequencies of occurrence were observed for cotton single jersey fabrics produced in some renowned knitting factories of Bangladesh at different time intervals. It was found that among various defects contamination, Slub and Hole are the most occurring type having the maximum presence in the knitted fabric. The work thus throws light on the key concerns for improvement in the fabric quality of a knitting floor.

Key words: knitted fabric defect, contamination, hole, slub, relative frequency, 4-point system etc

INTRODUCTION

Since customers have become more conscious about quality, demand for high quality knitted fabrics has increased significantly. In order to avoid fabric rejection, knitting mills have to produce fabrics of good quality constantly. There are various types of defects which occur in the weft-knitted fabrics of all types. The sources of faults could be yarns, knitting elements, knitting machine setting or improper fabric finishing. Defects detection in the grey fabric state is very much crucial as it gives the scope of rectifying the faults at the early state of manufacturing. The imperfections observed in the grey fabric are generally the result of faulty yarn or knitting machine malfunction. Generally knit-defects are assessed by type, gravity and the frequency of occurrence in the fabric. Manual inspection by general fabric inspection machines is still widely practiced to classify faults after knitting and after finishing. Standard fabric inspection system like 4-point system is usually followed for decision making regarding the quality. The purpose of this work was to analyze defects observed in grey knitted fabrics in terms of their frequencies of presence irrespective of type or magnitude. Thus the work is oriented with fact finding rather than quality judgment.

COMMON WEFT-KNITTED FABRIC DEFECTS

A defect is a fault that would reduce the expected performance of the knitted fabric or, if it appears in a prominent position in an article made from the fabric, would readily be seen and rejected by a prospective purchaser. There are various types of defects, which occur in the knitted fabrics of all types, caused by a variety of reasons. The same type of defects may occur in the fabric, due to a variety of different causes.

The sources of faults could be-(Lyer/Mammel/Schach, 1995).

- Faults in yarn & yarn package
- Yarn feeding & yarn feed regulator
- Machine setting & pattern defects
- Machine maintenance
- Climatic and housekeeping conditions in the knitting plant

Table 1 gives a brief description of some very common weft-knitted fabric defects and figure 1 shows some images of these defects.

10

J. Innov. Dev. Strategy 5(2): August 2011

Table 1. Defects in weft-knitted fabrics, their definitions and causes

Defect Types	Definition	Causes
Hole	Self-descriptive. Result of cracks or yarn breakage.	Weak yarn, Bad needle, High tension on yarn, Badly tied knots, Yarn with slub etc. (Anbumani 2007).
Barre Effect	Visual banding of weft-knitted fabric. Usually such bars are horizontally disposed (Brackenbury 1992).	Uneven Courses traverse horizontally and repeat regularly or irregularly. Caused by a number of factors like- Uneven yarn tension, Lack of uniformity in yarn size, color or luster, Improper stitch cam setting etc. (Anbumani 2007).
Slub	A defect consisting of a short lump or thick place on the fabric in course-direction.	Caused by a thick or heavy place in yarn. Also may be caused by lint or small length of yarn adhering to the base yarn of knitting (Anbumani 2007).
Contamination	Self-descriptive. Appears in the form of foreign matter.	i) By using contaminated yarn (yarn containing dead fibres and other foreign materials, such as- dyed fibres, husk, synthetic fibres etc.) ii) Dyed and other types of fibres flying from the adjacent knitting machines cling to the yarn being used for knitting and get embedded in the grey fabric (Lyer/Mammel/Schach, 1995).
Horizontal line	Continuous Horizontal defect. Generally visible in line form instead of band form.	Uneven yarn, Uneven yarn tension, Uneven stitch length, Mixed yarns etc. (Ajgaonkar 1998).
Vertical Line	Continuous vertical defect. Longitudinal gaps in fabric-irregular space between adjacent wales-broken appearance in fabric.	Defective needle, Wrong needle, Dirt in trick slots, Sinker rides high because of dirt etc. (Reichman 1974).
Oil Stain	Self-descriptive. Usually shows as dirty area in the fabric with or without build up of soiled material.	Oil dripping from the machine due to over lubrication or faulty lubrication system (Brackenbury 1992).
Tuck or Double Stitches	Unintentional tuck loops or floats, also showing up as thick places or small beads in the fabric.	Take down mechanism too loose, Improper stitch cam setting, Needle moves too freely in its slot etc. (Reichman 1974).
Visible Knot	Self-descriptive. Usually shows as lump and tail of yarn in the fabric.	Operator's unskillness in tying two ends of yarn together, Wrong type of knot.
Cloth Press-off/ Pressed-off Stitches	A condition where the fabric either falls off the machine or the design is completely disrupted or destroyed. The yarn is not stitched by several needles lying adjacent to one another.	This defect results from broken yarn coming away from the knitting needles during knitting (Au 2011). The main causes of pressed-off stitches are-Faulty stop motion, Plugged yarn guide with lint, Machine running too fast etc. (Ajgaonkar 1998).
Dropped Stitches	Vertical defect appears as missing stitches.	Improper setting of the yarn feeder, Insufficient yarn tension etc. (Au 2011).

Vertical (Needle) Line

Horizontal line

Contamination

Oil Stain

Hole

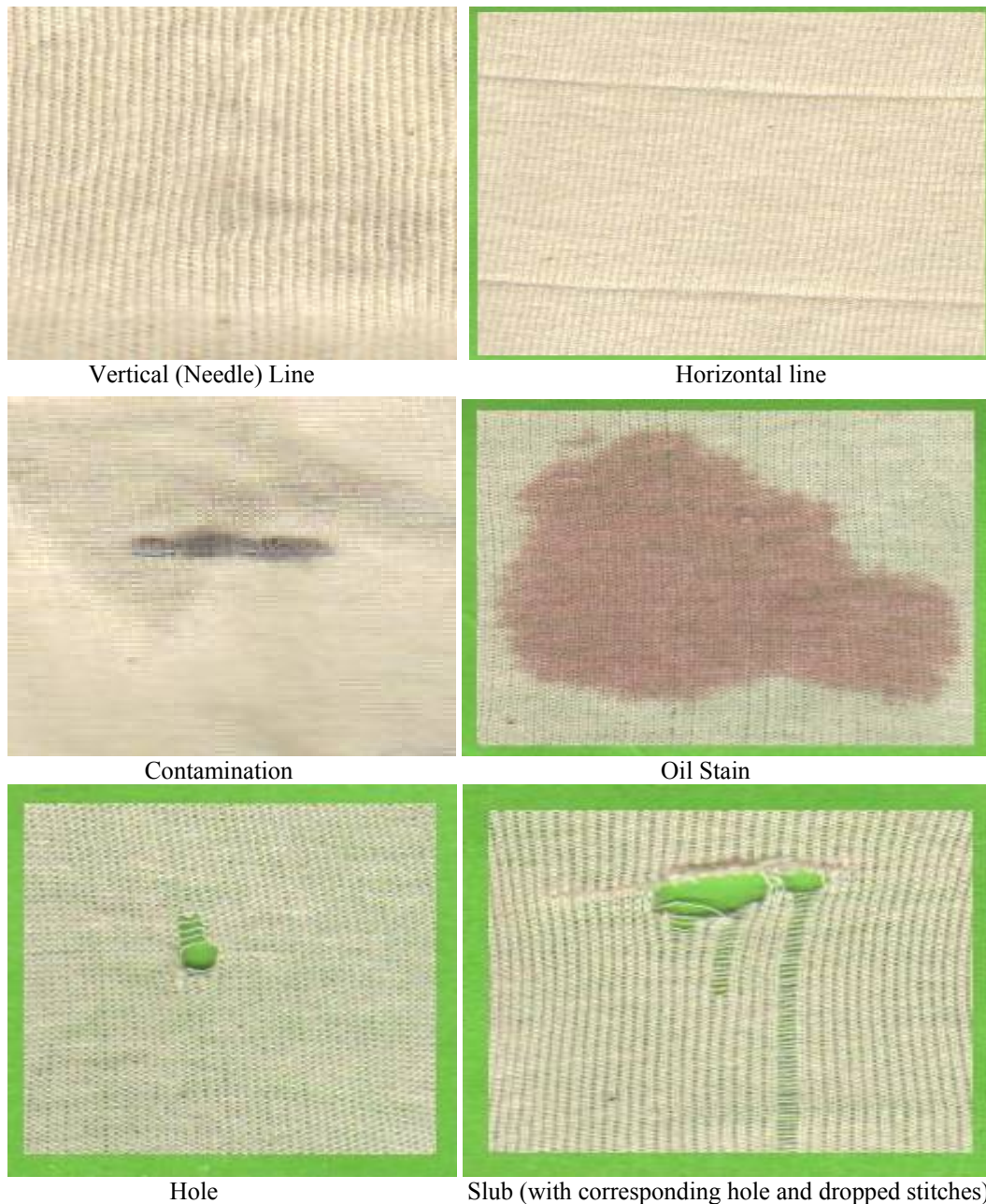Slub (with corresponding hole and dropped stitches)

Figure 1. Various types of defects in weft-knitted grey fabric

EXPERIMENTAL PROCEDURE

To carry out the study some export-oriented renowned knitting factories of Bangladesh maintaining 100% grey fabric inspection were taken as the sample. For selecting these factories it was also considered that they follow similar rule for counting defects. The factories are Shwan Knit Composite Limted, Beximco Knitting Limited, Northern Corporation Limited, AKH Knitting & Dyeing Limited a Padma Polycotton Knit Fabrics Limited and Apex Spinning and Knitting Mills Limited. The following steps were followed sequentially.

1. For each factory fabric inspection records of some knitting machine were collected for different time periods. The machines were running in normal operational environment producing Cotton Single Jersey fabrics.

2. Defect data collected from the inspection records were accumulated according to type and shown graphically to present their comparative positions in the observed production quantity.

3. Statistical analysis was carried out to find out the frequencies of these defects and thus the most occurring faults were identified for the knitting floors of Bangladesh.

4. Based on the above results the major areas were pointed out for improvement to reduce the defect rate in the produced fabric of a knitting machine.

DATA COLLECTION

Factory No. 1. Shwan Knit Composite Limted (Chourasta, Gazipur)
Observation Period: 20-22 January, 2010

Table 2 shows the summarized data obtained through grey fabric inspection

Table 2. Grey Knit-fabric defects identified at Shawn Knit Composite Limited

Knit Machine Type	Fabric Type	Fabric Quantity inspected	Defects found	No. of each defect type	Total no. of defects
Circular Single knit machine (Factory machine no.06)	Cotton Single Jersey	118 Kg	Hole	06	11
			Horizontal Line	02	
			Contamination	01	
			Vertical Line	01	
			Slub	01	

Factory No. 2. Beximco Knitting Limted (Kashimpur, Gazipur)
Observation Period: 11-13 February, 2010

Table 3 shows the summarized data obtained through grey fabric inspection

Table 3. Grey Knit-fabric defects identified at Beximco Knitting Limited

Knit Machine Type	Fabric Type	Fabric Quantity inspected	Defects found	No. of each defect type	Total no. of defects
Circular Single knit machine (Factory machine no. 3,5 & 20)	Cotton Single Jersey	2765.32 Kg	Contamination	354	753
			Hole	242	
			Slub	152	
			Vertical Line	05	

Factory No. 3. Northern Corporation Limited (Tongi, Gazipur)
Observation Period: 10-12 March, 2010

Table 4 shows the summarized data obtained through grey fabric inspection

Table 4. Grey knit-fabric defects identified at Northern Corporation Limited

Knit Machine Type	Fabric Type	Fabric Quantity inspected	Defects found	No. of each defect type	Total no. of defects
Circular Single knit machine (Factory machine no.11 & 14)	Cotton Single Jersey	530 Kg	Contamination	107	192
			Hole	44	
			Visible Knot	16	
			Pressed-off Stitches	15	
			Slub	04	
			Vertical Line	04	
			Oil Stain	02	

Factory No. 4. AKH Knitting & Dyeing Limited (Savar, Gazipur)
Observation Period: 19-21 March, 2010

Table 5 shows the summarized data obtained through grey fabric inspection.

Table 5. Grey knit-fabric defects identified at AKH Knitting & Dyeing Limited

Knit Machine Type	Fabric Type	Fabric Quantity inspected	Defects found	No. of each defect type	Total no. of defects
Circular Single knit machine (Factory machine no. 16, 19 & 20)	Cotton Single Jersey	1318.06 Kg	Hole	76	227
			Slub	61	
			Contamination	45	
			Oil Stain	31	
			Vertical Line	07	
			Visible Knot	03	
			Pressed-off Stitches	02	
			Barre Effect	02	

Factory No. 5. Padma Polycotton Knit Fabrics Limited (Tejgaon, Dhaka)
Observation Period: 22-24 March, 2010

Table 6 shows the summarized data obtained through grey fabric inspection.

Table 6. Grey knit-fabric defects identified Padma Polycotton Knit Fabrics Limited

Knit Machine Type	Fabric Type	Fabric Quantity inspected	Defects found	No. of each defect type	Total no. of defects
Circular Single knit machine (Factory machine no. 1, 2 & 5))	Cotton Single Jersey	1250 Kg	Contamination	225	531
			Slub	214	
			Hole	43	
			Oil Stain	30	
			Pressed-off Stitches	19	

Factory No. 6. Apex Spinning & Knitting Mills Limited (Chandora, Kaliakair, Gazipur)
Observation Period: 05-07 July, 2011

Table 7 shows the summarized data obtained through grey fabric inspection.

Table 7. Grey knit-fabric defects identified Apex Spinning & Knitting Mills Limited

Knit Machine Type	Fabric Type	Fabric Quantity inspected	Defects found	No. of each defect type	Total no. of defects
Circular Single knit machine (Factory machine no. 55)	Cotton Single Jersey	307.5 Kg	Slub	64	185
			Contamination	34	
			Tuck Stitch	25	
			Hole	23	
			Oil Stain	17	
			Horizontal Line	11	
			Barre Effect	05	
			Vertial Line	04	
			Pressed–off Stitches	02	

DATA ANALYSIS WITH GRAPHICAL REPRESENTATION

(I) Figure 2 represents the position of presence of different defects over the research sample of six factories.
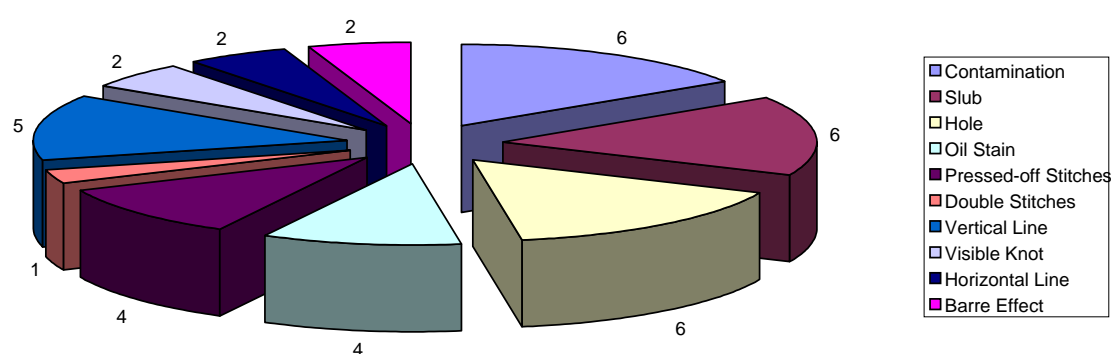

Figure 2. Total no. of factories showing different types of defects for the inspected production quantity

(II) Table 8 shows an average measure of detected defects that may be considered for the inspected fabric quantity and Figure 3 shows the respective graphical representation.

Table 8. No. of different defects calculated for 100 kg of inspected fabrics

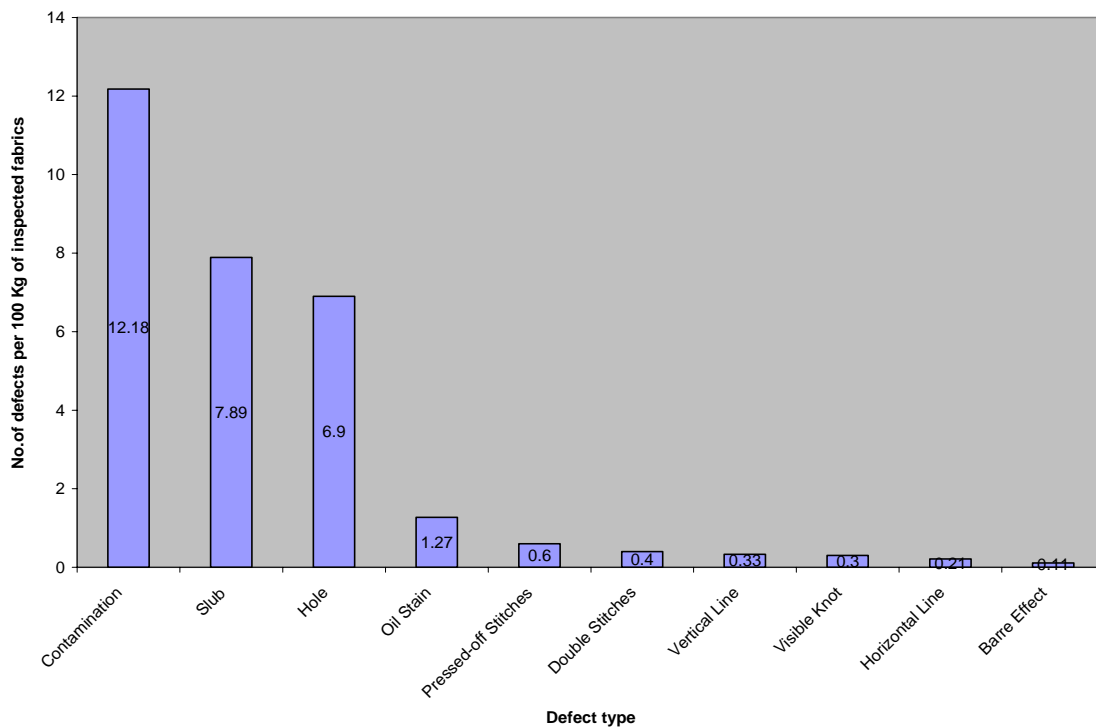| Total Inspected quantity	Defect Type	Total no. of defects For each type	Defects Per 100kg of inspected fabric
6288.88 Kg	Contamination	766	12.18
	Slub	496	7.89
	Hole	434	6.90
	Oil Stain	80	1.27
	Pressed-off Stitches	38	0.60
	Double Stitches	25	0.40
	Vertical Line	21	0.33
	Visible Knot	19	0.30
	Horizontal Line	13	0.21
	Barre Effect	07	0.11

Figure 3. Graphical representation of different defects based on 100 Kg of inspected fabric

(III) Table 9 shows the frequency distributions with relative frequencies for each defect type over the entire inspected fabric quantity and Figure 4 shows the respective graphical representation

Table 9. Frequency table for different defects observed during inspection

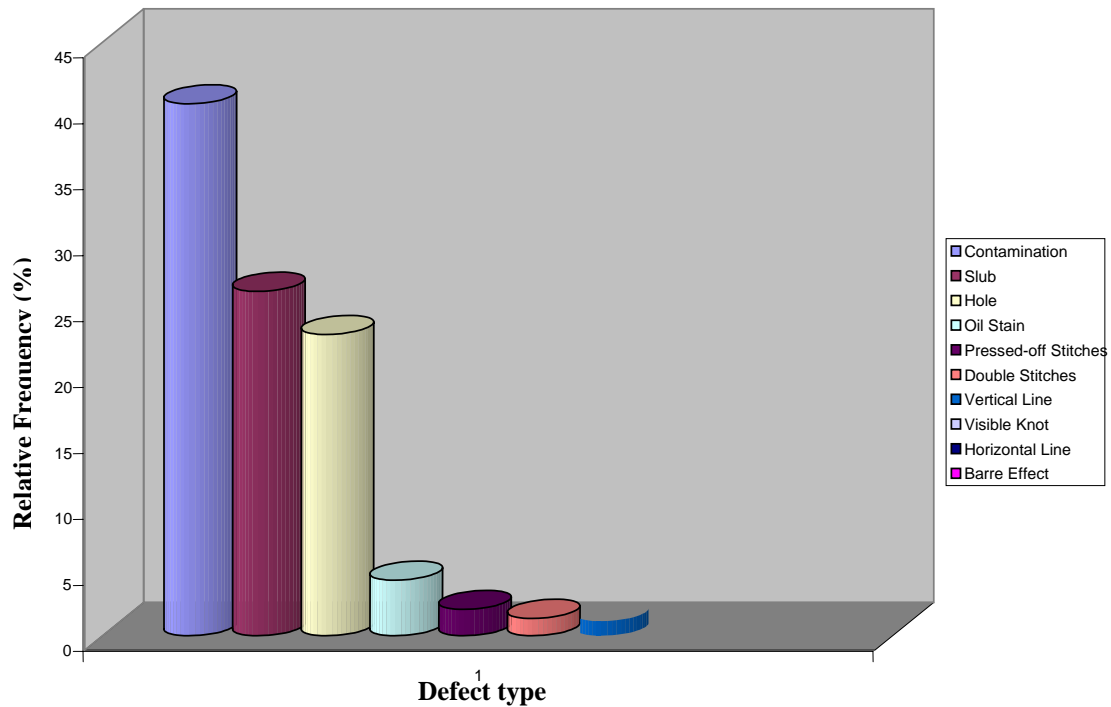| Defect Type	No. of defects found/ Frequency of each defect type	Relative frequency (%) of each defect type
Contamination	766	40.34
Slub	496	26.12
Hole	434	22.85
Oil Stain	80	4.21
Pressed-off Stitches	38	2.0
Double Stitches	25	1.32
Vertical Line	21	1.11
Visible Knot	19	1.0
Horizontal Line	13	0.68
Barre Effect	07	0.37

Total=1899

Figure 4. Graphical representation of relative frequencies calculated for each defect type over the total inspected fabric quantity

RESULTS AND DISCUSSIONS

► During this study various types of knitted fabric defects were detected through the inspection like Vertical Line, Contamination, Hole, Slub etc. Among these Contamination, Slub and Hole were common to all of the observed factories. Vertical Line, Oil Stain and Pressed-off Stitches were also found in around two-third of these factories. So based on the sample result one may identify the mentioned six (06) types of defects as the very common ones for the knitting factories of Bangladesh [*Data Analysis (I)*]

► From the observation it was discovered that Contamination, Slub and Hole appear as maximum number with higher probabilities of occurrence in the knitting floors of the manufacturing plants. It was also found by the study that Contamination had the maximum relative frequency(r.f.) of 40.34 followed by Slub (r.f. 26.12) and Oil Stain (r.f. 22.85). Other problems like Oil Stain, Pressed-off Stitches, Barre Effect etc. were found in comparatively less numbers than Contamination, Slub or Hole [*Data Analysis (II)&(III)*].

► The obtained results throw light on some significant areas that should be considered deeply by the management for quality improvement. As Contaminations has been identified as the most occurring type, the highest priority should be given to minimize this defect. Knitting machines running with different fibres or colors must be segregated with plastic curtains or fine nets to prevent fly contamination. Yarn contamination may be avoided by sourcing good quality yarn of rich fibre mixing and reliable processing sequence. The second most occurring fault Slub may be controlled greatly by preventing accumulated lints (fibre-dust) falling into knitting zones and knitted into the fabric. For this, good housekeeping during the knitting process is very much essential. Holes occur due to various reasons like weak places in yarn, excessive yarn tension, badly tied knots etc. So to reduce the frequency of Hole, a number of measures may be taken simultaneously like using yarns of good strength and evenness, running machines with correct setting and condition and deploying skilled operators.

CONCLUSION

Control of the quality of the fabric being knitted is a major responsibility of the knitter. To do this he must know definitely which defects are prominent in his floor and what causes are responsible for these defects. When the cause is known, correction will soon follow. The present work is such an effort based on some knitting factories of Bangladesh. It was interesting to note that those defects were identified as the most frequent ones which are deeply involved with poor housekeeping and faulty yarns. However this finding may vary for factories running

in different production environment and situation. The current work thus acts as a guideline to investigate for the most frequent defects and think about the immediate cure.

ACKNOWLEDGMENTS

REFERENCES

Ajgaonkar DB (1998) Knitting Technology, 1st Edition, Universal Publishing Corporation, India, pp.209.

Anbumani N (2007) Knitting: Fundamentals, Machines, Structures and Developments, 1st Edition, New Age International (Pvt.) Limited, India, pp.99-100.

Au KF (2011) Advances in Knitting Technology, 1st Edition, Woodhead Publishing Limited, U.K., pp.229.

Brackenbury T (1992) Knitted Clothing Technology, 1st Edition, Blackwell Science Limited U.K., pp.167, 176.

Lyer/Mammel/Schach (1995) Circular Knitting: technology, process, structures, yarns, quality, 2nd Edition, Meisenbach Bamberg, Germany, pp.231, 248.

Reichman C (1974) Knitted Fabric Technology, 1st Edition, National Knitted Outerwear Association, U.S.A., pp.104-105.