Variation in Speed of Industrial Sewing Machines and its Effect on Production

A N M Ahmed Ullah*, A. B. M. Foisal, Md. Nazmul Haque, Abdullah-Al-Numan and Md. Ridwan Ahamed

Department of Textile Engineering
Southeast University, 251/A and 252 Tejgaon Industrial Area, Dhaka 1208, Bangladesh

Abstract
This work was carried out at Alim Knit Bangladesh Ltd. a concern of Mondol group, Gazipur with a view to find out the effectiveness on production at various speed of sewing machines. In this work it was observed that the sewing of side seam, sleeve joint, bottom hemming of T shirt and the collar joint of polo shirt performed by overlock, flat lock and plain sewing machine respectively. The rate of production with the increased rate of running speed of machines has been evaluated. It is shown that though the production rate increased, some sewing faults have been noticed which is acceptable in range.

Keywords: *T-shirt, Polo-shirt, side seam, sleeve joint, Bottom Hemming, Collar joint.*

I. Introduction

Sewing machines are invented during the first Industrial Revolution to decrease the amount of manual sewing work performed in clothing companies. Since the invention, the efficiency and productivity of the clothing industry has been greatly improved. Now various types of sewing machines are used for sewing depending on different stitches. Most of them are automatic and run by motor. The speed is an important issue for sewing. All machines are not same, all operators are not equal experienced in production, quality expectation, stitch type, etc.

When stitch is formed, three things come into factor such as needle thread, fabric types and bobbin thread or looper thread (Webster *et al.*, 1998). Seam strength completely depends on quality of fabric and sewing machine. Sewing thread needs to choose according to the properties of fabric (Chowdhary *et al.*, 2006). Since seam strength is dependent on the thread strength, a reduction in thread strength during sewing will lead to lower seam strength. Therefore, in order to minimize the thread strength reduction, it is important to understand the contribution of different machine elements or processes during sewing (Midha *et al.*, 2009).

During high speed sewing, the needle thread is subjected to stresses that adversely influence both its sewing and seam performance (Sundaresan *et al.*, 1998). Needle thread also plays a vital role during seam forming (Rengasamy *et al.*, 2014). Improper tightening tension of the needle thread creates various problems in sewing with an industrial sewing machine. If the tightening tension is too large, the stitch becomes too tight to often result in seam puckering and thread breakage. If the tension is too low the stitch becomes loose. Therefore, it is very important to maintain the correct tightening tension (Kamata *et al.*, 1982).

However, our work was to sew the side seam, sleeve joint, bottom hemming of T-shirt and collar joint of polo shirt by sewing machines such as overlock, plain and flat lock machine at different speed. In this work, various faults or defects such as staggered stitch, seam puckering, width irregular, raw edge, open seams, thread breakages, skip stitches, bad shape, gathering in edge etc. are found due to the increase of running speed of machines which were within our limit.

II. Methodology

At the sewing floor the Industrial Engineer introduced us with four operators and a mechanic. The mechanic increases and decreases the machine rpm (revolution per minute) and the operators run the sewing machines accordingly. At first, we collected required time data from over lock machine running with 3 different rpm for 3 bundles of T-shirt's components.

Each bundle had 25 pieces. After that we collected the bundles which were stitched by different speed of sewing machines and went to a quality inspector for inspection. Then we collected data faults. By using same process we collected required time and faults data for flat lock and plain machine. After that we calculated avg. required time and per hour production. We also calculated faults percentages. After found avg. time, per hour production and faults % we prepared our results and discussions are made.

III. M/C Specifications

The table 1 shows the specifications of sewing machines which were involved in the work.

Table 1: The specifications of sewing machines which were used in this work

Specifications	Flat Lock machine	Plain machine	Over Lock machine	Over Lock machine
Model	NL-800-3	DDL-9000C-FSH	MO-6814D	MO-6814D
Machine speed (RPM)	4050-5050	3000-4000	4050-5050	4550-6050
Stitch per Inch (SPI)	12	12	12	12
Stitch length	108 cm	43 cm	108 cm	114 cm
Operations	T-shirt Bottom Hemming	Polo-shirt Collar joint	T-shirt sleeve joint	T-shirt side seam
Observation no.	1, 2, 3	4, 5, 6	7, 8, 9	10, 11, 12

Table 2: The average time, production per hour in pcs and faults found in this work

Machine Name and operations	Obs. No.	Machine Speed (rpm)	Avg. Time (seconds)	Per hour Production (pcs)	Faults
T-shirt bottom hemming by Flat lock m/c	1	4050	17.05	211	0%
	2	4550	16.22	221	8%
	3	5050	15.41	233	12%
Polo shirt collar joint by Plain m/c	4	3000	48.38	74	0%
	5	3500	46.19	77	8%
	6	4000	44.30	81	12%
T-shirt sleeve joint by over lock m/c	7	4050	24.05	149	4%
	8	4550	23.23	154	4%
	9	5050	21.21	169	8%
T-shirt side seam by over lock m/c	10	4550	36.77	97	0%
	11	5050	34.99	102	4%
	12	6050	32.21	111	12%

Table 3: The variation in machine speed and faults found in this work

Machine Name and operations	Obs. No.	Machine Speed (rpm)	Fault types	Faults
T-shirt bottom hemming by Flat lock m/c	1	4050	Staggered stitch, seam puckering, Skip stitch, and raw edge.	0%
	2	4550		8%
	3	5050		12%
Polo shirt collar joint by Plain m/c	4	3000	Bad shape, width irregular, open seam, gathering in edge.	0%
	5	3500		8%
	6	4000		12%
T-shirt sleeve joint by over lock m/c	7	4050	Raw edge, width irregular, top side loose, over stitch, uneven stitch.	4%
	8	4550		4%
	9	5050		8%
T-shirt side seam by over lock m/c	10	4550	Allowance uneven, thread breakage, uneven stitch, seam puckering.	0%
	11	5050		4%
	12	6050		12%

IV. Results and Discussions

The table 2 shows the average time required for production as well as production per hour in pcs and fault in percentages found in this work. The table 3 shows the variation in machine speed as well as faults found during production and faults in percentages in this work.

Production/hour (Pcs) and Average time

The figure 1 shows that the production rate pieces (pcs) per hour have been increased with the increased rpm of machines. In case of observation no. 1, 2 and 3 which indicate the sewing of bottom hemming of T-shirt by Flat lock machine. It was found that at 4050, 4550 and 5050 rpm the average time required for sewn were 17.05, 16.22 and 15.41 seconds and the production per hour in pcs were 211, 221 and 233 respectively.

In case of observation no. 4, 5 and 6 which indicate the sewing of collar joint of polo shirt by plain machine. It was found that at 3000, 3500 and 4000 rpm the average time required for sewn were 48.38, 46.19 and 44.30 seconds and the production per hour in pcs were 74, 77 and 81 respectively.

Similarly, in case of observation no. 7, 8 and 9 which indicate the sewing of sleeve joint of T-shirt by overlock machine. It was found that at 4050, 4550 and 5050 rpm the average time required for sewn were 24.05, 23.23 and 21.21seconds and the productions per hour in pcs were149, 154 and 169 respectively.

Likewise, the observation no. 10, 11 and 12 which indicate the sewing of side seam of T-shirt by overlock machine also. It was found that at 4550, 5050 and 6050 rpm the average time required for sewn were 36.77, 34.99 and 32.21seconds and the productions per hour in pcs were 97, 102 and 111 respectively.

In all the cases, it was obviously found that with the increased rpm of machines the average time required for production was decreased and the production rate in pcs were increased.

Production/hour (Pcs) and Fault%

The figure 2 shows that the production rate pieces (pcs) per hour and faults percentages have been increased with the increased rpm of machines. In case of observation no. 1, 2 and 3 which indicate the sewing of bottom hemming of T-shirt by Flat lock machine. It was found that at 4050, 4550 and 5050 rpm the production per hour in pcs were 211, 221 and 233 and the fault rate was 8% and 12% at 4550 and 5050 rpm respectively. The faults were staggered stitch, seam puckering, Skip stitch, and raw edge.

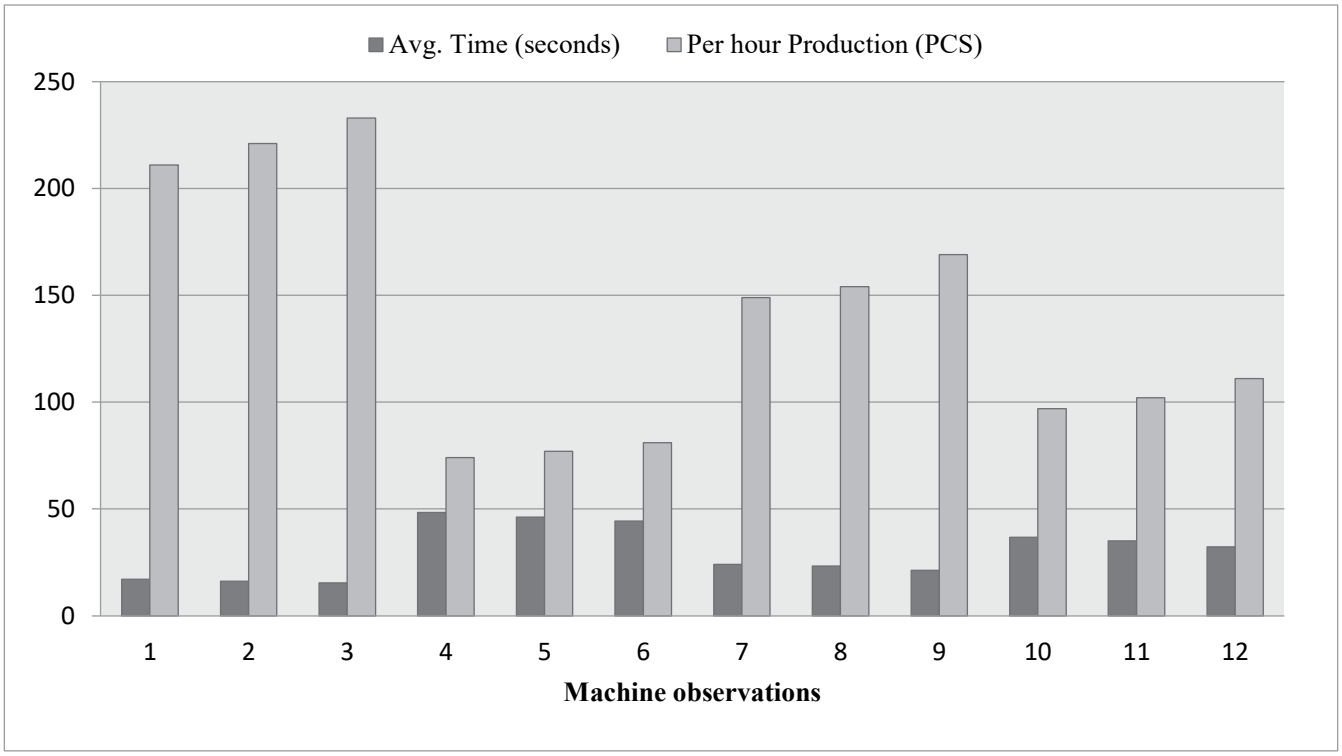

Figure1: The Bar diagram of production per hour in pcs and average time required for one piece production

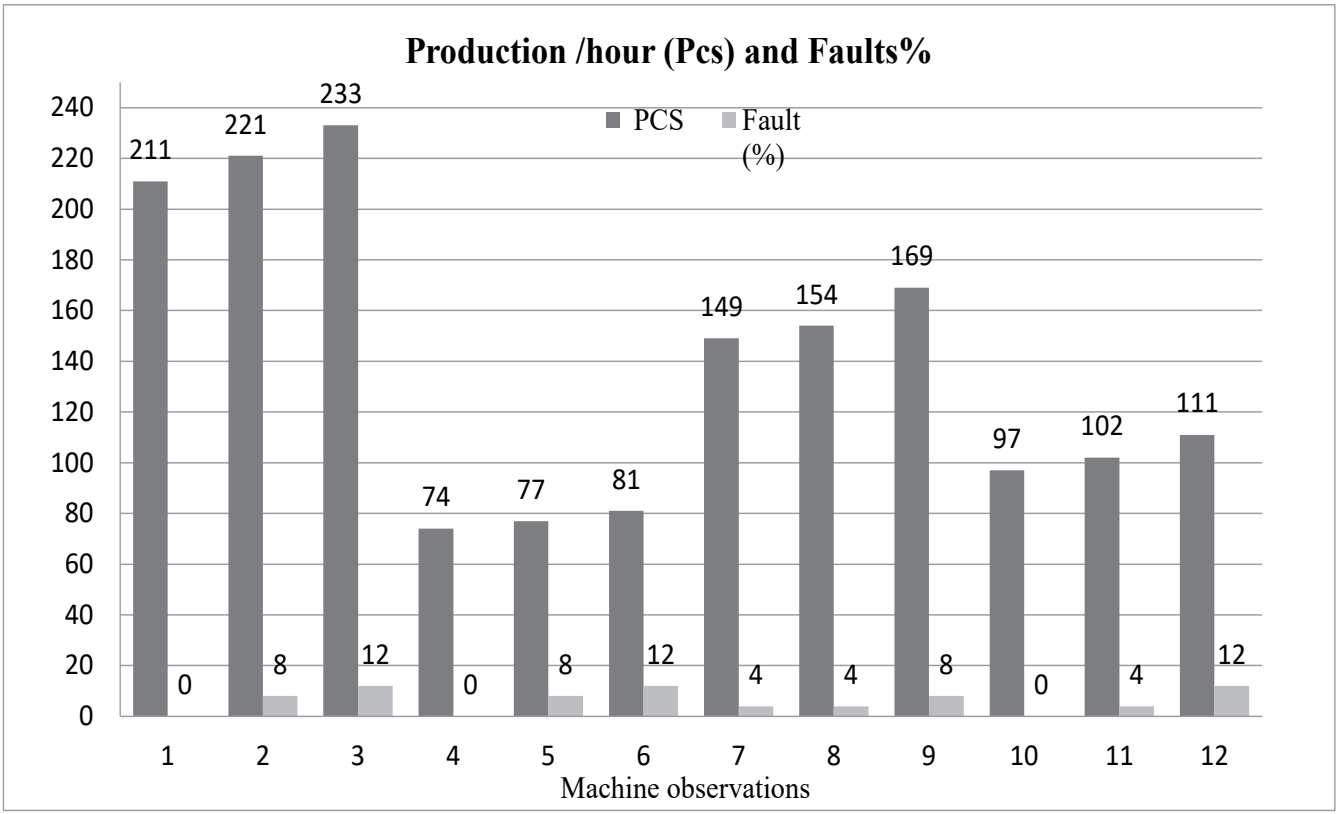

Figure 2: The Bar diagram of production per hour in pcs and faults found in production

There was not any fault found at 4050 rpm of machine. Similarly, In case of observation no. 4, 5 and 6 which indicate the sewing of collar joint of polo shirt by plain machine. It was found that at 3000, 3500 and 4000 rpm the production per hour in pcs were 74, 77, 81 and the faults rate were 8% and 12% at 3500 and 4000 rpm respectively. The faults were Bad shape, width irregular, open seam, gathering in edge. There was not any fault found at 3000 rpm of machine.

Likewise, in case of observation no. 7, 8 and 9 which indicate the sewing of sleeve joint of T-shirt by overlock machine. It was found that at 4050, 4550 and 5050 rpm the productions per hour in pcs were 149, 154, 159 and the faults rate were 4% at 4050 and 4550 rpm and 8% at 5050 rpm. The faults were Raw edge, width irregular, top side loose, over stitch, uneven stitch etc.

In the last 3 observations, i.e. 10, 11 and 12 which indicate the sewing of side seam of T-shirt by overlock machine. It was found that at 4550, 5050 and 6050 rpm the production per hour in pcs were 97, 102, 111 the fault rate was 8% and 12% at 5050 and 6050 rpm respectively. The faults were allowance uneven, thread breakage, uneven stitch, seam puckering. No fault was found at 4550 rpm of machine.

In all the cases it was obviously found that with the increased rpm of machines the production rates were increased but faults were also increased.

V. Conclusion

The findings of this work is revealed that although the production per hour in pcs increases with the increase of machine speed due to the decrease of average time required to sew the specific items of knitwear, there are some faults such as staggered stitch, seam puckering, width irregular, raw edge, open seams, thread breakages, skip stitches, bad shape, gathering in edge etc. are found. The investigation was done not only depending on the machine rpm but also included other factors such as experienced operators, quality expectations, machine type etc. This study investigated the knitwear sewing process in a ready-made clothing manufacturing industry. It helps to find out the optimum speed of sewing machine of certain brands. It can be suggested that, if required the finest quality then machine should be run in best practicable speed. It also can be suggested that, it is not a wise decision to run machine with higher rpm which decreases the product quality and sometimes it may causes an accident.

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