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APPLYING THE VARIANCE-LENGTH CURVES AS A QUALITY CONTROL PARAMETER

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Abstract

The yarn irregularity is usually determined by the determination of eveness, count variation and spectrogram for the determination of periodical faults. These three Quality estimators are not sufficient for characterizing the whole figure of yarn quality. The variance-length curve B(L) or the weight-variance curve W(L), can give a more detailed information concerning the long, medium and short term variation for the whole processing system. A standard curve for B(L) and W(L) were obtained from which the level of spinning processing can be determined. The quality level of count variation for different yarns counts and types are determined. The effect of some spinning parameters on B(L) and W(L) curves were detected. The efficiency of the processing prior to spinning frame were estimated for carded and combed cotton yarns.

Introduction*

The quality of fibres assembly, slivers, rovings or yarns is regularly determined by the irregularity of mass per unit length. Two measures of irregularity are always determined, the over-all coefficient of variation this give a good description of short-term irregularity while it is limited in value for the primary processes, count variation is the second measures and determine one of the long term variation [1,2]. These two figures are not efficient for the description of yarn irregularity [2,3] and tends to misleading when comparing yarns that differ in long or medium term irregularity and are not sufficient when judging on a machine or a process. Three functions which can be used for better representation of yarn irregularity consisting of:

1. The autocorrelation function which represents the dependence of wave length [4,5]. Determined only by the method of cutting and weighing and no special tester is available.
2. The wave length spectrum which deals with periodical defects [6]. Determined by means of spectrogram and comparing the obtained spectrogram with standard results periodical faults are determined.
3. The variance-length curve determine the variation for tested length [7]. The B(L) curve is now determined within a large range of lengths by the tester evenness I,II.
4. The efficiency of the preparatory processes [3,7].

   Unfortunately, no standard B(L) curves exist which can enable the

* The individual results of variance curves are not included due to lack in space and are subjected as appendix to editor.

comparison of the obtained results. Theoretical curves obtained applying the practical ones, and are different for every fibre type and yarn count. [1,3,8,9] proposed a weight variation curve which can give only one curve for all different counts, which can also departs from the experimental results [3,10]. The minimum variance-length curve is fairly straight line on Log-Log scale. The deviation from straight line relation can indicate processing problems further points within the deviations points can pick out the problem [10].

The aim of the work consists of introducing standard B(L) and W(L) curves for both combed and carded cotton yarns, which enable the experimental values of B(L) and W(L) curves to give a statisfactory judgement on spinning system.

Experimental Procedure

1. Twenty combed yarns ranging from 5.95 tex to 16.42 tex were produced by changing four parameters on both roving and spinning machine. Table (1) shows the different experimental conditions, using 15% combed silver of 3.30 ktex from Giza 77 Cotton.
2. The B(L) curve for different combed and carded yarns obtained from the industry were obtained.
3. The B(L) curves were obtained on evenness tester I, 10 tested length were determined ranging from 8 mm to 40 mt. The count coefficient of variation was obtained which is equivalent to 100 mt on the B(L) curve.

Standard Curves

The standard B(L) curves can be obtained by using the Uster standard

Table (1)
Different Experimental Conditions
For The Processed Yarns

Exp. No.	FACTORS				Yarn
	Rove Draft	Spinning Draft	Break Draft Spinning	Twist Factor	Count tex
1	13.5	42.3	1.26	1.05	5.9
2	14	40.4	1.39	0.95	6.5
3	12.5	40.4	1.38	0.95	6.7
4	11	44.1	1.1	1.05	6.8
5	11	42.3	1.44	0.95	7.3
6	10.4	44.1	1.39	1.05	7.5
7	9.8	44.1	1.34	0.85	7.7
8	9.8	42.3	1.1	1.05	7.9
9	13.5	30.3	1	0.85	8.3
10	10.4	38.2	1.44	0.95	8.3
11	9.8	40.4	1.1	0.75	8.4
12	10.4	36.2	1.1	0.85	8.8
13	9.8	36.2	1.38	1.15	9.3
14	8.8	40.4	1.34	0.95	9.4
15	11	30.3	1.1	0.85	9.4
16	13.5	25.2	1.38	1.15	9.9
17	13.5	22.1	1	0.75	11
18	7.5	28.2	1	0.85	15.5
19	7.4	28.2	1.49	0.95	15.8
20	7.2	28.2	1.21	1.05	16.4

[11] of both evenness and the range of standard C.V. counts, taking in mind that the B(L) curves follow a straight line relation on the log-log scale [10]. Variance-length curves for different yarn counts are obtained for both combed and carded cotton yarns and these are shown in Fig. (1) and Fig. (2).

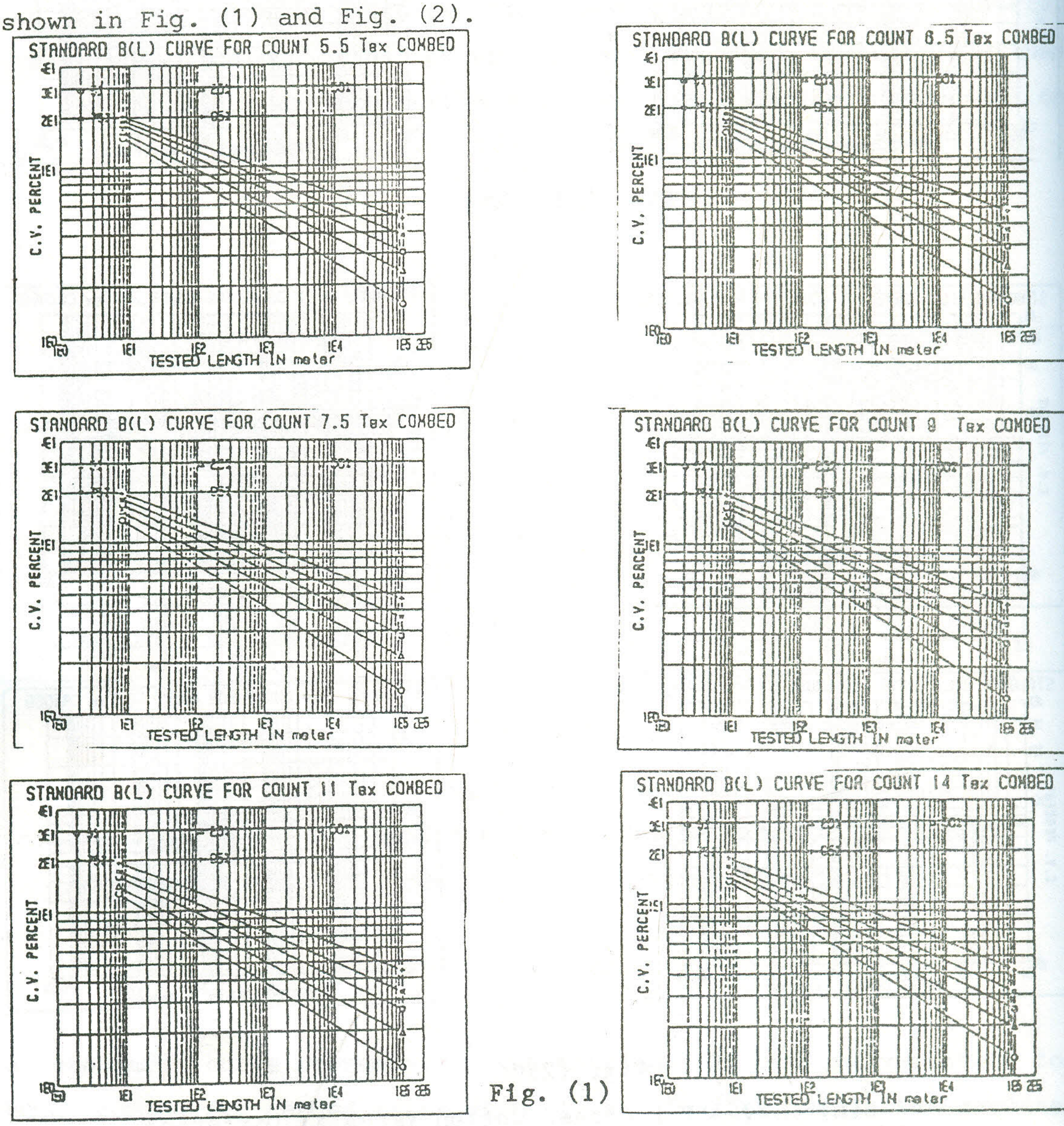


Fig. (1)

Standard B(L) Curves For Combed Cotton Yarns At Different Counts For (5%, 25%, 50%, 75%, and 95%) Quality Levels.

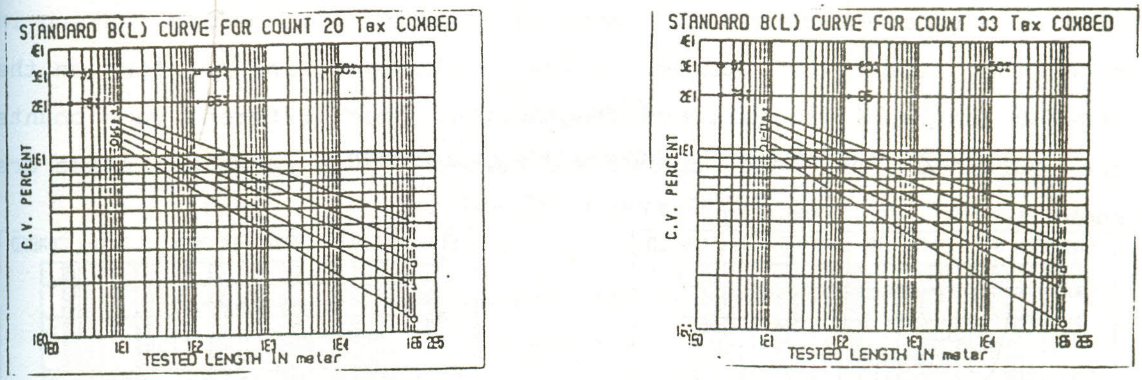


Fig. (1) Cont.

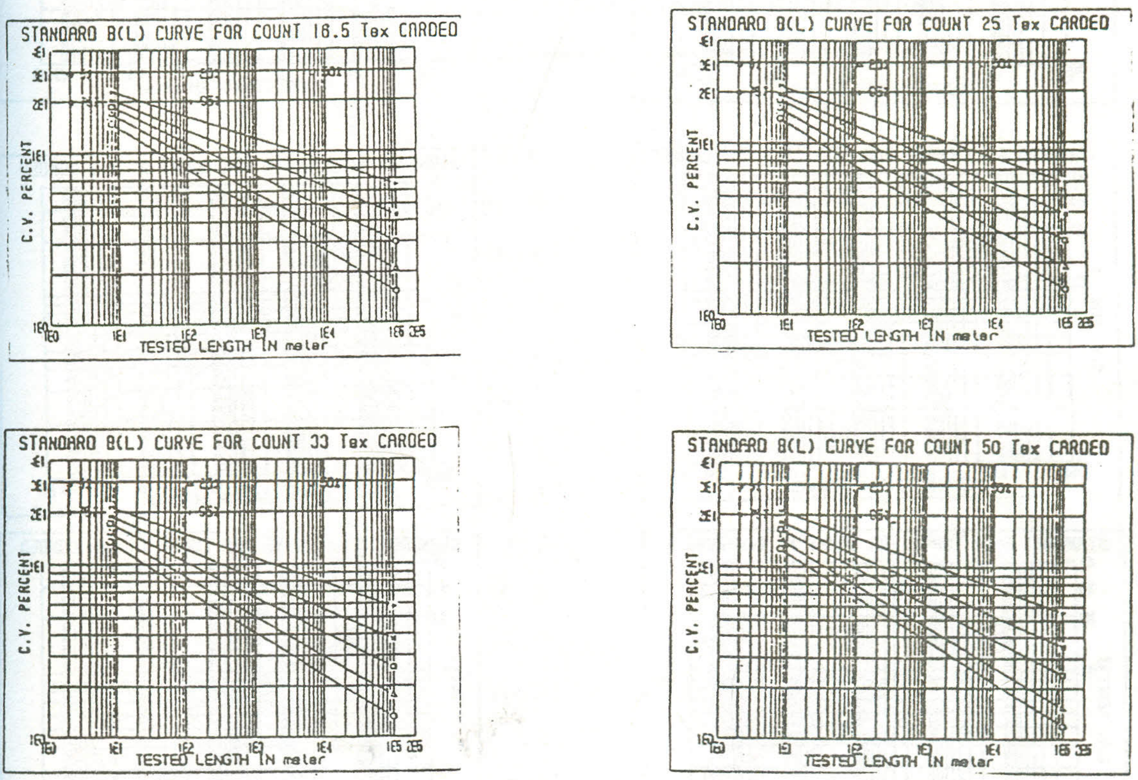
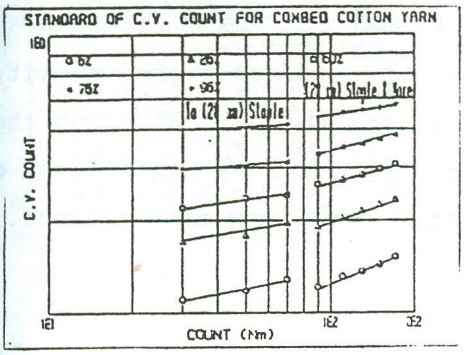


Fig. (2)

Standard B(L) Curves For Carded Cotton Yarns At Different Counts For (5%, 25%, 50%, 75%, and 95%) Quality Levels.



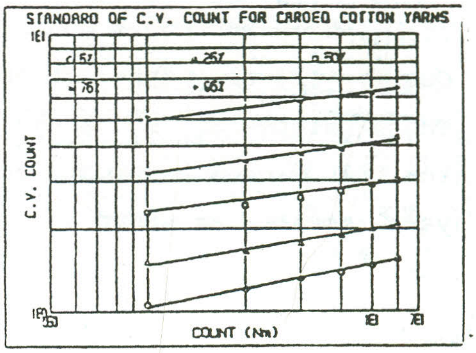


Fig. (4)

Standard C.V. Counts For Carded & Combed Cotton Yarns At Different Quality Levels (5%, 25%, 50%, 75%, and 95%).

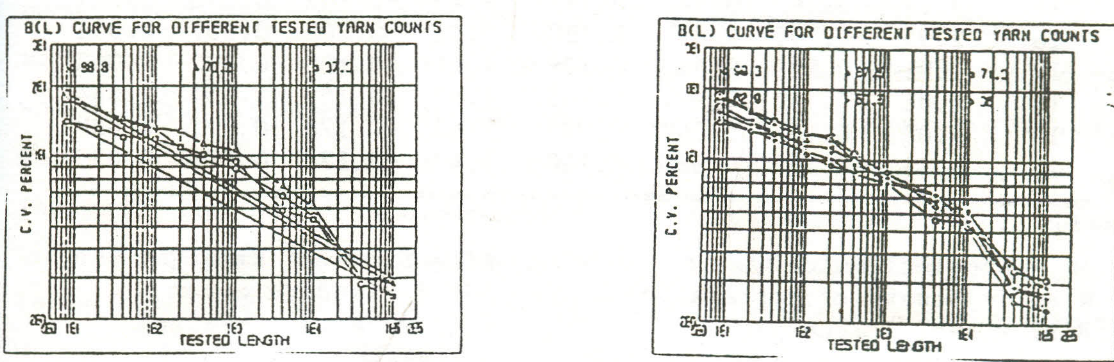
Results and Discussion

Effect of spinning parameter on variance curves. The coefficients of regressions repressting the B(L) and W(L) curves for the yarnsobtained under different spinning conditions are shown in table (2). No significant difference in slope exist between both B(L) & W(L) curves while the difference in the A_o value is due to scale variation, while the SSE value is always lesser in W(L) than in B(L) which indicate the more representation of the results by the W(L) curves. The values of correlation between A_o, A_1 and count are shown in table (3) for both B(L) and W(L) which indicate that the variance curve is purely affected by the processing conditions. While difference between A_o, A_1 within the working spinning conditions is obtained.

Table 3- Correlation Coefficient Between Count, A_o And A_1 For B(L) And W(L) Curves.

Parameter	A_o	A_1
B(L)	- 0.1643	0.2903
W(L)	- 0.2295	0.3809

The B(L) curves for six yarns are shown in Fig. (5-a) for counts varing from (5-16 tex), it is clearly shown that the most of the variation is introduced at the finishing drawing while roving and spinning frames introduce a lesser variability, the B(L) curves for other three counts ranging from (6.5 - 16 tex) are shown in Fig. (5-b), it is surprising to detect that the experimental B(L) for count 8.5 tex is worth than that of 6.5 tex in the roving region which indicate that the best working conditions for this count is not attained at the roving frame. The straight lines connecting yarn evennes and count variations are nearly parallel for all counts.



(a) (b)

Fig. (5)

B(L) Curves Of Some Experimental Combed Cotton Yarns.

The W(L) curves for the best three yarns are shown in Fig. (6) which shows that the straight lines connecting the yarn evenness and count variations for three counts are the same.

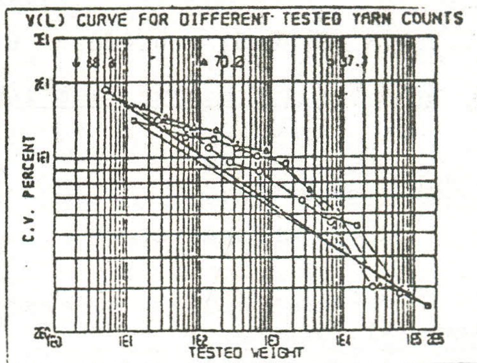


Fig. (6)

W(L) Curve Of Three Experimental

Combed Cotton Yarns

While the curve for the 6.5 tex shows a better relation than the two other coarser counts. These two counts don't indicate a significant defference between them. This tends another time to the fact that these yarns are not set to be the best operating conditions. The multiple regression relation between the experimental conditions and both A_o and A_1 show-significant relation for the B(L) while for the W(L) the values are shown in table (4).

From that, A_o, A_1 are essentially affected by the twist factor in rove and the spinning draft. For attaining a higher quality we have to attain a minimum value of X_1 and a maximum value of X_1X_2.

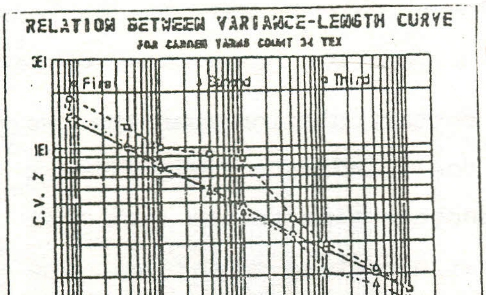
Table 4- Regression coefficients between spinning parameters and A_o, A_1 for the W(L) curve

Parameter	Equation	R	SE	F_{cal}	sig
A_o	$y=1.28 + 0.213X_1^2$	0.62	0.062	11.24	3.5%
A_1	$y=-0.114 - 0.0025X_1X_2$	-0.51	0.036	6.2	2.3%

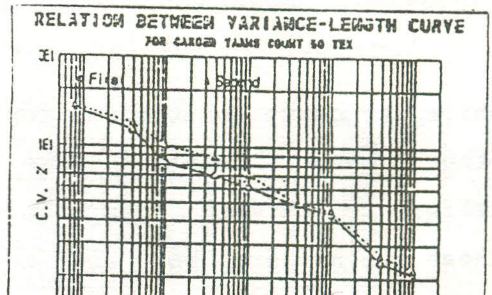
X_1 = Twist factor X_2 = Spinning draft,
R = correlation coeff. SE = standared error

Variance Curves of Industrial Yarns

The results of the variance curve for the yarns taken from industries are shown in Fig. (7) for carded yarn and Fig. (8) for combed yarn.

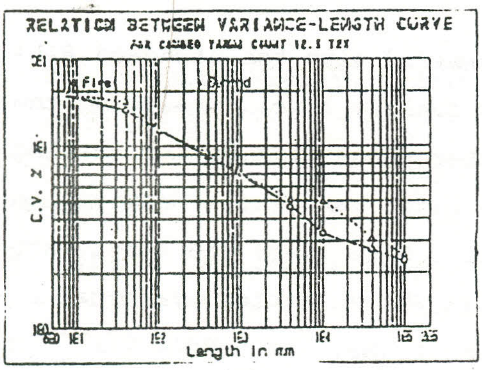


(a)

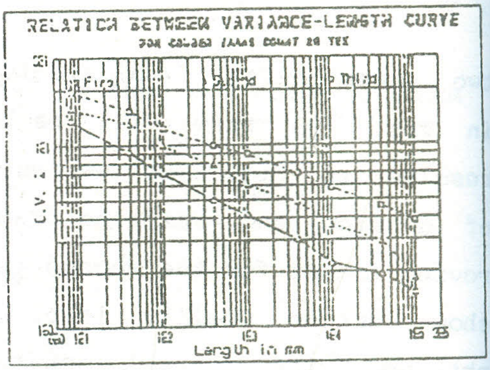


(b)

Fig. (7)
Results of Variance curves For The Yarns Taken From Ind: stries
(Carded Yarn)



(a)



(b)

Fig. (8)

Results of Variance curves For The Yarns Taken From Industries (Combed Yarn)

The summary of the regression equations are shown in table (5).

Table (5)

The Regression Coefficients For The Variance-Length Curve For Yarns Taken From Industry

Yarn Type	Yarn Count	A0	A1	R	SSE	F calc.	Sig.
Carded	20	1.4	-0.21	0.987	0.051	260	> .001
Carded	20	1.46	-0.215	0.99	0.046	334.2	> .001
Carded	30	1.37	-0.234	0.9996	0.0094	9655	> .001
Carded	30	1.43	-0.261	0.997	0.0317	1049	> .001
Carded	30	1.565	-0.264	0.98	0.08	167.8	> .001
Combed	50	1.32	-0.233	0.997	0.026	1216.2	> .001
Combed	50	1.44	-0.22	0.991	0.044	383.8	> .001
Combed	50	1.46	-0.174	0.999	0.013	2857.6	> .001
Combed	80	1.55	-0.243	0.994	0.038	618	> .001
Combed	80	1.54	-0.225	0.993	0.041	465.9	> .001

two yarns in Fig. (7-a) are identical compared with the standard B(L) in Fig. (2) they will be between 75% quality level. Analysing the results in Fig. (7-a) we can obtain better yarns with better setting of drawing and spinning frames for the first yarn while drawing and roving frames for the second yarn. Analysing Fig. (7-b) the first yarn shows better Quality level within 25% while better yarn can be obtained with careful look to the drawing frame. The second yarn can attain a better condition if more care is carried on the roving frame, the third yarn shows a 95% quality level, most of this is due to the roving frame. Analysing the results of combed yarns shown in Fig. (8-a), it can be concluded that the variation from quality level of 25% to 95% in B(L) curve is not due to defective process, this is mainly due to the variation in the process type, little progress can be expected with better care to the whole process. The results of combed yarns shown in Fig. (8-b) indicate no significance between the two yarns while, we can obtain yarns of quality level better than 75% if more studies are carried on both drawing and roving frames.

Conclusions

1. Standard B(L), W(L) and C.V. count curves were determined for carded and combed cotton yarns for different counts which can enable the evaluating the quality level of spinning factory.
2. The B(L) or W(L) curves can evaluate to a great extent the spinning performance, Quality level level of the process and detecting the unstable machine.
3. The variance curves can be used specially when the testing results are affected by material condition.
4. The variance-length curve can be obtained with lesser material and higher precision than in sliver and rove material.

5. The variance-length curve is affected by the rove twist and the spinning draft.

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