ISSN- 2394-5125 VOL 07, ISSUE 03, 2020

"Effect of Waste Control on Yarn Parameters and Yield Improvement in Spinning Mill"

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Abstract- The developing international opposition forces the spinning mills to produce yarns in constant quality at competitive prices. When comparing the cost in different locality it can be seen that under consideration of all the regional variability and conditions – that the raw material price constitutes the dominating factor in yarn manufacturing total cost. This can concluded that the major constitute of yarn cost is raw material cost, it means despite of influences of labor cost and capital cost, It can be seen that to survive in the international market, optimum and best possible use of raw material is necessary.

` This study deals with the various process points and remedial alternate measures in each phase, section and for the control of waste to improve the yarn realization in spinning. Present research presents the various factors influencing the yarn realization and control of hard waste and their standers norms. The impact of process and machine parameters on control of waste in blow room, carding and comber and the influence of modern developments on waste control have been discussed. The case study gives the details insight on effect of contamination on final yarn quality and various techniques methods and alternatives for elimination of contamination during spinning processes leading to optimum utilization of available and in process raw material

Key Words - Spinning mill, Yarn Quality, Yarn Productivity, waste control, yarn realization.

1 INTRODUCTION

A good yarn realization is a factor of great importance in the economics of production of spinning mill and also has great influence on total yield. One per cent reduction in yarn realization would cause almost the same economic impact on the mill's profit as 1 percent enhancement in the raw material cost would make. This is because resale valueof waste is much less than the actual price of cotton till it reaches yarn stage. To understand, suppose the prevailing cotton cost and yarn selling price, even a 1% improvement in yarn realization would lead to a saving of Rs 2 million per year for a 25000 spindle mill manufacturing 30s yarn. Therefore control of yarn realization is important to a mill as the control of cotton and mixing costs. Yarn Realization is nothing but- percentage of yarn output produced from the available cotton input. Yarn Realization largely depends on the level of solid trash in cotton.

Our challenge is to enhance quality and productiveness of Asian spinning mill. The study is carried out in "Priyadarshani Sahakari soot Girni Limited" Situated in shirpur metropolis of Dhule District of Maharashtra India. Reducing variability is a magic method to resolve our excellent hassle in our challenge; we assure lowering the variant in good sized variety and achieve the specified excellent level quality.

2 PROBLEM STATEMENTS

The environment for organizations may become more uncertain in the century. The Spinning industry Priyadarshani Sahakari Soot Girni Ltd in Dhule district is facing both short-term and long-term problems. Former includes problems of fluctuating prices and shortage of raw materials, liquidity problems due to poor sales and accumulation of huge stocks due to lack of export quality yarn. The long term problems of the spinning industry include the slow speed of modernization, outdated technology and techniques resulting into low productivity, high cost of production, low profitability and increasing sickness of mills.

3 METHODOLOGY

The calculation and estimation of yarn realization has to be done accurately by maintaining proper records of cotton bale weights received from different locations, wastes and yarn produced. Because the estimation of quantities such as moisture content in cotton and yarn, tare weights, allowances for twist contraction and idle spindles and invisible loss are subjected to a number of assumptions and also inevitable and predictable sources of error.

Generally most of the mills use the following formula:

Total yarn realization in (%) =

$$\frac{\text{Yarn production}}{\text{Cotton Consumption}} \times 100$$

Where, Cotton consumption

= Cotton issued (kg) + Opening process stock − Closing process stock

For the calculation of yarn realization only non-usable wastes are taken into consideration.

Formula for estimating the yarn realization given by SITRA is-

Yarn Realization YR (%)

$$= (100 - (W_{bl} + W_c + W_k + W_s + W_g) - I) \ldots \text{ for carded counts}$$

$$= (100 - (W_{bl} + W_c + W_k + W_h + W_s + W_g) - I) \ldots \text{ for combed count}$$

W_{br} = Blow room waste%

W_k = Card waste%

W_c = Comber noil%

W_h = Yarn waste%

W_s = Sweep waste%

W_g = Gutter / Filter waste%

I = Invisible loss%

It is suggested that if a mill does not reuse the usable wastes in the same mixing, the corresponding usable wastes (%) must be deducted in the above calculations.

Norms for yarn realization and waste in different section

The percentage yarn realization depends mainly on the process waste takenout at the blow room, cards and combers. Off course, the waste taken out in the blow room depends on the trash or solid content of the mixing, the waste in cards,on the type of cards and also on the trash in the lap and the waste in comberson the type and nature of fibre length distribution of actual mixing used for different combed counts. The standard norms for the different waste losses and yarn realization for types of yarns are given in Table 1

Content	**Carded**					**Combed**		
Count	**4–9**	**10–13**	**14–25**	**26–34**	**28–34**	**35–44**	**45–70**	**71–99**
Trash%	11	10	7	5	5	4	3	2
B.R. dropping	12	11	7.7	5.4	5.4	4.4	3.2	2.2
Card waste	4.2	4.2	4.4	4.5	4.5	4.3	4.3	6.4

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Comberwaste	–	–	–	–	9	10.9	12	13
Sweeping	2	1.8	1.6	1.4	1.4	1.2	1	1
Clearer waste	0.6	0.5	0.4	0.4	0.4	0.3	0.2	0.1
Hard waste	0.6	0.5	0.3	0.3	0.3	0.3	0.3	0.3
Invisible loss	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Y.R.%	78.1	79.7	83.6	86.5	77.5	77.4	77.9	77.9

Table -1 Norms for Types of waste in spinning

4. Effect of the cotton fibre parameters on yarn realization

The fibre parameters which can influence the yarn realization are:

1. Solid trash percentage in mixing

If the trash percentage is greater in mixing, more waste in blow roomand card be removed to get the required quality compared to the cotton having less trash percentage in mixing, which in turn affects the yarn realization.

Fig. 1 – Bale Mixing

1 Short fibre content (SFC) in mixing-
Higher SFC in mixing resulted in more waste in blow room. Impropercontrol of short fibres leads to fluff liberation in the departments which in turn higher invisible loss and affects the yarn realization.

2 Moisture content in mixing-
If there is more moisture content in cotton, the amount of invisible loss will be larger.

3 Maturity Ratio-
In more immaturity cotton, due to fibre rupture in blow room and card the waste will be higher. Stickiness of cotton / Honey dew content- Higher honey dew content in cotton leads to more white waste and higher micro dust/fluff accumulation on the machine components andleads to higher invisible loss or micro dust which in

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turn affects the yarn realization.

5. Method used for recording and estimating yarn realization and waste

The various quantities for which systematic records have to be kept for the purpose of obtaining the yarn realization and waste losses, and their inter- relationships are shown in Table 1. It contains only one quantity which is not directly measured, namely, the invisible loss. The quantity of the invisible loss is obtained by subtraction.

By implication the invisible loss refers to the loss caused by the evaporation of part of the moisture content in the cotton, and by the escape into the atmosphere of some fibres and dust at various stages of processing. In general, however, the invisible loss is the total unaccounted loss and consequently reflects immediately any mistake, or systematic error in record keeping. A relatively little inaccuracy in the waste or production records causes a large proportionate change in the invisible loss.

Fig. 2 Sampling and recording

We had recorded all data daily; the only exceptions are the stock in process and the gutter loss in blow room. The overall and mixing-wise values of yarn realization should be calculated once every month and the overall invisible loss also determined at that time. If the values of overall invisible loss remain steady over the months, but the overall yarn realization fluctuates,then it is clear that the changes in the yarn realization are real and are due to some changes in the waste levels. If however, the invisible loss also fluctuatessubstantially then it indicates some mistake in calculation or in recording data,besides a possible change in the waste levels.

6. Control of invisible loss

While calculating the yarn realization, the quantity of wastes which are not weighable / quantifiable due to evaporation of part of the moisture content in the cotton and the escaping of short fibres and dust at various stages of processing of cotton such as micro dust, flies etc. are called as invisible loss.

Invisible loss = 100 – packed yarn production% – packed waste% (including micro dust and sweeping waste).

In practice, however, the invisible loss is the total unaccounted loss and consequently reflects immediately any mistake in record keeping. A relatively small inaccuracy in the waste or production records would cause a large proportionate change in the invisible loss.

Reasons for invisible loss

1. Short fibres and fluff escaping from departments
2. Weighment errors in cotton purchased and wastes sold
3. Excess give away of yarn and inaccuracies in the estimates of stockheld in process
4. Differences in moisture content between cotton and yarn
5. Errors in the estimates of stock held in process
6. Improper accounting of waste produced

7. Control measures for invisible loss

Ensure the moisture content in yarn is equal or little higher than the moisture content in mixing. The loss due to this would be invariably very insignificant and the mills should keep a check by weighing a few bales at random after a lapse of 3–4 months and compare the same with the weight at the time of purchase. Normal moisture content in mixing – 6–7% Normal moisture content in yarn: Before yarn conditioning – 4.5–5.0% After yarn conditioning – 6.0–6.5% During the process of fibre to yarn conversion, the decrease of 1–2 percentage happens which would not only affect the yarn quality,but also the invisible loss. The yarn conditioning process increases the moisture content by 1.0–1.5% (by restoring the yarn's natural regain). The increase in moisture content in yarn after conditioning would reduce the invisible loss and in some cases it would result in 'invisible gain'.

1 Maintain the relative humidity at 65% in winding 70% in packing departments

2 Condition the yarn at least for 12–16 hours in humidified atmosphere before packing

3 Use yarn-conditioning plant, if necessary. The objective of yarn conditioning system is to restore the natural properties of yarn like moisture content and to improve the strength and elongation and to produce a balance yarn (twist setting). So due to this the invisible loss is compensated.

4 Accuracy of balances used in weighment plays a crucial role since any under estimation in weight would be a financial loss to the mill and over estimation would lead to market complaints. Hence balances used in cotton godown, cone winding packing departments must be calibrated as per schedule and cross-checked periodically with standard weight.

5 Tare of different packs viz., bags, cartons and pallets must be checked every week

8. Control of hard waste in spinning mill

A high incidence of yarn waste, apart from leading to a loss of Rs 6–15 perspindle per year for every 0.1% waste, is an indication of poor machinery condition and maintenance, and inappropriate work practices of operatives. The norms for hard waste for different machines are given in Table 2

S. no.	Department	Good	Average	Poor
1	Conventional cone winding			
	• Mechanical slub catcher	0.10	0.15	0.20
	• Electronic clearer	0.10	0.15	0.20
2	Reeling	0.10	0.15	0.20
3	Doubler winding			
	• Cop feed	0.15	0.25	0.30
	• Cone feed	0.04	0.06	0.08
4	Ring doubling	0.05	0.08	0.10
5	Two-for-one twister	0.03	0.05	0.06
6	Auto coner			
	• Savio	0.40	0.60	0.75
	• Muratec	0.50	0.75	1.00
	• Padmatex 138	0.50	0.75	1.00
	• Schlafhorst 238	0.30	0.45	0.60
7	Open end spinning	0.01	0.02	0.03
8	Ring spinning	0.02	0.03	0.04

Table 2 -Norms for hard waste in spinning and post spinning machines (SITRA)

The incidence of hard waste in any process is influenced by the following three factors:

1. End breaks and feed package replacement
2. Work practices and

ISSN- 2394-5125 VOL 07, ISSUE 03, 2020

3. Other causes such as quality of feed packages, housekeeping and material handling.

9. Control of hard waste in ring frame

Causes of hard waste

Since the ring cops are the feed packages for single yarn winding, the qualityof ring cops must be maintained at good level. Whenever there is a count change in ring frame, the cop quality should be checked. Proper quality of cop ensures higher winding efficiency. In ring frames, poor work practices of workers and poor maintenance of machinery affect the quality of cops which in turn increases the end breaks, slough off, cop rejection etc., in the post spinning process ultimately leading to high hard waste. Some of the wrong work practices which affect the qualityof the cop are double gaiting, over-end piecing, upward and downwardratcheting, not engaging the pawl on the ratchet wheel while starting the frameafter doffing, using empties with remnants, not stopping the frame properly for doffing thus leading to more backwind coils, etc

The incidence of high hard waste in ring frames is due to the followingcauses:

1. High end breaks
2. Removing more yarn unnecessarily while attending defects in cops
3. Taking more length of yarn from cops while piecing
4. Removing the cops roughly without stopping the spindle and making slough off
5. Poor doffing practice – doffing and donning separately
6. More frequent wrapping (for count checking)

Measures to reduce hard waste

1. Preventive maintenance to avoid frequent breakage rate in all post-spinning operations b
2. Enhance the quality of cops by reducing the defects like ring cuts, slough off, over filled cops, double gaiting, etc.
3. Frequent training to workers for correct work methods
4. Maintain the machinery in good condition
5. Maintain the number of backward coils / under wind coils in the cop
6. Follow good material handling practices such as use of plastic crates for transporting cops, trolleys, etc.
7. Good housekeeping. Keep cop stocks in cone winding with proper covers and full cones should be stocked in raised platform.

10. Control of hard waste in cone winding

Different measures required to reduce the hard waste level in windingdepartment are given below:

1. Keep the functioning of stop motions in cone/cheese winding in best condition
2. Maintain the cop rejection in autoconers below 8% by improving the cop quality. The various reasons of bobbin rejection are as follows:
   - Long tail end, kirchi / lapetta, deshaped bobbin, overfilled bobbin, bottom spoiled bobbin, ring cut bobbin, soft bobbin, sick bobbin
   - Bobbin feeding in magazine
   - Top bunch transfer failure
   - Fault in winding unit and yarn quality
   - Double gaiting / over piecing in ring frame
   - Low and insufficient suction in the gripper arm

11. Control of blow room waste

ISSN- 2394-5125 VOL 07, ISSUE 03, 2020

Raw cotton comes with various kinds of trash, such as leaf, bark, and seed coat particles. The content of each of those trash categories is highly dependingon the origin that is location of the cotton and its harvesting method. Trash content from bale to sliver should reduce through the opening. In one hand, the requirements of sliver quality impose that the cotton must be intensively cleaned during ginning, spinning mill and carding. On the other hand, the quantity of those contaminations provides useful information for finding more efficient cleaning processes and predicts the quality of the finished yarn.

12. Need for opening

The term 'opening' in the technological sense, means while number of fibres remaining constant when volume of the flock is increased, i.e. the specific density of the material is reduced. Opening is usually the first stage in the spinning process and includes removal of the fibres from the bale by plucking followedby further opening using pinned cylinders and pinned lift aprons. Opening toa fine degree is normally performed using a feed roll/feed plate combination to restrain the cotton whilst it is opened into very small tufts by wire wound cylinders, pinned beaters or blade beaters. At each stage of opening a cleaningoperation can be performed. Cotton has to be opened more than once becausetrash is removed only from the surface of tufts and multiple opening actions are needed to expose all the trash.

In the blow room cotton pack size vary from 5 mg to not more than 150 mg. Throughout the processing steps in the spinning plant the density of the fibre assembly changes as shown in Table 3.

Processing step	**Density**
In the bale	0.30–0.70 g/cm^3
In mixer or blender	0.10 g/cm^3
In the sliver can	0.10 g/cm^3
On the roving bobbin	0.25–0.35 g/cm^3
Yarn on the bobbin	0.50 g/cm^3

Table-3 Density of fibres at different processing stages

The intensity of opening of cotton in blow room depends upon on raw material, machines, machine speed and ambient conditions. All these factors have to be considered before optimizing the opening and cleaning of the cotton in the blowroom. The impact of number of machines in the blow room line is shown in Fig 1.

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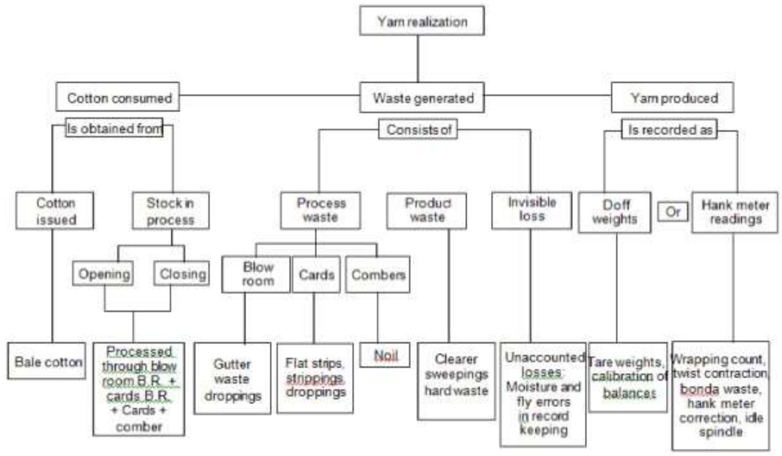

Fig.-1 Waste recording steps in process line

Almost all data are recorded on daily basis; the only exceptions are less stock in process and the gutter loss in blow room. The overall and mixing-wise values of yarn realization calculated once every week during the period pf investigation and the overall invisible loss also determined at that time. If the values of overall invisible loss remain steady over the week, but the overall yarn realization fluctuates,then it is clear that the changes in the yarn realization are real and are due to some changes in the waste levels. If however, the invisible loss also fluctuatessubstantially then it indicates some mistake in calculation or in recording data, besides a possible change in the waste levels themselves.

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Invisible loss = 100 – packed yarn production% – packed waste% (including micro dust and sweeping waste).
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Conclusion

The actual waste collected compared with the norms and causesfor deviation Checked thoroughly. Weekly waste indices showingthe ratios of actual hard waste and sweep wastes to the respective norms shouldbe calculated for each section. Often, the causes of high hard waste, soft wasteand sweepings are due to negligence of workers, rough handling of materialsand poor working conditions. A high sweep waste arises due to operatives throwing away the waste like bonda waste etc. on the floor. Periodically the sweep waste checked for the presence of good fibres. The spinning tenters should be provided with bags and it should be ensured that the bonda waste is kept in the bags during piecing. Good and proper supervision, maintenance and accurate control would help to reduce the incidence of these wastes.
The process waste need to be weighed only once a month and percentagefor all categories of waste estimated taking the total cotton consumed as the basis. Estimates of the invisible loss or gain in ring spinning, reeling and winding stages should be made at periodic intervals. By exercising strict control over end breaks in various machines, material handling and storage and workpractices of operatives a mill could maintain the usable waste below 4%. In Synthetic processing all wastes are reusable except Blow room droppings and carding flat strips. Maximum waste achieved in blow room dropping is 0.6%,card flat strip is 1.6%, and Invisible loss is 0.5%. So, all the synthetic mills canable to achieve 97%–98% yarn realization.

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ISSN- 2394-5125 VOL 07, ISSUE 03, 2020

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