

Cost Comparison of Ring Spun Yarn of China Hui Hong Polyester Fiber and Blended Yarn of Khalis and PSL Polyesters Fiber

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Abstract- The theme of this research paper is to create a cost comparison report between yarn made from the expensive China Hui Hong polyester fiber and yarn made by blending ring spun of polyester of less costly Khalis Fiber Limited (KFL) and Pakistan Synthetic Limited (PSL). Polyesters yarns of 30Ne were made on ring spinning frame at different recipes of KFL and PSL, i.e., 100% KFL, 75% KFL+25% PSL, 60% KFL+40% PSL, 50% KFL+50% PSL, 40% KFL+60% PSL, and 100% PSL and then the costs for all fibers compared with those for 100% China optical Hui Hong fiber. Yarn cost and production effecting parameters were determined such as yarn ounces per spindle (OPS), yarn yield and monthly profit. Based on the results, comparison reports were made using Uster Tester 4. The theme of this report is to establish a methodology to achieve more margin with demanding market trends, customer requirement, and product application for yarn spinning industry.

Keywords: OPS, Yield%, spindle cost, conversion cost

I. INTRODUCTION

Ring spinning is the oldest and most versatile process for making different types of yarns from textile fibers [1]. No one can deny its importance till the early 1960s. Then it was felt that this process has high capital investment together with a high raw material cost [2]. Therefore, different experiments have been performed to make yarns with low raw material cost and [3] high profitability range. Blending of fibers which differ in properties, with a view to achieving or improving certain characteristics of the yarn has been worked since many years ago [4]. The blend is an intimate mixture of staple fibers of different structures, lengths, diameters or colors. Fabrics made from blending

of yarn types have better properties than those made from a single yarn [5,6].

The blending of cotton fiber with polyester fiber is done to enhance drape properties, comfort ability, dye ability and many other properties of the fabric products [7,8]. In the cotton/polyester blends, polyester fiber plays an outstanding role in all areas of the life-saving medical textiles to the geo-textiles [9,10]. The advantages of polyester over other fibers are strength, luster and aesthetics properties [11,12]. The polyester fibers do not possess a high absorption of water and wick less water. In this research project, there is focus on the economic growth, quality of product and profitability range. It will focus on to set manufacturing process parameters so that yarn spinning industry earns more profit, changing market trends, customer requirement, product application and product properties on demand to maintain standard quality and productivity of yarn as per customer requirement. Due to high crisis, there are requirements to form recipes of different types of fibers in such ratios as final quality and profitable product can be made. This research was conducted to investigate the final qualitative and profitable product of the yarn via blending of PSL and Khalis polyesters, achieving the quality parameters and maximizing profitable range. Recipe of the KFL and PSL polyesters fibers in different ratios were made to achieve the required strength and quality characteristics of qualitative yarn. Due to improper control of recipe in blow room process by operator, we suggest the new model for the spinning process to run in an efficient way and mix fibers, which is required for a recipe that set for quality development and profitable product. By controlling manufacturing process with semi-automated devices this provides easiness to the operator to control manufacturing process in an efficient way, which produces the final quality product.

Due to weather changes in different seasons, temperature varies from 4 °C to 50 °C. Change in temperature causes trouble in controlling precise moisture in fiber mat to develop the quality product. For avoiding these issues new automated devices have been implemented at the assembly line for the minimization of waste, which automatically

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TABLE I
HVI FIBER TESTING OF PSL POLYESTER, KFL POLYESTER AND CHINA POLYESTER

Parameters	KFL polyester	PSL polyester	China polyester
Denier	1.2	1.2	1.2
Length (mm)	51	51	51
Type	Dull	Semi dull	Semi dull
Color R	55	92	80
Color b	45	8	20
No of Crimps	4	13	8
Moisture (%)	0.41	0.39	0.4
Elongation (%)	15	24	19
Tenacity	5	7	6
Shrinkage (%)	3	3.5	3.3
Grade	C	A	B

measures the moisture control, dust cleaning and reduces material wastage as well as controlling the environmental pollution. Moisture and weight of fiber mat can be measured on the assembly line and can be viewed on an LCD screen by operators to monitor and control the process. Data of the manufacturing process can also be stored on the hard drive for future usage and the management purpose. By installing these devices, the operator load and wastage of material are reduced, and manufacturing process becomes precise, accurate and easy to handle.

II. EXPERIMENTAL

A. Materials and Methods

Polyesters yarns of 30Ne and 1.05 HR were produced on a ring spinning Machine (EJM 178) in different recipes by using PSL, KFL and China Hui Hong polyesters. Sliver in a card department of 65 grains was prepared by using a scutcher in blow-room line and card machine (Mekin). These slivers were then fed by two passages through drawing machines, i.e., a breaker drawing machine named Howa Breaker and a finisher drawing machine (RSB D 35) to get uniformity of sliver in drawing department. Following methods are adopted for making different recipes of KFL, PSL and China optical polyesters mixed fibers. The properties of fibers and the temperatures set at different departments of the yarn manufacturing process are listed in Tables I and II, respectively.

B. Methods of Different Fibers

1) For 100% polyester/100% China optical:

Issuance of bales = ring bags production target, excess 5% of ring target bags \times 45.36/bale weight.

Suppose ring production target is 440 bags, excess 5% of = $440 \times 0.05 = 462$ bags.

Therefore, mixing for 462 bags = $462 \text{ bags} \times 45.36 \text{ (kg) / 350 kg}$

= 59.87 bales of 100% polyester.

Mixing of fibers in different recipes can be calculated as:

2) 25% Polyester + 75% KFL Mixing

Suppose ring production = 185 bags, 5% extra = 194 bags, = 194×45.36

= 8811.78 kg (total mixing in kg)

For 25% PSL

$8811.78 \times 25/75 = 29371 \text{ kg}$ (25% PSL mixing in kg), 2937/bale weight of PSL 2937/350

= 8.39 bales of PSL

Now

For 75% KFL

Total mixing – PSL (25% mixing in kg), $8811.78 - 2937 = 5874 \text{ kg}$ of KFL

5874/bale weight of KFL,

$5874/255 = 23$ bales of KFL

3) 50% PSL + 50% KFL Mixing

Suppose ring production = 62 bags, 5% extra = 65 bags

TABLE II
TEMPERATURE AND HUMIDITY AT YARN
MANUFACTURING SECTIONS

Department	Dry bulb (°F)	Wet bulb (°F)	Humidity (%)
Blow room	75	62	46.5
Card	84	72	56
Drawing	76	63	47
Simplex	77	64	48
Ring spinning	101	83	45
Auto cone	82	70	55

Profit/loss (monthly) = Amount of all income (amount from sale bags+amount gain from waste)-all expenses (9)
 China polyester bale net weight is 275 kg (Price = PKR 30250/bale) at mill

PSL polyester bale net weight=350 kg (Price = PKR 52500/ bale)

KFL polyester bale net weight=260 kg (Price = PKR 18200/bale)

II. RESULTS AND DISCUSSION

A. Yield Analysis of Khalis Fiber, Pakistan Synthetic Fiber and China Hui Hong Fiber

Fig. 1 shows the yield recovery of PSL, Khalis fiber and China Hui Hong fiber. As seen, the yield recovery increases gradually by increasing the ratio of PSL fiber. The maximum yield recovery values have been obtained at 100% PSL. The higher yield recovery value leads to the lower waste of fiber. From a production point of view it can be said that low yield recovery causes low profit margin.

B. Analysis of Ounces per Spindle of Yarn of Khalis Fiber, Pakistan Synthetic Fiber and China Hui Hong Fiber

Fig. 2 shows the effect of PSL fiber on ounces per spindle

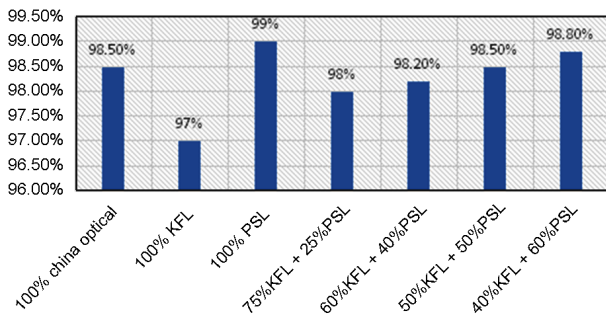


Fig. 1. Yield/recovery% of KFL fiber, PSL fiber and China Hui Hong fiber.

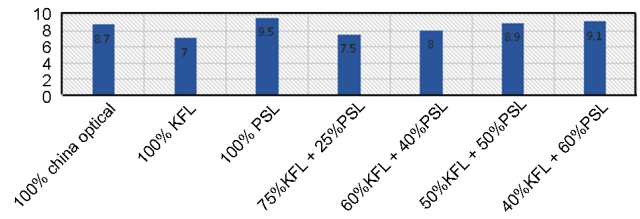


Fig. 2. OPS of Khalis fiber, PSL and China Hui Hong fiber.

(OPS) of Khalis fiber. As the ratio of PSL fiber increases, the OPS increases gradually. The maximum OPS values have been obtained at 100% PSL.

Higher OPS value means higher production. From a production point of view it can be said that low OPS leads to a low production.

C. Monthly Cost Analysis for Khalis Fiber, Pakistan Synthetic Fiber and China Hui Hong Fiber

Fig. 3 shows the effect of PSL fiber on the monthly profit. As the ratio of PSL fiber increases, the profit margin decreases gradually.

The monthly profit calculated for 50% PSL+50% KFL is about 8600000, which is higher than that for 100% China optical. In addition, the monthly profits calculated for 100% PSL and 60% PSL+40% KFL are both high, but keep in mind that the raw material costs of 100% PSL and

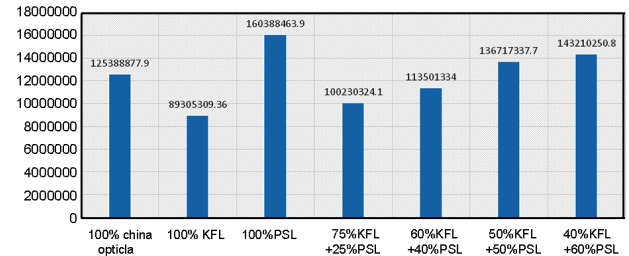


Fig. 3. Monthly profit (in PKR) estimated for KFL, PSL and China Hui Hong Fiber.

TABLE IV
 CHARACTERISTICS OF ALL TYPES OF PRODUCED YARN

Fiber Used	100% China optical	100% KFL	100% PSL	75% KFL+ 25% PSL	60% KFL+ 40% PSL	50% KFL+ 50% PSL	40% KFL+ 60% PSL
Specification	1.2Denx51mm	1.2Denx51mm	1.2Denx51mm	1.2Denx51mm	1.2Denx51mm	1.2Denx51mm	1.2Denx51mm
Fiber type	Polyester	Polyester	Polyester	Polyester	Polyester	Polyester	Polyester
Count	30's	30's	30's	30's	30's	30's	30's
CLSP	4738.23	3838.9	5053.05	4292	4564.75	4724.8	4882.35
Imperfection index	73	150	38	128	69	55	50
Uniformity of yarn (%)	9.80	11	9.60	10	9.90	9.80	9.70
CVm	12.9	15	11.1	13	12.9	12	11.7

60% PSL+40% KFL are also high. Everyone cannot afford to initialize product.

At the same raw material cost, the profit margin estimated for 50% PSL+50% KFL is higher than that estimated for 100% China optical due to its higher production capacity and higher rate of bag market. By considering customer requirements it is obvious that the quality of 50% PSL+50% KFL is better than that of 100% China optical.

III. CONCLUSION

In this research project, there was attempted to study economic growth, quality of product and profitability range for different types of fibers. It was totally focused on setting such parameters so that yarn spinning industry earns a lot of profit, changing market trends, customer requirement, product application and product properties on demand to maintain standard quality and productivity of yarn as per customer requirement.

Due to low profitability, there were requirements to form recipes of different types of fibers in such ratios as final quality and profitable product can be made. This research was conducted to investigate the final qualitative and profitable product of the yarn via blending of PSL and Khalis polyesters, achieving the quality parameters and maximizing profitable range. Recipe of the KFL and PSL polyesters fibers in different ratios were made to achieve the required strength and quality characteristics of China optical qualitative yarn.

From the preformed experiments in different ratios of PSL and KFL fibers, it was concluded that whenever the ratio amount of PSL polyester in KFL polyester fiber was increased, more strength, higher productivity and better quality were obtained.

When the experiments were performed using 75% KFL+25% PSL, 60% KFL+40% PSL, 50% KFL+50% PSL, and 40% KFL+60% PSL, the strength and quality increased by increasing ratio % of PSL, as well as the raw material costs increased.

For 50% PSL+50% KFL, the raw material cost was equal to that for 100% China optical but its profit range and quality were good as compared to those of 100% China optical. For the industries using China optical fiber, the 50% PSL+50% KFL blend fiber is a better choice than 100% China optical polyester fiber, 100% PSL is more profitable but to initiate product, it requires high raw material cost, which everyone can not afford. The present research suggests new methods for development of quality products from different cheap recopies. This will be beneficial for industries to save the cost of purchasing high quality of yarn at high market rates.

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CONFLICT OF INTEREST

The authors have no conflict of interest.

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