Effect of first nozzle pressure on 100% viscose Murata Twin Spun yarn properties

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Abstract: **In this paper the effect of first nozzle pressure on various yarn properties of Murata twin spun yarn was been studied by keeping second nozzle pressure constant.100% viscose yarn was been prepared on Murata twin spinner with first and second nozzle combinations 1.8 Kg/cm^2 & 5Kg/cm^2, 2kg/cm^2 & 5kg/cm^2 and 2.2kg/cm^2 & 5kg/cm^2 respectively.1 denier viscose fiber of 40 mm was used to prepare the yarn on MTS. The two parallel wounded yarns are then twisted together on TFO. For assessing the effect of nozzle pressure on yarn, various properties like imperfection, breaking elongation and tenacity were been tested.**

1. INTRODUCTION

Hairiness inevitably occurring during the spinning process is one of the most serious causes of inefficiency in sizing, weaving and knitting. Higher number of hairs on the surface of fabrics makes the appearance fuzzy and prone to pill formation. Yarn hairiness is a key factor, affecting properties and process ability of yarn as well as fabrics. Hairiness can be reduced by conventional techniques such as sizing for short staples and two-folding for long staples. Some new technologies, nozzle in air- jet spinning. The swirling air current inside the nozzle is capable of wrapping the protruding hairs around the yarn body, thereby reducing yarn hairiness.

R. S. Rengasamy et al placed an air nozzle having an axial angle of 50° and inner diameter of 2.2 mm below the front roller nip in a ring frame, at various distances. Simulation of the air flow pattern inside the nozzle provides some useful insight into the actual mechanism of hairiness reduction [1]. Prof K Ramachandralu, V Ramesh Combined the advantage of air-jet spinning system, with conventional ring spinning system. Two types of air-jet nozzle similar in all dimensions but differing in the direction of inclination of orifice, namely 'S' nozzle and 'Z' nozzle and a suitable air chamber to house these two nozzles in tandem have been designed and fabricated. This twin air-jet nozzle assembly has been positioned in between the front roller nip and lappet hook without altering the spinning angle. The yarn samples thus produced have been tested for their properties like tenacity, elongation, evenness, imperfections, hairiness, diameter and twist. From the results it has been observed that the introduction of twin air-jet nozzle system in ring spinning has lead to better compaction of yarn with improvement in yarn quality index, yarn tenacity and packing factor [2]. K Ramachandralu, et al studied & B S Dasaradan designed and fabricated two types of air jet nozzle differing with each other in the direction of inclination of orifice and suitable for air vortex ring spinning system for the objective of reducing the hairiness of cotton yarns. The drafted cotton roving strand emerging from the front roller nip and passing through the air jet nozzle has been subjected to the air vortex of compressed air which tucks the protruding hairs subsequently as the yarn emerges out of the nozzle they are bound by the mechanical twisting agency and results in the reduction of hairiness [3]. Boong Soo Jeon designed an air-suction nozzle as alternatives to the commonly used air-jet nozzle to reduce yarn hairiness, and attaching them to a conventional spinning machine. To examine the effect of various nozzle parameters on yam hairiness and quality [4]. S N Subramanian, AVenkatachalam, and V Subramanian Studied the effect of single, double and triple air-jet nozzles of different materials, such as brass, aluminum and teflon, on the characteristics of jet ring - spun yarns. It is observed that the jet ring-spun yarns display lower hairiness and higher tenacity [5]. Huseyin Gazi Ortlek and Sukriye Ulku examined the influence of various parameters such as delivery speed, nozzle pressures, and yarn count on the properties of vortex yarns produced using a Murata vortex spinning system. They found that the delivery speed, nozzle pressure, and yarn count are all significant parameters for yarn evenness, imperfections, hairiness and tensile properties. When the nozzle pressure increases, yarn unevenness, the number of thick places, the neps values, and the tensile properties of vortex yarns increases but the hairiness values of vortex yarns decreases [6]. Guldemet Basal, William Oxenham investigated the effects of a number of process parameters, including the nozzle angle, nozzle pressure, spindle diameter, yarn delivery speed, and distance between the front roller and the spindle, on the structure and properties of vortex spun yarns. A modified version of the tracer fiber technique combined with the Image

Analysis Application Version 3.0 (B.A.R.N. Engineering) was utilized to explore yarn structure. The results showed that the short front roller to the spindle distance caused better evenness, low imperfections, and less hairiness [7].

2. MATERIALS AND METHODS

In this work $2/30^S$ count was been prepared from 100% viscose fiber of 1 denier and of 40 mm length. The following specifications were used for preparing the yarn is shown in table 1

Sr. no.	Machine Parameters	Setting
1	Speed	260 MPM
2	Total draft ratio	247
3	Mean draft ratio	35
4	Feed ratio	0.97
5	Take up ratio	0.99
6	Transverse angle	10°
7	Slub catcher setting	2mm

Table 1: Murata Twin Spinner machine parameters

Three samples of 100% viscose yarn were prepared on Murata Twin Spinner (MTS) by changing first nozzle pressure N_1=1.8 kg/cm^2, 2 kg/cm^2 and 2.2 kg/cm^2 at the same time second nozzle pressure was kept constant at N_2=5kg/cm^2.

2.1 Testing Methods

1) U%, Thick places/km (+50%), Thin places/km (-50%) and Neps/km (+2005) of the MTS yarn were tested on USTER TESTER 4-SX R1.8.0.

2) Breaking Elongation % and Tenacity (RKM) of MTS yarn tested on Premier Tensomax 7000

3. RESULTS AND DISCUSSION

$2/30^s$ yarns are prepared in mill by setting the first nozzle pressure at 1.8 kg/cm^2, 2kg/cm2 and 2.2 kg/cm2.For all settings nozzle pressure N_2 was kept constant at 5 Kg/cm².After preparing $2/30^s$ yarn of 100 % viscose on Murata Twin Spinner the yarn was tested for various properties. For the assessment of the results following properties are tested.

3.1 YARN TESTING

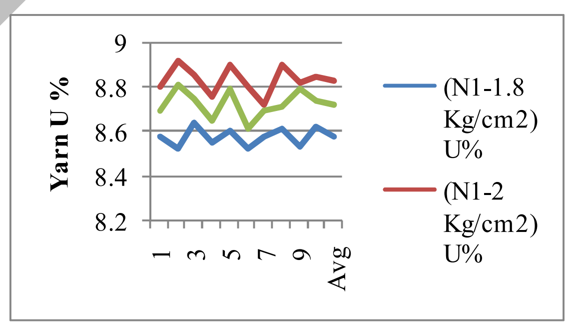
3.1.1 Evenness (U % of yarn)

The yarn properties are subject to variation, e.g. weight per unit length etc., and it is therefore necessary to decide which property will be the most useful one to measure in order to derive a numerical assessment of the irregularity. Most of the properties are related in some way and the specific purpose any one may be studied, but perhaps the most popular approach is to consider the variation in weight per unit length or thickness. Hence, yarn may be studied from this angle.

In this work for each nozzle pressure ten readings are taken for $2/30^S$ count of 100% viscose yarn. From table no.2 it is found that first nozzle pressure setting N_1 changes from 1.8 Kg/cm² to 2 Kg/cm² the average evenness (U%) value is rise from 8.58 to 8.83 and further increase in pressure to 2.2kg/cm^2 the U% value of yarn decreased to 8.72 This happen may be due to increasing the nozzle pressure increases the yarn unevenness value owing to concentration of mass in very short lengths due to greater incidence of wrapper fibers. But further increase in pressure causes some improvement it is may be due to controlled air current in first nozzle pressure, which helps to bind protruding fiber tightly to yarn core and form compact yarn structure.

Nozzle Pressure	(N_1-1.8 Kg/cm2)	(N_1-2 Kg/cm2)	(N_1-2.2 Kg/cm2)
Sr.No.	U%	U%	U%
1	8.58	8.8	8.69
2	8.52	8.92	8.81
3	8.64	8.86	8.75
4	8.55	8.76	8.65
5	8.6	8.9	8.79
6	8.52	8.8	8.61
7	8.58	8.72	8.69
8	8.61	8.9	8.71
9	8.53	8.82	8.79
10	8.62	8.85	8.74
Avg	8.58	8.83	8.72

Table no. 2 Effect of nozzle pressure on U% of yarn.



Graph no.1 Effect of nozzle pressure on U% of yarn.

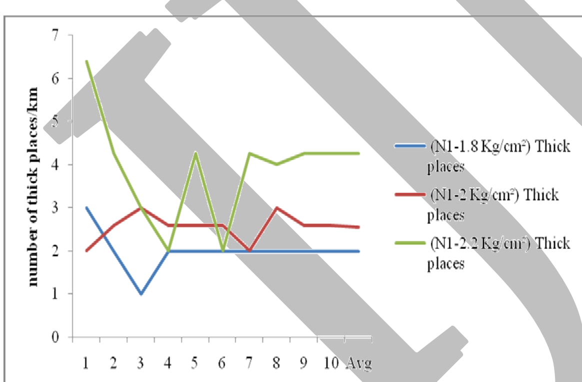
3.1.2 Thick place

Mostly yarn evenness is measured by the variation in mass per unit length. Thick places can influence many other properties of the yarn and the fabric made out of it. The purpose of testing yarn for thick places is to assess the effect of front and back nozzle pressure on the variance of yarn diameter.

In this work for each nozzle pressure ten readings are taken for 2/30^S count of 100% viscose yarn. From graph no.2 and table no.3 it is observed that as the first nozzle pressure increased from 1.8 Kg/cm² to 2 Kg/cm² and 2.2 Kg/cm^2 then average number of thick places is also increases gradually from 2.0, 2.6 and 4.3 this happen may be due to increasing the nozzle pressure increases the concentration of mass in very short lengths due to greater incidence of wrapper fibers.

Pressure	(N_1-1.8 Kg/cm²)	(N_1-2 Kg/cm²)	(N_1-2.2 Kg/cm²)
Sr. No.	Thick places	Thick places	Thick places
1	3	2	6
2	2	3	4
3	1	3	3
4	2	3	2
5	2	3	4
6	2	3	2
7	2	2	4
8	2	3	4
9	2	3	4
10	2	3	4
Avg	2.0	2.6	4.3

Table no. 3 Thick places in yarn



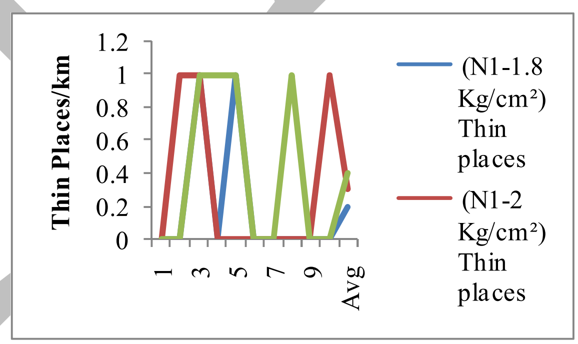
Graph no. 2 Effect of nozzle pressure on number of thick places in yarn.

3.1.3 Thin places

In this work for each nozzle pressure ten readings are taken for 2/30^S count of 100% viscose yarn. It is observed from graph no.3 and table no.4 that there is increase in number of thin places from 0.2 to 0.3 and 0.4 respectively, as the first nozzle pressure changes from 1.8 kg/cm^2 to 2 kg/cm^2 and 2.2 kg/cm^2. This may be due during the spinning process, the back nozzle creates a false twist, and the front nozzle makes the surface fibers to wrap around the core fibers. When the air pressure of the front and back nozzles is changed, the force that makes the yarn rotate will change, and the wrapping effect will change cause random distribution of fibers along the length of yarn.

Pressure	(N_1-1.8 Kg/cm²)	(N_1-2 Kg/cm²)	(N_1-2.2 Kg/cm²)
Sr. No.	Thin places	Thin places	Thin places
1	0	0	0
2	0	1	0
3	1	1	1
4	0	0	1
5	1	0	1
6	0	0	0
7	0	0	0
8	0	0	1
9	0	0	0
10	0	1	0
Avg	0.2	0.3	0.4

Table no. 4 Thin places in Yarn



Graph no. 3 Effect of nozzle pressure on number of thin places in yarn.

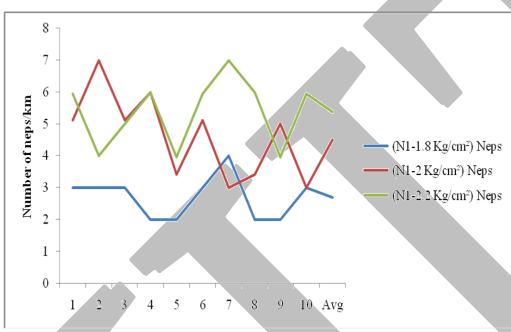
3.1.4 Neps

Neps are highly entangled fibres. Usually a nep contains ten or more fibres. It is a very serious problem in the textile industry.The ease with which a fibre forms part of a nep is related to its bending rigidity.

In this work for each nozzle pressure ten readings are taken for 2/30^S count of 100% viscose yarn. From graph no.4 and table no.5 it is found that as the first nozzle pressure increased from 1.8 Kg/cm² to 2 Kg/cm², 2.2 Kg/cm² the number of neps increases from 2.7 to 4.5 and 5.4 respectively, this may be due to increasing the nozzle pressure increases the concentration of mass in very short lengths due to greater incidence of wrapper fibers.

Pressure	(N_1-1.8 Kg/cm²)	(N_1-2 Kg/cm²)	(N_1-2.2 Kg/cm²)
Sr.No.	Neps	Neps	Neps
1	3	5	6
2	3	7	4
3	3	5	5
4	2	6	6
5	2	3	4
6	3	5	6
7	4	3	7
8	2	3	6
9	2	5	4
10	3	3	6
Avg	2.7	4.5	5.4

Table no. 5 Neps in yarn



Graph no. 4 Effect of nozzle pressure on number of neps in yarn.

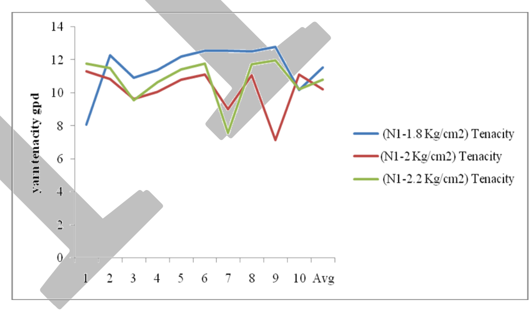
3.1.5 Tenacity

Tenacity is defined as the specific stress corresponding with the maximum force on a force/extension curve. The nominal denier or tex of the yarn or fibre is the figure used in the calculation; no allowance is made for any thinning of the specimen as it elongates.

In this work for each nozzle pressure ten readings are taken for $2/30^S$ count of 100% viscose yarn. It is observed from graph no.5 and table no 6 that average yarn tenacity increases form 10.23 gpd to 10.83 gpd as the first nozzle pressure N_1 changes from 2 Kg/cm² to 2.2 Kg/cm² this is happen may be because of increase in first nozzle pressure help to increase in number of wrapper fibers per unit length in the yarn core. But the yarn tenacity also increases in first nozzle pressure N_1 (2 Kg/cm² to 1.8 Kg/cm²) form 10.23 to 11.56,further increase in first nozzle pressure decrease in yarn strength this may be due to more fibers get detached from the main strand.

Pressure	(N_1-1.8 Kg/cm2)	(N_1-2 Kg/cm2)	(N_1-2.2 Kg/cm2)
Sr. No.	Tenacity	Tenacity	Tenacity
1	8.09	11.33	11.78
2	12.29	10.87	11.52
3	10.92	9.66	9.57
4	11.38	10.07	10.66
5	12.23	10.82	11.46
6	12.58	11.13	11.79
7	12.57	9.03	7.58
8	12.54	11.10	11.75
9	12.8	7.16	11.99
10	10.21	11.12	10.23
Avg	11.56	10.23	10.83

Table no. 6 Yarn tenacity



Graph no.5 Effect of nozzle pressure on tenacity of yarn.

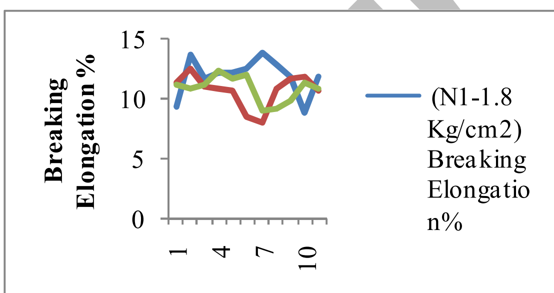
3.1.6 Breaking Elongation (%)

The breaking elongation of the air jet spun yarn depends not only on the yarn breaking load and the fiber modulus, but also on the proportion of fibers that slip or break. If all the core fibers in the yarn were to break without slipping, then the breaking elongation of the yarn will depend on the breaking load and the fiber elastic properties.

In this work for each nozzle pressure ten readings are taken for $2/30^S$ count of 100% viscose yarn. It is observed from graph no.5 and table no. 6 that Yarn tenacity increases form 10.23 gpd to 10.83 gpd as the first nozzle pressure N_1 changes from 2 Kg/cm² to 2.2 Kg/cm² this is happen may be because of increase in first nozzle pressure help to increase in number of wrapper fibers per unit length in the yarn core. But the yarn tenacity also increases in first nozzle pressure N_1 (2 Kg/cm² to 1.8 Kg/cm²) form 10.23 to 11.56,further increase in first nozzle pressure decrease in yarn strength this may be due to more fibers to be detached from the main strand.

Nozzle Pressure	(N_1-1.8 Kg/cm2)	(N_1-2 Kg/cm2)	(N_1-2.2 Kg/cm2)
Sr. No.	Breaking Elongation%	Breaking Elongation%	Breaking Elongation%
1	9.36	11.39	11.25
2	13.7	12.47	10.85
3	11.7	11.02	11.23
4	12.21	10.80	12.36
5	12.11	10.65	11.63
6	12.52	8.52	12.02
7	13.82	8.00	8.99
8	12.8	10.74	9.20
9	11.8	11.65	9.84
10	8.79	11.80	11.33
Avg	11.88	10.70	10.87

Table no. 7 Breaking Elongation of yarn.



Graph no 6 Effect of nozzle pressure on Breaking Elongation of yarn.

CONCLUSIONS

This study shows that the effect of first nozzle pressure on the properties of yarn is been significant. Here it is found that at 1.8 kg/cm^2 nozzle pressure yarn gives better U%. Yarn shows least thick, thin places and neps at same pressure. Yarn shows high tenacity of 11.56 gpd and breaking elongation of 11.88 % at 1.8 kg/cm^2. So it can be conclude that viscose yarn gives best results at nozzle 1.8 kg/cm^2 and 5 kg/cm^2 pressure combination of nozzles (N_1 and N_2) .

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