SOME STUDIES ON WEAVABILITY OF DREF YARN

by

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Yarn technology
Processing

CERTIFICATE

1. I am satisfied that the thesis presented by Mr. V. K. Joshi is worthy of consideration for the award of the Degree of **Doctor of Philosophy** and is a record of the original bonafide research work carried out by him under my guidance and supervision and that the results contained in it have not been submitted in part or full to any other University or Institute for award of any degree/diploma.

2. I certify that he has pursued the prescribed course of research.

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ABSTRACT

Present study is principally aimed at investigating, weaving behavior of friction yarns and also to find out how best friction yarns can be used as warp yarns for giving desired weaving efficiency. For this purpose, the present study has been divided into ten chapters.

Chapter I briefly deals with importance of weavability, role of spinning technology in yarn structure and its impact on weavability, various issues related to friction spun yarn and finally outlines the specific objectives of this research.

Chapter II reviews the research work done by earlier researchers on weavability of spun yarns and its relation with yarn quality, spinning technology, yarn structure, properties, yarn preparation and finally highlights the need of this research.

Chapter III explains the materials and the general methodology used for this research purpose. It also elaborates the various stages of preparation of yarn samples such as spinning, warping, sizing etc. Moreover, it gives a detail account of the tests carried out to ascertain the weavability and other relevant properties of various yarns.

Chapter IV aims to find out the spinning parameters, which will give the best weavability for a cotton Dref-2 yarn spun on a Dref-3 machine. For this, 3 levels, each of friction drum speed and delivery speed were chosen for manufacturing of 9 yarn samples of 74 Tex (8 Ne) and sized by 5% size solution. It was found that optimization of spinning condition is essentially required for achieving higher weavability of Dref-2 yarns. Further, it was observed that highest drum speed of 5000 rpm and low delivery speed give best weaving performance.

Dref-3 yarn is a later development of Dref-2 technology, which was taken into consideration in Chapter V. It aims to find out the spinning parameters, which will give the best weavability for a 100% cotton Dref-3 yarn. Box-Behnken model was

used to manufacture 15 samples of 74 Tex (8 Ne) Dref-3 yarns by varying core/sheath ratio, friction drum speed and delivery speed levels. Further these yarns were sized by 5% size solution. It was found that lowest possible core/sheath ratio of 50/50, maximum drum speed of 5000 rpm and delivery speed of 100 m/min show the best weavability.

In order to understand the weaving behavior of Dref yarn it is essential to compare the structure, property and relative weaving performance of Dref yarn with that of Ring and Rotor yarn, which have been already established as warp yarns. Therefore, Chapter VI mainly refers to the comparison of the weaving performance of Dref yarns with that of ring and rotor yarns. It also deals with the effect of twist multiplier or friction ratio on the weavability of different types of yarn. For this two yarn counts of 74 Tex (8 Ne) and 49 Tex (12 Ne) were spun from same cotton mixing on different spinning systems viz. ring, rotor and Dref-3 with different levels of twist multiplier or friction ratio. Then these yarns were sized by 5% size solution. It was found that weaving of single Dref yarn is almost impossible. Further, it was observed that under identical sizing conditions, weaving performance of Dref yarn is inferior to ring and rotor yarns.

Since the weavability of Dref-2 and Dref-3 yarn is observed to be poor even after sizing, than that of ring and rotor yarns, an attempt was made in Chapter VII to see how best the introduction of different cores can improve weavability of a Dref yarn. Further, these core spun yarns were sized by using 5% size solution. The study revealed that introduction of core does not help Dref yarn to achieve desired performance like ring and rotor yarns.

Therefore, it was decided to prepare Dref warp yarns by changing size-yarn interaction with a view to attain higher weavability. In order to know the effect of size-yarn interaction on the weavability of different types of friction spun yarns, Chapter VIII deals with different types of friction warp yarns, which were sized with different levels of add-on using 12% size solution. Another way to change the size-yarn interaction is by changing the size recipe. Therefore, another trial has been made by using a rich recipe consisting of acrylic size.

The study clearly showed that an optimized size add-on even fails to improve the weaving performance of Dref Yarn to bring it at par with that of equivalent ring and rotor yarns. It was observed that rich size recipe consisting acrylic size helps to improve weavability to certain extent.

After investigating the properties and relative weaving performance of various Dref yarns, the study was extended to explore the warp breakage phenomenon of Dref yarn. This was carried out mainly to understand the reasons for which Dref yarn gives comparatively poor performance so that necessary measures can be suggested to achieve the desired weavability.

Therefore, Chapter IX deals with warp breaking mechanism of friction spun yarns. The study has been carried out by different methods such as statistical analysis of the yarn failure, yarn damage rate, visual appearance of the broken yarns, and image analysis. In all technology yarns, failure occurs at minimum yarn diameter and maximum change in the yarn diameter. It was observed that fatigue resistance of Dref yarns is very weak compared to ring and rotor yarns. Inter-fiber slippage is predominant in warp breakage of friction yarns as compared to conventional yarns where fiber breakage is also playing an equally important role.

Lastly, the findings of the research have been concluded in Chapter X.

CONTENTS

CHAPTER III

EXPERIMENTAL METHODS

CHAPTER IV

WEAVABILITY OF DREF–2 YARN

CHAPTER VII

WEAVABILITY OF CORE SPUN DREF YARNS

CHAPTER IX

WARP BREAKAGE MECHANISM OF FRICTION SPUN YARNS