ABSTRACT

In the air-jet texturing process, the action of fluid forces causes the filaments of continuous filament yarns to separate and form loops of various configurations. Texturing process converts continuous filaments into more open, voluminous structure and its efficacy depends on the development of stable bulkier structure. Many methods of measuring air-jet textured yarn bulk have been reported.

Method based on comparison of package densities of parent and textured yarn is most widely used. A number of factors in package building affect the measured value of bulk in case of bulk measurement based on package densities. Effect of factors such as winder type (i.e. spindle driven winder and drum driven winder), winding time, package diameter and winding tension on the measured values of package densities and physical bulk of air-jet textured yarn has been analysed. Surfaces driven winders produce packages of higher densities and the measured values of physical bulk are lower. It was found that the effect of yarn tension during winding on the measured values of bulk is higher in the case of spindle driven winders as compared to drum driven winders. Winding at lower tension results in higher values of measured physical bulk. Changes in package densities of both parent yarn and textured yarn packages with the changes in winding time and package diameter affect the measured values of physical bulk while winding on equal time and equal diameter basis respectively. For the measurement of physical bulk, it is recommended to wind parent and textured yarn packages of large equal diameter in the case of equal diameter winding. Longer winding time is recommended to build the parent and textured yarn packages for the measurement of physical bulk if equal winding time is used as a basis for building packages.

For understanding the factors affecting evaluation of bulk through woven fabric, fabric thickness and specific volume in relation with nature of weft threads (air jet textured yarn or flat yarn), pick density and heat-setting have been analysed. Effect of pressure level during measurement of fabric thickness has also been studied. On heat-setting, textured yarn fabric thickness and specific volume become higher. The nature of change of fabric thickness and specific volume with the increase in pick density of textured and flat yarn fabrics depends on the applied pressure level during
thickness measurement. At higher pressure level, fabric thickness and specific volume decrease with the increase in fabric pick density. In view of many parameters other than the yarn bulk affecting the woven fabric specific volume, this method is not very useful for bulk measurement.

In case of knitted fabrics, fabric thickness and specific volume in relation to the nature of yarn that is air-jet textured and parent yarn, stitch length and relaxation treatment have been analysed. In dry relaxed state, change in textured yarn fabric thickness with the increase in stitch length is marginal and after full relaxation fabric thickness does not change with the change in stitch length. Specific volume of knitted fabric increases with stitch length. Specific volume of loosely knitted fabrics of a constant stitch length can be used for the evaluation of textured yarn bulk.

The texturing process variables affect the bulk of air-jet textured yarns. To evaluate individual and interaction effect of the process variables viz., overfeed, air pressure and texturing speed, a series of 19 yarn samples each was prepared from two feed materials based on 3 level Box Behnken design. With the increase in overfeed and air pressure, physical bulk of textured yarn and specific volume of knitted fabric were found to increase. Fabric specific volume evaluated at and beyond 5 g/f/cm² pressure during thickness measurement and the physical bulk of textured yarn using spindle driven winder with the winding tension of 0.6 g/ tex can be used for estimation of yarn bulk.

A new method based on image processing has been evaluated for the measurement of physical bulk of air-jet textured yarn. The image processing method is based on the captured image of air-jet textured yarn core and the total projected image of the yarn. Unlike package density method, physical bulk evaluated through image processing method is poorly correlated with specific volume of textured yarn fabric. The method is more useful for estimating structural irregularity of air-jet textured yarns.

Textured yarn instability plays an important role in determining the realisable textured yarn bulk in the fabric. Textured yarn instability is affected by the interaction effect of overfeed and texturing speed. Increase in instability is much higher when both the above process variables are higher. Normally with the increase in air pressure yarn instability initially increases followed by a decreasing trend. A software program has
been developed to obtain the suitable combinations of texturing process variables to obtain required bulk and stability of air-jet textured yarn.