

ABSTRACT

Pilling studies of selected textile materials such as 100 % Cotton, Viscose, Linen, P/C (80/20), P/C (65/35) and P/V (70/30) have been carried out on pill boxes with different geometrical shapes as a novel attempt. Thus pill boxes with various geometrical shapes have been designed and developed such as Cubical, Triangular, Hexagonal, Octagonal and Cylindrical. Pilling study of the selected samples in all these boxes are carried out for definite number of revolutions such as 5000, 10000, 15000 and 20000. The results of pilling are presented and discussed systematically first as the pilling of all the textile materials in a selected pill box geometry as per the order cubical, triangular, hexagonal, octagonal and cylindrical. Then they are compared in terms of material wise over all the boxes. Such analysis clearly reveals that the hexagonal box is efficient in pilling of textiles than the other geometrical shaped pill boxes. Among the materials, the P/C (65/35) has shown high pilling. As a common trend in all these woven fabrics, pilling increases with certain number of revolutions and then it starts decreasing. It is explained with the detailed mechanism of pill formation and falling with suitable schematics with 7 distinct stages.

Further, the pilling results are subjected to theoretical analysis considering the various possible kinetics of the sample tubes inside the pill boxes. Theoretical analysis revealed that as the number of polygon side increases, the total sample tube movement increases leading to continuous motion as in cylindrical box, single impact force decreases while the total impact force of the sample remain same. As sliding angle, the inclination angle of the polygon side with horizontal at which the sample tube starts moving, increases, increase in total impact force and tube travel time with

decreasing rate change is observed. Experimental trials have revealed that hexagonal box is more efficient in pilling of textiles than the other boxes. It has shown pills / in², as measured through counting glass, of 3.2, 4.5, 2.7, 4.3, 2.8, 2.4 for cotton, viscose, P/C (80/20), P/C (65/35), P/V (70/30) and linen, respectively with the total average pills of 79 put together for all the materials. Mechanisms and statistical analysis have been attributed. Overall ranking of the pill boxes have shown that hexagonal, cubical, octagonal, triangular and cylindrical is the order of pilling.

Prompted by the theoretical analysis, two cylindrical boxes with two different wavy patterns of cork linings are developed for the pilling study with P/C (65/35) blend as it has shown good pilling. The results are compared with the hexagonal box as it is found to be the best among the other geometrically shaped pill boxes with plain cork lining. This study also includes the effect of speed of rotation of the pill boxes in terms of RPM. Accordingly the pilling is carried out for 70, 60, 50, 40 RPMs. As per the study, cylindrical boxes with wavy patterned cork lining show a high degree of pilling compared to even the hexagonal box, particularly at higher RPMs. With decrease in pill box speed, the intensity of pilling of textile materials increase.