J. Farm Sci., 29(4): (495-499) 2016

Effect of laundering on absorbency properties of toweling fabrics

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(Received: August, 2016 ; Accepted: December, 2016)

Abstract: Towel is a word derived from the word 'tovalile' a roller towel or linen. A towel forms an important class in home textiles and is an essential part of consumption. Towels are absorbent cloths used to wipe one's hands, face, and body. The research on Effect of laundering on absorbency properties of toweling fabrics was carried out with an objective to know the Effect of laundering on absorbency properties of toweling fabrics. A self structured questionnaire was used to elicit information personally from the shops. Based on the survey results the most preferred toweling fabrics *viz.,* plain weave, Twill weave, Huck-a-back, Honey comb, Diamond weave, Both side uncut pile, One side uncut pile, One side cut pile were selected and assessed Effect of laundering on absorbency of toweling fabrics subjected to multiple washes (sinking test, water up take and wick up test).the results revealed that, Huck-a-back toweling fabric sample exhibited higher sinking time. In water up take Both side uncut pile, Huck-a-back and honey comb control sample had higher water up take. Huck-a-back, twill weave and Honey comb weave samples showed higher level of capillary rise in one and two and five minutes. However further increase in time, wick-up action was slow in the case of all toweling fabric samples. Thus, it can be recommended that Huck –a-back toweling fabrics as best suited fabric because of its comfort and better absorbency properties.

Key words: Diamond weave, Honey comb, Huck-a-back, Plain weave, Toweling fabrics

Introduction

Home textile consists of a various range of functional as well as decorative clothes used mainly for day- to- day household activities namely cooking, washing, cleaning, mopping bathing etc. The fabrics are used for home textiles consists of both natural and man-made fibres. Generally, home textiles are produced by weaving, knitting, crocheting, knotting, or pressing fibers together. A number of home textiles are typical in structure used for household purpose and are produced using different methods of construction and composition. The basic items may be grouped as sheets and pillowcases, blankets, table cloths, carpets, rugs and toweling fabrics. A towel forms an important class in home textiles and is an essential part of consumption. Towels are absorbent cloths used to wipe one's hands, face, and body. The invention of the towel was associated with the city of Bursa, Turkey in the 17th century. The city is still noted for the production of "Turkish towels." Towel is a word derived from the word 'tovalile' a roller towel or linen. They vary in weave being Plain, Twill, Pile or figured weave *i.e.,* Honey comb and Huck-a-back *etc.* Towels were made earlier of linen but now almost invariably made up of cotton, rayon/cotton or rayon/cotton/linen blends.

Absorbency, the ability of taking in a fluid, is one of the major property that provide comfort properties in some clothes such as sportswear and underwear clothing, for drying properties in napkins, towels and bathrobes, for health concerns in some medical textile such as bandages, gauze and absorbent cotton, and for cleaning properties in washcloths and mops. The present trend in towel market is towards innovative design that serves the functional requirements of absorbency and retains the softness in a better manner. The antimicrobial finishes for these products are also gaining importance. Such efforts help to serve the user purpose in an improved manner and result in fashionable high tech toweling products. India is one of the major exporters of towels; however, scientific approach towards functional requirements of toweling material is limited (Anon., 2008). Hence, the present study is planned on absorbency properties of toweling fabrics.

Material and methods

The most popular and preferred toweling materials were selected based on the survey results. The general information of the selected toweling fabrics viz., plain weave, Twill weave, Huck-a-back, Honey comb, Diamond weave, Both side uncut pile, One side uncut pile, One side cut pile is narrated in the table 1.

In the present study the toweling fabrics were tested for important absorbency properties of fabrics viz., sinking, water up take and wick up test

Wash test

The toweling fabrics were subjected to 15 washes and the parameters were assessed after every 5th wash

Effect of laundering on sinking of toweling fabric samples subjected to multiple washes

This type of test is suitable for measuring the performance of fabric intended for use as tent cloth, water buckets, *etc.*

Cloth sinking test of toweling fabrics subjected to multiple washes is furnished in Table 2. Huck-a-back control sample reported higher value of (8.0 sec) sinking time followed by plain weave (7.4 sec) and punche plain weave (7.1 sec) least was one side cut pile (3.0 sec).

Irrespective of different weave structure of toweling fabrics sinking time was increased with increase in number of washes. Similar trend was observed at 15th level of washes as it was

Table 1. Information of toweling fabrics

Name of the sample	Fibre content	Colour	Length x width(inches)	Price(Rs)
Plain weave Cotton	White	30 x 60	140	
plain weave Punche	Cotton	White	60 x 120	170
Twill weave Cotton	White	30 x 62	175	
Huck-a-back Cotton	White	75 x 150	165	
Honey comb Cotton	White	30 x 60	135	
Diamond weave	Cotton	White	30 x 60	160
Both side uncut pile	Cotton	White	74 x 149	250
One side uncut pile	Cotton	White	10 x 15	35
One side cut pile	Cotton	Orange	30 x 60	150

Table 2. Effect of laundering on Sinking (secs) of toweling fabrics subjected to multiple washes

Samples	Sinking test (secs)			
	Control	No. of washes		
		5th	10th	15th
Plain weave	7.4	7.5	7.7	8.0
Plain weave punche	7.1	7.4	7.5	7.6
Twill weave	4.5	5.1	5.2	5.5
Huck-a-back	8.0	8.1	8.3	8.7
Honey comb	4.6	4.8	4.9	5
Diamond weave	4.5	4.9	5	5.1
Both side uncut pile	4.2	4.4	4.6	5.3
One side uncut pile	3.5	4	4.4	4.8
One side cut pile	3.0	3.9	4	4.5

Anova table

Factors	S.Em+	C.D.	CV%
Plain weave	0.205	0.386	4.637
Plain weave Punche	0.302	0.569	7.051
Twill weave	0.543	1.023	18.484
Huck-a-back	0.501	0.944	10.458
Honey comb	0.235	0.442	8.425
Diamond weave	0.247	0.466	8.743
Both side uncut pile	0.434	0.818	16.586
One side uncut pile	0.129	0.243	4.370
One side cut pile	0.123	0.232	4.361

S.Em± = Standard Error Mean   C.D. = Critical Difference   C   V% = Co-efficient of variance

seen for control samples. Huck-a-back washed samples attained maximum sinking time (8.7sec) followed by Plain weave (8.0sec) and Plain weave punche (7.6sec) and least was One side cut Pile weave (4.5sec).

Statistical results revealed that, increase in cloth sinking time was found to be non significant between control and washed samples.

Huck-a-back Control sample exhibited higher sinking time and the least was observed in One side cut Pile (Table 2) and One side uncut Pile. This may be due to the higher level of individualized fibres in the constituent yarn and fabric which provides much larger air voids within the fabric structure, resulting in faster rate of sinking. Huck-a-back weave and plain weave restricted the migration of water molecules due to the smaller size air voids within the yarn and fabric structure. Bhargava *et al. (*1983) also recorded the similar results in their study. Keskin (1993) concluded that absorption was based mainly on the spaces within the fabric rather than on the fabric itself.

Further, it is observed that cloth sinking time was also increased with increased number of washes. This might be due to the decreased void content of all the samples with compactness of warp and weft yarn leads to lower porosity and as a consequence higher sinking time

Effect of laundering on water up take of toweling fabric samples subjected to multiple washes

Table 3 narrates about the water- up take of toweling fabrics subjected to multiple washes. Among the control samples, Both side uncut Pile sample attained higher values (49.32g) followed by Huck-a-back (45.04g) and Honey comb (45.14g). Lowest value was seen in one side cut Pile (19.93g).

Despite of different weave structures of toweling fabric samples values of water up take was observed in increasing order with the increase in number of washes. At 15th level of washes the same aforesaid order was seen with washed samples *i.e.,* Both side uncut pile depicted greater values of water up take (55.61g) followed by Huck-a-back (50.02g) and Honey comb

Table 3. Effect of laundering on water up take of toweling fabrics subjected to multiple washes

Samples	Water up take			
	Control	No. of washes		
		5th	10th	15th
Plain weave	44.71	46.35	47.73	49.80
Plain weave Punche	43.00	44.98	45.23	46.75
Twill weave	43.87	44.50	45.00	47.61
Huck-a-back	45.14	46.78	48.92	50.02
Honey comb	45.04	46.10	48.61	49.93
Diamond weave	42.25	43.85	45.06	47.73
Both side uncut pile	49.32	50.00	52.93	55.61
One side uncut pile	25.45	27.19	27.69	29.52
One side cut pile	19.93	20.52	23.25	25.61

Anova table

Factors	S.Em+	C.D.	CV%
Plain weave	0.1598	0.0189	4.6964
Plain weave Punche	0.1479	0.0072	3.9679
Twill weave	0.1585	0.0177	1.7227
Huck-a-back	0.1388	0.0434	9.4160
Honey comb	0.1422	0.08208	2.4674
Diamond weave	0.1003	0.0094	2.0143
Both side uncut pile	0.1812	0.1008	10.8759
One side uncut pile	0.1589	0.0806	7.6172
One side cut pile	0.1456	0.0685	9.8119

S.Em± = standard error mean C.D. = critical difference CV% = co-efficient of variance

(49.93g) and the least was one side cut pile (9.93g). Statistically it was inferred that the water up take value of all the toweling fabric samples were found non-significant between control and washed samples.

Both side uncut pile, Huck-a-back and honey comb control sample had higher water up take (Table 3) and the least for one side cut pile weave. This may be because of both side uncut pile weave , Huck-a-back and Honey comb weave have the maximum float length i.e. more surface area associated with ridges and hollows in the structure, causing more water molecules to penetrate in to the fabric and therefore, greater absorption of water. Water up take was found higher for coarse fabric than fine fabric. Loose weave structure provides greater capacity to hold water molecules as the fabric porosity is higher. Also under spacing of yarn facilitates more expose of yarn surface to water molecules and higher absorption capacity. Increase in cloth sett gives a lower value of permeability i.e., a denser fabric has lower porosity as compared to a loose fabric. This behavior is due to the weave structure and openness or closeness of warp and weft yarn (Booth, 1996).

Effect of laundering on cloth wick-up of toweling fabric samples subjected to multiple washes

High and uniform absorbency of toweling fabrics is a desirable quality in all the household activities absorbency of fabrics is influenced by their wicking ability. Wicking occurs when a fabric is completely or partially immersed in a liquid or in contact with a limited amount of liquid. Wicking plays an important role in its performance, transporting perspiration from wet skin for quick evaporation, absorption of fluid or water by towel, cleaning cloth, diapers, gauge and bandages *etc.*

In the present study, the liquid rise in a capillary is measured. Higher the liquid rise in the capillary in a given time where a specified set of experimental conditions, better is the wickability of the material.

It is revealed from Table 4 a b c that, Huck-a-back, twill weave and Honey comb weave of control as well as washed samples showed higher level of capillary rise in one and two and five minutes. The rise of water by the wick-up action was very quick in the 1st one minute. However further increase in time, wick-up action was slow in the case of all toweling fabric samples this may be because of the amount of water a towel can take up initially depends on the affinity of fibre material towards the water. Subsequently fabric construction, inter and intra yarn space play role. Besides fibre affinity towards water, water can also rest between fibres in the yarn. The space available between fibres depends on the configuration of fibres in the yarn. *i.e.,* yarn structure wicking height varies directly with the cohesiveness of the yarn.

The wicking height also increased in control and washed sample with increased number of washes which may be due to increase of the contact surface area which results in higher water absorbency. This simulates the exact body wiping conditions with towels. Similar findings were reported in the study conducted by Swani *et al.* (1984)

Conclusion

Control Huck-a-back toweling fabric sample exhibited higher sinking time and the least was one side cut pile and one side uncut pile. Both side uncut pile, Huck-a-back and honey comb control sample had higher water up take and the least for one side cut pile weave.Huck-a-back, twill weave and Honey comb

Table 4(a). Effect of laundering on wick up test (Cm) of toweling fabrics for 1 min subjected to multiple washes

Samples	Wicking test(cm)							
	Control		No. of washes					
			5th		10th		15th	
	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
Plain weave	4.9	6.3	5.9	5.53	7.5	6.9	7.6	7.7
Plain weave Punche	5.3	6.5	5.6	6.6	5.8	6.8	6.1	7
Twill weave 7.26	7.7	7.3	7.9	7.4	8.1	7.6	8.3	
Huck-a-back	7.8	7.7	8	7.9	8.1	8.5	8.6	8.6
Honey comb	6.5	7.6	7.8	7.9	7.9	8.1	8.0	8.2
Diamond weave	5.8	7.6	6.0	7.8	6.1	7.9	6.3	8.4
Both side uncut pile	5.1	5.1	5.6	5.2	5.7	5.5	5.9	5.8
One side uncut pile	5.0	5.3	5.2	5.4	5.4	5.7	5.6	5.8
One side cut pile	4.8	5.1	5.0	5.3	5.2	5.8	5.5	6.1

Anova table

Factor	S.Em±		C.D.		CV%	
	Warp	Weft	Warp	Weft	Warp	Weft
Plain weave	0.592	0.369	6.147	0.775	15.769	9.620
Plain weave Punche	0.192	0.424	0.363	0.800	5.82	10.903
Twill weave	0.247	0.332	0.466	3.114	5.260	7.016
Huck-a-back	0.233	0.346	0.439	0.652	5.443	7.461
Honey comb	0.195	0.168	0.368	3.074	4.466	3.648
Diamond weave	0.279	0.219	0.526	0.412	7.968	4.781
Both side uncut pile	0.140	0.228	0.264	0.430	4.343	7.296
One side uncut pile	0.201	0.247	0.379	0.466	6.550	7.697
Both side cut pile	0.218	0.297	0.411	0.560	7.315	9.234

S.Em± = standard error mean C.D. = critical difference CV% = co-efficient of variance

Table 4(b). Effect of laundering on wick up test (cm) of toweling fabrics 2 min subjected to multiple washes

Samples	Wick up test							
	Control		No. of washes					
			5th		10th		15th	
	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
Plain weave	6.7	8.1	7	7.9	8.5	8.5	8.7	7.7
Plain weave Punche	6.9	8.4	7.1	8.6	7.4	8.8	7.6	9
Twill weave	8.9	10.0	9.1	10.1	9.3	10.4	9.4	10.6
Huck-a-back	9	8.96	9.23	9.33	9.6	9.7	10.16	10.33
Honey comb	8.7	8.9	9.2	9.3	9.8	9.4	10.6	9.6
diamond weave	8.56	8.76	8.63	8.83	8.83	9.06	9	9.53
Both side uncut pile	5.2	5.3	5.4	5.7	5.6	6.0	5.9	6.2
One side uncut pile	5.1	5.4	5.3	5.7	5.7	5.8	5.8	6.0
Both side cut pile	5.3	5.4	5.7	5.8	6.1	6.1	6.2	6.4

Avova table

Factor	S.Em±		C.D.		CV%	
	Warp	Weft	Warp	Weft	Warp	Weft
Plain weave	0.373	0.298	0.969	0.625	8.331	6.057
Plain weave Punche	0.221	0.244	0.417	0.461	5.273	4.853
Twill weave	0.268	0.305	0.505	0.575	5.036	5.129
Huck-a-back	0.179		0.337		3.969	
Honey comb	0.141	0.435	3.074	3.074	2.516	6.837
diamond weave	0.239	0.210	0.461	0.396	4.727	4.034
Both side uncut pile	0.239	0.184	0.451	0.346	7.472	5.529
One side uncut pile	0.15	0.241	0.282	0.454	4.709	7.254
One side cut pile	0.197	0.206	0.371	0.389	5.789	6.003

S.Em± = standard error mean C.D. = critical difference CV% = co-efficient of variance

Table 4(c). Effect of laundering on wick up test (cm) of toweling fabrics 5 min subjected to multiple washes

Samples	wick up test							
	Control		No. of washes					
			5		10		15	
	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
Plain weave	11.06	11.93	11.16	9.96	11.5	11.73	11.93	12.06
Plain weave Punche	11.5	11.93	11.9	12.13	12	12.36	12.43	12.56
Twill weave	11.56	13.23	12.16	13.5	12.76	13.63	12.96	13.96
Huck-a-back	11.1	12.33	12.03	12.66	12.1	13.1	12.83	13.5
Honey comb	7.86	8.13	8.1	8.46	8.93	8.9	9.1	9.1
Diamond weave	10.76	12.13	11.1	12.36	11.3	12.6	11.8	12.9
Both side uncut pile	8.5	6.1	9	6.5	9.33	7	9.6	7.3
One side uncut pile	5.5	5.7	5.7	5.9	6.0	6.2	6.6	6.9
One side cut pile	7.2	7.6	7.8	8	8.2	8.8	8.8	8.9

Anova table

Factor	S.Em±		C.D.		CV%	
	Warp	Weft	Warp	Weft	Warp	Weft
Plain weave	0.491	0.325	1.031	0.682	7.452	4.930
Plain weave Punche	0.346	0.233	0.652	0.439	5.023	3.299
Twill weave	0.202	0.425	0.381	0.800	2.839	5.422
Huck-a-back	0.295	0.460	3.074	0.867	4.256	6.185
Honey comb	0.197	0.270	0.371	0.508	4.0184	5.412
Diamond weave	0.263	0.179	0.496	0.337	4.060	2.487
Both side uncut pile	0.226	0.317	0.425	0.598	4.299	8.179
One side uncut pile	0.186	0.2	0.350	3.389	5.394	5.572
One side cut pile	0.242	0.213	0.456	0.401	5.232	4.431

S.Em± = standard error mean C.D. = critical difference CV% = co-efficient of variance

weave of control as well as washed samples showed higher level of capillary rise in one, two and five minutes. The rise of water by the wick-up action was very quick in the 1st one minute. However, with further increase in time, wick-up action was slow in the case of all toweling fabric samples. The present study also revealed the effect of repeated washing treatments on fabric stability *i.e.,* water absorption behavior, structural and durable properties.

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