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Research Article

INFLUENCE OF STRUCTURAL PROPERTIES ON DURABILITY OF DYED COTTON FABRIC AFTER LAUNDERING

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Abstract: In this study an attempt has been made to know the influence of structural properties on durability of cotton fabric after laundering. The structural and durable properties were assessed before washing and after every 5th wash and influence was calculated. The results revealed that the influence of GSM of black and blue test samples has affected the warpway tensile strength after 10th and 15th washes (-05.10 and -03.07 respectively) and green and red test samples after 15th wash (-04.41 and -03.38 respectively) and the GSM has negatively influenced the weftway tensile strength of black (-02.83) and red (-02.43) test samples; and positively the blue sample (02.52) after 15th wash. The warpway elongation was influenced by GSM of black sample (-02.74) and cloth thickness of green sample (03.63) at control and the cloth thickness of blue sample after 5th wash (02.41). After 15th wash, the cloth thickness of blue sample (-02.45) and GSM of green sample (-02.79) influenced negatively and the ends per inch influenced the weftway elongation of green fabric at control (-03.46) & the cloth count (warpway) and GSM of red sample did influenced after 5th (02.48 and 02.38 respectively) and 15th washes (02.57 and -04.05).After 15th wash the abrasion cycles influenced by the picks per inch (cloth count weft - 02.44).This is because the tensile force readily displaced the cellulose molecules in the amorphous region and wear off of the ultimate fabric and chemicals present in the surfactant.

Keywords: Dyed cotton fabrics, Surfactant, Laundering

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Introduction

Improvement Cotton textiles represent more than half of the global textile market and the demand is expected to continue. This dominance mainly due to its natural comfort and simple process of its dyeing and finishing compared to synthetic fibre, because of excellent absorbency ability [1]. A measurement of the length of time of a textile product will meet expectation of performance for its end use. Durable properties relating to resistance to wear and destruction in use. Durability of fabric is one of the very important criteria for consumers. It is affected mainly by strength, abrasion resistance and other related mechanical parameters. All finished fabrics must conform to certain performance specifications depending upon their intended end use. The tensile strength is the fundamental ability to resist strain or rupture induced by tension. The tensile strength of the fabric depends upon the fibre content and its inherent properties like type of yarn, yarn number, crimp in the yarn, threads per inch (TPI) and compactness of the weave. Friction is resistance to the relative motion of one body sliding over another body when they are in contact. The maintenance of cotton fabric is an important aspect, which could be done with the usage of proper soaps and detergents that not only remove dirt and grime from the fabric but also act as conductive to maintain good health [2]. But it has adverse effect on physical properties of cotton fabric. So, the present work was designed to experimentally study the effect or influence of structural properties like cloth count, cloth thickness and cloth weight on durability like tensile strength and elongation and abrasion resistance of cotton fabric after laundering.

Methodology

The present investigation entitled efficiency of surfactants on stain removal was carried out during the year 2015-16 at College of Rural Home Science, Dharwad, Karnataka. The experimental procedure involved selection of test samples, dye and colour; laundering of dyed fabric; and assessment of quality parameters on subsequent washes.

The test sample selected for the present study was dyed cotton fabrics. The most popular dye commonly used on cotton to dye the fabric, vat dye, that has good light and wash fastness was selected. Further four dark hues (black, blue, green and red) which fade on exposure to light and bleed on washing were chosen, of which one being the neutral colour, the black. Both dye and hues were selected purposively. The dyed cotton fabrics were subjected for a total of 15 washes and the quality parameters were assessed after every 5th wash. The surfactant which was in demand by the consumer and sold maximum was selected to wash the test samples.

Result and discussion

The results are presented in three sub headings *viz*., Influence of cloth count, cloth thickness and cloth GSM on tensile strength (kgf), elongation (%) and abrasion resistance (cycles) of dyed cotton samples.

Influence of Cloth Count, Cloth Thickness and Cloth GSM on Tensile Strength (Kgf) of Dyed Cotton Samples

[Table-1(a)] and [Table-1(b)] reveals the influence of cloth count, cloth thickness and GSM on warpway tensile strength of dyed samples. It is evident from [Table-1(a)] that the cloth count and cloth thickness did not influence the corresponding warpway tensile strength significantly. On the contrary, the influence of GSM of black and blue test samples on the corresponding warpway tensile strength was found to be significant at 1 % level of significance after 10th and 15th washes (-05.10 and -03.07 respectively). Similarly, the influence of GSM of green and red test samples was also significant at 1 % level of significance after 15th wash (-04.41 and -03.38 respectively), which clearly indicates that the GSM of the test samples has direct and positive impact on the warpway tensile strength. However, it is imperative to state that the cloth count and cloth thickness have impact on GSM, that intern has affected the warpway tensile strength.

Table-1(a) Influence of cloth count, cloth thickness and GSM on warpway tensile strength (kgf) of dyed cotton samples

Sample	Warpway tensile strength (kgf)												
	Control				5th wash			10th wash			15th wash		
	Variables	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat
Black	X_1	0.17	0.24	0.70^{NS}	-0.17	0.19	-0.89^{NS}	-0.09	0.08	-01.10^{NS}	-0.75	01.05	-0.71^{NS}
	X_2	-0.19	0.11	-01.73^{NS}	0.10	0.30	0.35^{NS}	-0.12	0.13	-0.87^{NS}	0.19	01.30	0.14^{NS}
	X_3	-05.66	21.08	-0.26^{NS}	-13.45	15.44	-0.87^{NS}	-03.06	09.26	-0.33^{NS}	-51.31	90.19	-0.56^{NS}
	X_4	-52.48	09.90	-05.29^{NS}	-152.21	134.89	-01.12^{NS}	-122.77	42.22	-02.90**	249.89	246.65	03.01**
	R^2		0.86			0.34			0.72			0.38	
Blue	X_1	0.32	0.51	0.64^{NS}	-0.09	0.20	-0.47^{NS}	-0.24	0.20	-01.18^{NS}	-0.31	0.48	-0.26^{NS}
	X_2	01.23	0.63	01.94^{NS}	0.96	0.96	01.00^{NS}	-0.34	0.30	-01.12^{NS}	-0.33	0.57	-0.59^{NS}
	X_3	48.63	74.79	0.65^{NS}	-17.45	23.02	-0.75^{NS}	03.70	21.79	0.16^{NS}	03.01	76.35	0.03^{NS}
	X_4	156.00	111.65	01.39^{NS}	61.80	173.44	0.35^{NS}	-221.16	43.33	-05.10**	-731.14	237.77	-03.07**
	R^2		0.51			0.21			0.86			0.82	
Green	X_1	-01.54	0.71	-02.14^{NS}	0.13	0.16	0.77^{NS}	0.30	0.79	0.37^{NS}	-0.19	0.34	-0.57^{NS}
	X_2	-0.05	0.63	-0.08^{NS}	-0.03	0.25	-0.13^{NS}	0.03	0.60	0.06^{NS}	0.02	0.24	0.11^{NS}
	X_3	130.20	38.97	00.34 ^{NS}	01.60	14.71	0.10^{NS}	-15.02	51.12	-0.29^{NS}	18.55	34.18	0.54^{NS}
	X_4	-77.67	72.28	-01.07^{NS}	180.41	68.49	02.63 ^{NS}	25.16	126.56	0.19 ^{NS}	-555.89	125.79	-04.41**
	R^2		0.72			0.69			0.03			0.83	
Red	X_1	0.02	0.72	0.04^{NS}	0.04	0.64	0.07^{NS}	0.43	0.76	0.57^{NS}	0.80	0.23	0.37 ^{NS}
	X_2	-0.24	0.56	-0.44^{NS}	0.37	0.54	0.69^{NS}	0.37	0.50	0.72^{NS}	-0.57	0.27	-02.06^{NS}
	X_3	-48.94	61.20	-0.79^{NS}	-02.22	17.77	-0.12^{NS}	-42.64	35.54	-01.19^{NS}	-57.28	36.55	-01.56^{NS}
	X_4	-12.07	324.28	-0.03^{NS}	46.54	122.73	0.37^{NS}	-59.47	205.21	-0.28 ^{NS}	-316.96	93.76	-03.38**
	R^2		0.13			0.13			0.42			0.80	

X1= Cloth count warp, X2= Cloth count weft,X3= Cloth thickness, X4= Cloth GSM, NS – Non significant, * - Significant at 5 % level of significance, ** - Highly significant at 1 % level of significance

Table-1(b) Influence of cloth count, cloth thickness and GSM on weftway tensile strength (kgf) of dyed cotton samples

Sample	Weftway tensile strength (kgf)												
	Control				5th wash			10th wash			15th wash		
	Variables	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat
Black	X_1	-0.48	0.44	-1.08 ^{NS}	0.17	0.30	0.57 ^{NS}	-0.79	0.39	-2.03 ^{NS}	-0.46	0.35	-1.31 ^{NS}
	X_2	0.052	0.20	0.26 ^{NS}	-0.19	0.46	-0.42 ^{NS}	-0.15	0.63	-0.24 ^{NS}	0.87	0.43	2.01 ^{NS}
	X_3	-8.76	37.82	-0.23 ^{NS}	41.05	24.03	1.70 ^{NS}	7.09	42.01	0.16 ^{NS}	-16.69	30.02	-0.55 ^{NS}
	X_4	-11.07	17.76	-0.62 ^{NS}	-258.12	209.88	-1.22 ^{NS}	-410.57	191.60	-2.14 ^{NS}	-232.71	82.11	-2.83*
	R^2		0.35			0.38			0.60			0.79	
Blue	X_1	0.11	0.34	0.33 ^{NS}	-0.03	0.26	-0.15 ^{NS}	-0.16	0.90	-0.17 ^{NS}	0.06	0.36	0.18 ^{NS}
	X_2	-0.38	0.43	-0.88 ^{NS}	1.71	1.23	1.38 ^{NS}	-0.52	1.36	-0.38 ^{NS}	-0.32	0.42	-0.76 ^{NS}
	X_3	9.28	50.87	0.18 ^{NS}	-21.39	29.64	-0.72 ^{NS}	36.39	96.64	0.37 ^{NS}	-40.36	56.53	-0.71 ^{NS}
	X_4	57.37	75.95	0.75 ^{NS}	159.67	223.26	0.71 ^{NS}	-231.01	192.20	-1.20 ^{NS}	444.37	176.04	2.52*
	R^2		0.39			0.30			0.30			0.63	
Green	X_1	-1.31	0.31	-0.25 ^{NS}	-0.08	0.34	-0.25 ^{NS}	-0.34	0.82	-0.41 ^{NS}	-0.33	0.34	-0.99 ^{NS}
	X_2	-0.47	0.27	-1.70 ^{NS}	0.46	0.52	0.87 ^{NS}	-0.12	0.61	-0.20 ^{NS}	0.11	0.24	0.47 ^{NS}
	X_3	-19.72	17.09	-1.15 ^{NS}	12.40	29.91	0.41 ^{NS}	15.63	52.73	0.29 ^{NS}	28.04	33.66	0.83 ^{NS}
	X_4	-13.3	31.69	-0.42 ^{NS}	-37.71	139.17	-0.27 ^{NS}	-17.11	130.55	-0.13 ^{NS}	-266.54	123.89	-2.15 ^{NS}
	R^2		0.87			0.22			0.52			0.49	
Red	X_1	-1.002	0.37	-0.19 ^{NS}	1.41	0.31	2.56 ^{NS}	0.18	0.19	0.97 ^{NS}	1.31	0.35	2.17 ^{NS}
	X_2	0.41	0.28	1.42 ^{NS}	0.75	0.26	2.25 ^{NS}	-0.08	0.12	-0.65 ^{NS}	-0.67	0.41	-1.62 ^{NS}
	X_3	-65.49	31.39	-2.08 ^{NS}	-26.99	8.52	-1.16 ^{NS}	3.08	8.94	0.34 ^{NS}	-67.91	55.08	-1.23 ^{NS}
	X_4	-506.15	166.32	-2.04 ^{NS}	179.87	58.86	2.05 ^{NS}	19.38	51.62	0.37 ^{NS}	-725.52	141.30	-2.43*
	R^2		0.13			0.87			0.34			0.85	

X1= Cloth count warp, X2= Cloth count weft,X3= Cloth thickness, X4= Cloth GSM, NS – Non significant, * - Significant at 5 % level of significance, ** - Highly significant at 1 % level of significance

The R^2 value of black and blue test samples were found to be 0.72 and 0.86 respectively after 10th wash *i.e.*, the influence is 72.00 and 86.00 per cent respectively; and that of black, blue, green and red samples were found to be 0.38, 0.82, 0.83 and 0.80 respectively, which indicates that the percentage influence of GSM on the tensile strength of black fabric was minimum (38.00 %) compared to others. From [Table-1(b)], it is found that the influence of cloth count, cloth thickness and GSM on weftway tensile was non-significant at control, after 5th and 10th wash. But the GSM has negatively influenced the weftway tensile strength of black (-02.83) and red (-02.43) test samples; and positively the blue sample (02.52) where the value is significant at 5 % level of significance. The R^2 value of black, blue and red test samples was 0.79, 0.63 and 0.85 respectively.

Influence of Cloth Count, Cloth Thickness and Cloth GSM on Elongation (%) of Dyed Cotton Samples

[Table-2a)] and [Table-2b)] depict the influence of cloth count, cloth thickness and GSM on warpway elongation (%) of dyed fabrics. It is evident from [Table-2a)] that there was influence of GSM on warpway elongation of black sample (-02.74) and cloth thickness of green sample (03.63) at control and is found to be significant at 5 % levels of significance, respectively.

Table-2(a) Influence of cloth count, cloth thickness and GSM on warpway elongation (%) of dyed cotton samples

Sample	Warpway elongation (%)											
	Control				5th wash			10th wash			15th wash		
	Variables	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat
Black	X_1	-0.06	0.07	-0.93^{NS}	0.02	0.05	0.04^{NS}	0.21	0.09	2.26^{NS}	-0.14	0.22	-0.62^{NS}
	X_2	-0.02	0.03	-0.07^{NS}	0.01	0.09	0.17^{NS}	-0.12	0.15	-0.80^{NS}	0.12	0.28	0.42^{NS}
	X_3	0.61	6.04	0.10^{NS}	-8.09	4.70	-1.72^{NS}	-4.57	10.41	-0.43^{NS}	-11.14	19.61	-0.56^{NS}
	X_4	-7.79	2.83	-02.74*	12.22	41.08	0.29^{NS}	-21.05	47.48	-2.44*	25.17	53.65	02.46*
	R^2		0.71			0.38			0.63			0.28	
Blue	X_1	0.06	0.08	0.72^{NS}	-0.09	0.05	-1.68^{NS}	-0.21	0.16	-1.24^{NS}	-0.02	0.08	-0.35^{NS}
	X_2	0.11	0.10	1.10^{NS}	-0.43	0.27	-1.59^{NS}	0.03	0.25	0.13^{NS}	-0.07	0.09	-0.77^{NS}
	X_3	14.33	12.49	1.14^{NS}	15.65	6.48	02.41*	-1.28	18.02	-0.07^{NS}	-31.50	12.81	-02.45*
	X_4	8.41	18.65	0.45^{NS}	-30.54	48.83	-0.62^{NS}	20.11	35.84	2.56*	-68.83	39.91	-01.72^{NS}
	R^2		0.38			0.76			0.34			0.82	
Green	X_1	-0.37	0.16	-2.21^{NS}	0.07	0.03	2.07^{NS}	0.10	0.26	0.38^{NS}	-0.16	0.28	-0.57^{NS}
	X_2	0.01	0.14	0.09^{NS}	-0.04	0.05	-0.75^{NS}	0.09	0.19	0.45^{NS}	0.01	0.19	0.06^{NS}
	X_3	33.11	9.10	03.63**	-2.15	3.16	-0.68^{NS}	-5.61	16.92	-0.33^{NS}	15.45	27.74	0.55^{NS}
	X_4	-28.63	16.87	-1.69^{NS}	-22.25	14.70	-1.51^{NS}	28.52	41.89	0.68^{NS}	-284.98	102.10	-02.79*
	R^2		0.76			0.61			0.12			0.64	
Red	X_1	0.01	0.36	0.03^{NS}	0.23	0.18	1.29^{NS}	0.43	0.76	0.57^{NS}	-0.07	0.12	-0.60^{NS}
	X_2	-0.11	0.28	-0.42^{NS}	0.21	0.15	1.40^{NS}	0.37	0.50	0.72^{NS}	0.01	0.14	0.12^{NS}
	X_3	-21.85	30.63	-0.71^{NS}	-5.07	5.06	-1.00^{NS}	-42.64	35.54	-1.19^{NS}	01.87	19.52	0.09^{NS}
	X_4	11.84	162.31	0.07^{NS}	27.51	34.95	0.78^{NS}	-59.47	205.21	-0.28^{NS}	-61.71	50.08	-01.23^{NS}
	R^2		0.10			0.40			0.34			0.46	

X1= Cloth count warp, X2= Cloth count weft,X3= Cloth thickness, X4= Cloth GSM, NS – Non significant, * - Significant at 5 % level of significance, ** - Highly significant at 1 % level of significance

Table-2(b) Influence of cloth count, cloth thickness and GSM on weftway elongation (%) of dyed cotton samples

Sample	Weftway elongation (%)											
	Control				5th wash			10th wash			15th wash		
	Variables	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat
Black	X_1	-0.28	0.27	-1.04^{NS}	-8.40	0.11	-0.07^{NS}	-0.28	0.10	-2.58*	-0.11	0.20	-0.53^{NS}
	X_2	0.04	0.12	0.35^{NS}	-0.06	0.17	-0.33^{NS}	0.02	0.16	0.17^{NS}	0.14	0.25	0.56^{NS}
	X_3	-7.71	23.26	-0.33^{NS}	20.34	9.12	2.22^{NS}	2.56	10.92	0.23^{NS}	-10.10	17.85	-0.56^{NS}
	X_4	-0.40	10.92	-0.03^{NS}	-2.19	79.71	-0.027^{NS}	-203.23	49.79	-4.08**	-88.17	48.83	-2.80*
	R^2		0.25			0.50			0.80			0.62	
Blue	X_1	0.04	0.13	0.36^{NS}	0.005	0.11	0.04^{NS}	0.14	0.22	0.66^{NS}	0.03	0.19	0.20^{NS}
	X_2	-0.05	0.16	-0.33^{NS}	0.89	0.53	1.67^{NS}	0.11	0.33	0.33^{NS}	-0.13	0.22	-0.61^{NS}
	X_3	-0.005	19.53	-0.002^{NS}	-13.10	12.79	-1.02^{NS}	-6.68	23.53	-0.28^{NS}	-24.55	29.75	-0.82^{NS}
	X_4	19.19	29.16	0.65 ^{NS}	77.17	96.38	0.80^{NS}	86.90	46.80	1.85^{NS}	157.94	92.64	2.41*
	R^2		0.22			0.42			0.51			0.43	
Green	X_1	-0.71	0.20	-03.46**	-0.10	0.10	-0.96^{NS}	-0.33	0.37	-0.88^{NS}	-0.13	0.21	-0.62^{NS}
	X_2	-0.19	0.18	-1.10^{NS}	0.17	0.16	1.08^{NS}	-0.05	0.28	-0.20^{NS}	0.03	0.15	0.20^{NS}
	X_3	-3.09	11.10	-0.27^{NS}	7.77	9.26	0.83^{NS}	1.91	24.33	0.07^{NS}	11.75	21.00	0.55^{NS}
	X_4	2.04	20.59	0.09^{NS}	-4.19	43.09	-0.09^{NS}	-2.68	60.25	-0.04^{NS}	-168.15	77.28	-2.17^{NS}
	R^2		0.77			0.34			0.15			0.50	
Red	X_1	-0.38	0.19	-1.97^{NS}	0.67	0.15	2.48*	-0.03	0.07	-0.53^{NS}	0.54	0.21	2.57*
	X_2	0.13	0.14	0.91^{NS}	0.47	0.12	1.29 ^{NS}	0.03	0.04	0.77^{NS}	-0.25	0.24	-1.04^{NS}
	X_3	-27.09	16.30	-1.66^{NS}	-12.86	4.12	-2.11 ^{NS}	-6.06	3.29	-1.84^{NS}	-25.91	32.53	-0.79^{NS}
	X_4	-190.59	86.40	-2.20^{NS}	124.94	28.50	2.38*	19.71	19.00	1.03^{NS}	-338.04	83.44	-4.05**
	R^2		0.82			0.89			0.60			0.77	

X1= Cloth count warp, X2= Cloth count weft,X3= Cloth thickness, X4= Cloth GSM, NS – Non significant, * - Significant at 5 % level of significance, ** - Highly significant at 1 % level of significance

Further the cloth thickness influenced the warpway elongation of blue sample (02.41) after 5th wash and is significant at 5 % level of significance. After 15th wash, the cloth thickness of blue sample (-02.45) and GSM of green sample (-02.79) influenced the warpway elongation negatively and the values are significant at 5% level of significance. The R^2 value of black and green samples were found to be 0.71 and 0.76 (control), blue to be 0.76 after 5th wash, blue and green samples to be 0.82 and 0.64 after 15th wash. [Table-2(b)] indicates the influence of cloth count, cloth thickness and GSM on weftway elongation (%) of four dyed cotton samples. It is found that the ends per inch influenced the weftway elongation (%) of green fabric at control (-03.46) and is significant at 1 % level of significance. Similarly, the cloth count (warpway) influenced the elongation (%) of red sample after 5th wash and 15th wash (02.48 and 02.57 respectively) and is significant at 1 % level of significance. Meanwhile the GSM of red sample did influence the percentage elongation after 5th and 15th washes (02.38 and -04.05

Table-3 Influence of cloth count, cloth thickness and GSM on cloth abrasion resistance (cycles) of dyed cotton samples

Sample	Cloth abrasion resistance (cycles)												
	Control				5th wash			10th wash			15th wash		
	Variables	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat	Coefficient	Standard error	t Stat
Black	X_1	-12.28	8.91	-1.37^{NS}	0.81	3.19	0.25^{NS}	0.82	2.73	0.30^{NS}	4.04	6.05	0.66^{NS}
	X_2	0.63	4.03	0.15^{NS}	-3.11	4.93	-0.63^{NS}	-9.02	4.40	-2.04^{NS}	8.04	7.47	1.07^{NS}
	X_3	175.15	762.02	0.22^{NS}	-21.36	252.54	0.084^{NS}	-324.31	293.61	-1.10^{NS}	98.67	517.31	0.19^{NS}
	X_4	338.80	357.92	0.94^{NS}	151.90	205.57	0.068^{NS}	-679.73	338.89	-0.50^{NS}	-242.13	414.78	-0.87^{NS}
	R^2		0.34			0.18			0.58			0.31	
Blue	X_1	2.63	8.72	0.30^{NS}	3.00	2.51	1.19^{NS}	2.29	4.35	0.52^{NS}	2.45	3.18	0.76^{NS}
	X_2	-1.25	10.82	-0.11^{NS}	-7.00	11.86	-0.59^{NS}	-6.63	6.57	-1.00^{NS}	9.12	3.73	02.44*
	X_3	-103.48	274.79	-0.08^{NS}	237.50	283.91	0.83^{NS}	-161.18	465.44	-0.34^{NS}	187.78	498.55	0.37^{NS}
	X_4	-291.07	903.10	-1.15^{NS}	543.54	238.23	0.72^{NS}	307.15	925.65	0.33^{NS}	-155.3	152.52	0.74^{NS}
	R^2		0.25			0.41			0.42			0.58	
Green	X_1	-2.30	7.10	-0.32^{NS}	0.22	2.52	0.087^{NS}	-3.59	5.54	-0.64^{NS}	2.55	5.29	0.48^{NS}
	X_2	0.30	6.25	0.04^{NS}	3.76	3.86	0.97^{NS}	-1.78	4.17	-0.42^{NS}	-5.77	3.75	-1.53^{NS}
	X_3	382.84	384.99	0.99^{NS}	-40.27	219.48	-0.18^{NS}	287.88	355.59	0.80^{NS}	533.27	523.21	1.01^{NS}
	X_4	-487.29	713.98	-0.68^{NS}	-255.78	121.30	-0.25^{NS}	-436.24	880.37	-0.49^{NS}	-884.03	925.55	-0.45^{NS}
	R^2		0.22			0.24			0.18			0.37	
Red	X_1	-0.37	6.07	-0.061^{NS}	11.42	9.70	1.17^{NS}	7.34	6.19	1.18^{NS}	0.08	2.95	0.02^{NS}
	X_2	3.02	4.70	0.64^{NS}	8.53	8.21	1.03^{NS}	-3.57	4.13	-0.86^{NS}	-3.70	3.44	-1.07^{NS}
	X_3	613.67	512.98	1.19^{NS}	-128.21	266.09	-0.48^{NS}	-80.39	288.50	-0.27^{NS}	-120.75	453.92	-0.26^{NS}
	X_4	-660.86	717.85	-0.61^{NS}	-253.09	837.67	-0.13^{NS}	-433.92	665.67	-1.46^{NS}	-807.75	964.37	-0.69^{NS}
	R^2		0.23			0.28			0.33			0.28	

X1= Cloth count warp, X2= Cloth count weft, X3= Cloth thickness, X4= Cloth GSM, NS – Non significant, * - Significant at 5 % level of significance

respectively) and is significant at 5 % and 1% level of significance, respectively; however, the latter showed negative influence. The R^2 value of green sample was found to be 0.77 at control, red sample to be 0.89 after 5th, black sample to be 0.80 after 10th and red sample to be 0.77 after 15th washes.

Influence of Cloth Count, Cloth Thickness and Cloth GSM on Abrasion Resistance (Cycles) of Dyed Cotton Samples

[Table-3] reveals the influence of cloth count, cloth thickness and GSM on cloth abrasion resistance (cycles) of dyed samples. From this Table it was found that the influence of cloth count, cloth thickness and GSM was found to be non significant at control, after 5th and 10th washes. Whereas, after 15th wash the influence of picks per inch (cloth count weft was 02.44) found to be significant at 5 % level of significance and the corresponding R2 value of sample was 0.58.

Conclusion

The warp way tensile strength was higher (22.18 kgf) than its corresponding weft way (09.24 kgf) strength. The tensile strength was higher at control than subsequent washes because the tensile force readily displaced the cellulose molecules in the amorphous region and also there was decrease in breaking load after every 5th (04.95 % and 06.06 %), 10th (09.10 % and 11.03 %) and 15th (09.43 % and 09.43 %) washes in warp and weft directions respectively. Similarly, a trend of decrease in elongation (%) was observed after every 5th wash because of wear off of the ultimate fabric. A great reduction in elongation (%) was observed after 15th wash in warpway (from 11.91 % to 27.59 %) compare to 5th and 10th wash compared to weftway reduction (10.46 % to 20.31 %). In abrasion resistance, the dyed sample exhibited reduction on washing. The reduction in abrasion resistance is because of wearing off of the fabric and chemicals present in the surfactant which affected the polymer system of the fibre. A great reduction was found in abrasion resistance after 10th wash (54.26 % to 58.77 %) compared to 5th wash (06.01 % to 15.50 %). A gradual reduction in abrasion resistance observed after every 5th wash.

Application of research: Now a day, cotton will reach the consumers either in the form of fabrics or readymade garment. Today's consumer is conscious not only of style and comfort, but also of care and durability which could be done with the usage of proper soaps and detergents. But it has adverse effect on physical properties of cotton fabric as chemicals present in these surfactants affect the surface appearance of the fabric *viz*., pilling, weight, thickness, shrinkage, colour fastness, yarn slippage etc.

Research Category: Textile and Apparel Designing

Abbreviations: GSM- Grams per Square Meter, TPI- Threads per Inch, kgf-kilogram force

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