

Study on the Colorfastness Properties of Underwear Manufactured in Bangladesh

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ABSTRACT

Bangladesh is one of the leading exporters of knitted item. Bangladesh started exporting garments for almost 5 decades. Bangladesh earns around 82% of the foreign export earnings from the garments and textile sector. Which is remarkably positive for Bangladesh's economic growth. Bangladesh exports different textile products or textile items or apparel product such as knitted and woven apparels such as t-shirt, polo shirt, ladies tank tops, sportswear and denim apparels. In this study locally manufactured or locally produced underwear was tested. The test results indicate that local underwear could have positive impact to encourage the local manufacturers which will definitely attract the foreign buyers to place orders. It was observed that the color fastness to light, color fastness to washing , dry and wet rubbing and color fastness to perspiration were changed and was within the significant range.

INTRODUCTION

The underwear sector is directly benefitting from the shift of work orders from China and Sri Lanka, growing silently over the last few years. Currently, underwear is the fifth item exported the most from Bangladesh. It is a glowing example of diversification of garment items in recent years. Only a few factories used to produce underwear for some select international retailers and brands as this was not a regular export item for the country. Now more than 500 factories are regularly producing underwear as demand for the locally made items is growing in the West for their competitive prices. Usually, the prices of underwear, such as like lingerie, are more than normal attires as specialized fabrics are required for their manufacture. Last fiscal earning from underwear shipments grew 31.46 per cent year-on-year to \$2.34 billion, according to the Export Promotion Bureau's data compiled by the Bangladesh Garment Manufacturers and Exporters Association (BGMEA).

The export earnings from underwear accounts for 5.49 per cent of the \$42.61 billion-worth garments exported last fiscal year. From this region, Sri Lanka is still famous for producing underwear meant for women as this South Asian country started exporting it many years ago. However, recently they have been steadily losing their market share to Bangladesh.

LITERATURE REVIEW

Knitting is the most common method of interlooping and is second only to weaving as a method of manufacturing textile products. It is estimated that over 7 million tons of knitted goods are produced annually throughout the world. Although the unique capability of knitting to manufacture shaped and form-fitting articles has been utilised for centuries, modern technology has enabled knitted constructions in shaped and unshaped fabric form to expand into a wide range of apparel, domestic and industrial end-uses. [2]

Lingerie and intimate wear garment export to the USA market has emerged as a new strength for

Bangladesh’s robust apparel manufacturing industry. Bangladesh shipped \$150.39 million worth of brassieres, including categories such as shapewear and foundation garments in the 11 months of 2021. Making the country the 5th top lingerie exporter in the USA.

According to the latest official US custom data, Bangladesh brassieres export to the USA gained an impressive 43% growth in January to November period of 2021.

Meanwhile, the data also showed that the USA imported \$2.57 billion worth of brassieres in the first 11-month period of 2021, observing 46.81% year-on-year growth. Marking a lingerie market boom in the USA.

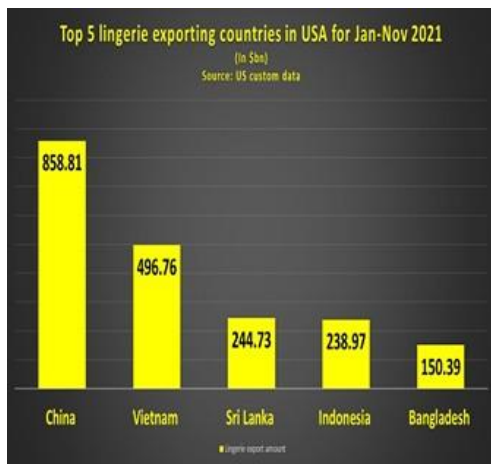


Figure -1 – Top 5 lingerie exporting countries in USA for Jan-Nov 2021

Among the other top 4 lingerie exporter countries – China bragged the top position with \$858.81 million, noting 48.64% Y-o-Y growth in January to November 2021 period. Vietnam exported \$496.76 million brassieres to the USA, growing by 52.77% on yearly basis. Sri Lanka exported \$244.73 million worth of lingerie items, gaining by 34.54%. While Indonesia shipped \$238.97 million worth of lingerie and intimatewear garments. Witnessing a significant 89.64% growth in January to November period of 2021. According to industry insiders, now Bangladesh annually exports \$700 million worth of lingerie globally.^[3]

A complete data is provided with yearly knit and woven apparel export to the world mentioning the country of export.

Table -1 Bangladesh’s Apparel Export to World

(FY2019-20, FY2020-21 & FY2021-22)

Export Value in Million USD^[4]

EU Countries	Woven			Knit			Total		
	2019-20	2020-21	2021-22	2019-20	2020-21	2021-22	2019-20	2020-21	2021-22
Austria	6.06	8.87	11.90	24.13	23.06	32.35	30.19	31.93	44.25
Belgium	282.47	221.73	226.06	310.83	339.86	496.45	593.31	561.59	722.52
Bulgaria	0.13	0.44	0.28	2.14	1.35	1.23	2.27	1.79	1.51
Denmark	226.42	291.35	386.03	397.38	542.46	766.00	623.81	833.81	1152.03
Finland	6.49	7.14	5.27	24.46	23.66	31.03	30.95	30.80	36.31
France	618.26	659.39	849.32	950.99	1109.61	1541.67	1569.25	1769.00	2390.98

Germany	2136.11	2518.67	2987.71	2656.91	3094.01	4181.83	4793.03	5612.68	7169.53
Greece	7.47	7.53	11.54	27.16	25.43	43.45	34.63	32.96	54.99
Italy	425.49	381.68	506.14	770.55	834.72	1090.63	1196.03	1216.40	1596.77
Ireland	67.28	55.08	75.23	79.35	95.07	137.35	146.64	150.15	212.58
Netherlands	395.02	422.72	621.13	477.19	621.02	853.19	872.21	1043.74	1474.32
Portugal	23.13	17.55	26.50	45.26	41.03	59.07	68.39	58.59	85.57
Romania	3.66	3.41	3.89	9.21	11.92	16.87	12.87	15.33	20.76
Spain	936.40	927.40	1280.29	1082.81	1234.01	1738.24	2019.21	2161.41	3018.52
Sweden	198.50	215.61	257.54	350.95	393.94	527.47	549.45	609.55	785.01
Cyprus	0.44	0.21	0.19	1.83	2.03	1.42	2.27	2.23	1.61
Czech Republic	101.70	128.18	130.74	89.79	95.25	139.91	191.49	223.43	270.65
Estonia	0.05	0.09	0.07	1.03	0.95	1.21	1.08	1.04	1.28
Hungary	1.34	17.22	31.04	12.96	68.15	108.86	14.30	85.37	139.90
Latvia	0.05	0.13	0.21	0.60	0.70	0.83	0.65	0.84	1.04
Lithuania	0.42	0.31	0.18	1.42	0.93	0.23	1.84	1.24	0.41
Malta	4.47	0.04	0.06	1.97	0.69	0.21	6.43	0.73	0.27
Poland	448.55	512.48	744.08	629.43	867.92	1261.97	1077.98	1380.40	2006.05
Slovakia	25.13	26.04	21.96	40.20	51.67	58.64	65.33	77.71	80.60
Slovenia	12.24	15.58	23.46	42.47	54.32	91.80	54.71	69.90	115.25
Croatia	5.06	3.56	4.60	9.59	9.77	12.72	14.64	13.33	17.32
Luxembourg	0.04	0.04	0.23	0.68	0.85	1.58	0.72	0.89	1.81
Sub-Total (EU)	5932.38	6442.46	8205.66	8041.30	9544.39	13196.20	13973.68	15986.85	21401.85
EU % of World	42.25	44.44	42.30	57.82	56.28	56.85	50.00	50.82	50.22
Growth%	-19.12	8.60	27.37	-19.10	18.69	38.26	-19.11	14.41	33.87
USA	3772.93	3887.71	5892.92	1373.61	2058.69	3120.17	5146.53	5946.40	9013.09
% of USA	26.87	26.82	30.38	9.88	12.14	13.44	18.41	18.90	21.15
Growth%	-18.32	3.04	51.58	-9.31	49.87	51.56	-16.09	15.54	51.57
U.K.	1464.28	1331.02	1805.87	1708.94	2113.55	2691.35	3173.23	3444.57	4497.22
UK % of World	10.43	9.18	9.31	12.29	12.46	11.59	11.35	10.95	10.55
Growth%	-20.49	-9.10	35.68	-15.30	23.68	27.34	-17.77	8.55	30.56
Canada	480.63	502.99	646.90	395.64	492.60	679.46	876.27	995.59	1326.36
% of Canada	3.42	3.47	3.33	2.84	2.90	2.93	3.14	3.16	3.11
Growth%	-26.19	4.65	28.61	-25.09	24.51	37.93	-25.70	13.62	33.22
Non-Traditional Markets									
Japan	492.49	462.05	507.94	469.45	482.77	590.68	961.94	944.82	1098.62
Australia	260.33	300.74	312.06	340.81	430.38	500.18	601.14	731.13	812.24
Russia	178.76	220.41	207.54	262.12	373.25	376.24	440.88	593.66	583.78

India	272.21	253.49	399.84	148.51	168.37	315.57	420.73	421.86	715.41
Korea Rep.	135.49	143.09	204.27	157.94	179.22	235.48	293.43	322.31	439.75
China	192.33	145.55	138.13	137.63	125.73	84.20	329.96	271.28	222.33
United Arab Emirates	76.31	111.52	144.69	71.14	114.47	137.73	147.45	225.99	282.41
Mexico	90.16	75.69	132.79	76.29	83.01	142.31	166.45	158.70	275.10
Malaysia	62.56	47.88	55.75	92.80	107.21	153.57	155.36	155.09	209.31
Saudi Arabia	39.36	62.70	57.98	47.28	65.32	85.73	86.64	128.02	143.70
Turkey	104.20	73.27	98.28	54.06	43.88	95.41	158.26	117.15	193.69
South Africa	33.37	42.52	49.75	41.85	56.53	68.52	75.22	99.05	118.27
New Zealand	26.29	32.90	33.35	48.53	63.78	77.65	74.82	96.68	111.00
Chile	49.58	37.12	80.99	54.27	45.44	102.35	103.85	82.56	183.34
Brazil	50.96	34.97	38.93	55.67	35.76	54.56	106.63	70.73	93.49
Other Countries	326.56	288.61	385.22	330.16	375.67	506.97	656.73	664.28	892.20
Sub-Total (Non-Trad.)	2390.96	2332.53	2847.49	2388.51	2750.79	3527.14	4779.48	5083.32	6374.63
% of Non-Traditional	<i>17.03</i>	<i>16.09</i>	<i>14.68</i>	<i>17.17</i>	<i>16.22</i>	<i>15.19</i>	<i>17.10</i>	<i>16.16</i>	<i>14.96</i>
% Growth of Non-Traditional	<i>-14.56</i>	<i>-2.44</i>	<i>22.08</i>	<i>-17.29</i>	<i>15.17</i>	<i>28.22</i>	<i>-15.95</i>	<i>6.36</i>	<i>25.40</i>
GRAND TOTAL	14041.19	14496.70	19,398.84	13908.00	16960.03	23,214.32	27949.19	31456.73	42613.16
% Growth	<i>-18.58</i>	<i>3.24</i>	<i>33.82</i>	<i>-17.65</i>	<i>21.94</i>	<i>36.88</i>	<i>-18.12</i>	<i>12.55</i>	<i>35.47</i>

The following table shows the export of knitted items export including underwear

Table 2- Main Apparel Items Exported From Bangladesh

Value in Million USD (Fiscal Year Basis) [5]

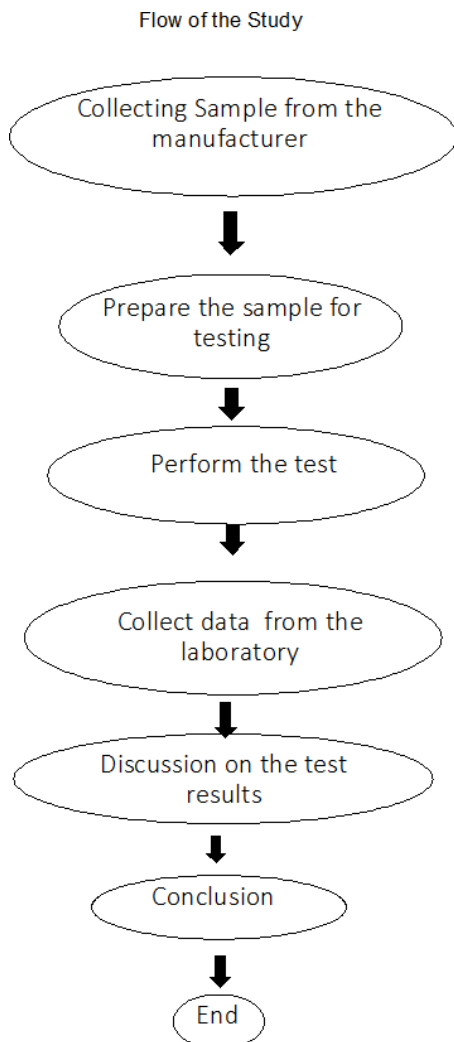
Year	Trousers	T-Shirts & Knitted shirts	Sweaters	Shirts & Blouses	Underwear
2015-16	10167.31	6892.80	3182.47	3076.36	1172.74
2016-17	9943.09	6650.51	3361.53	2918.97	1328.50
2017-18	10833.83	7153.84	3674.70	2927.34	1410.70
2018-19	11754.86	7902.27	4255.91	3190.23	1640.36
2019-20	9362.64	6273.77	3597.68	2449.65	1358.72
2020-21	10681.52	7239.74	4051.83	2048.40	1789.70
2021-22	14507.50	9857.54	5640.45	2765.91	2343.56

MATERIALS AND METHODS

In this study 100% cotton knitted underwear manufactured in a local textile mill was considered as sample. The sample was collected from a local manufacturer. This sample was then taken to the quality control laboratory of a reputed composite knit dyeing factory for testing. After that the sample was tested for the

colorfastness to light for 100% cotton shell fabric, color firstness to washing and rubbing for elasticated fabric and colorfastness to washing and rubbing dry and wet rubbing for 100% cotton shell fabric and colorfastness to perspiration for the 100% cotton shell fabric and colorfastness to perspiration for the elasticated fabric.

Flow of the Study



RESULT AND DISCUSSION

The test results are given below :

. The following instruments were used for the tests.

1. Xenon Arc Light Fastness Tester
2. Gyrowash
3. Crockmeter/Rubbing Fastness Tester

The test methods that were followed as per ISO (International Organization for Standardization) test method mentioned below[6] :

1. ISO 105-B02:2014(en)Textiles — Tests for colour fastness — Part B02: Colour fastness to artificial light: Xenon arc fading lamp test.

2. ISO 105-B04:1994 Textiles — Tests for colour fastness — Part B04: Colour fastness to artificial weathering: Xenon arc fading lamp test.
3. ISO 105-C06:2010Textiles — Tests for colour fastness — Part C06: Colour fastness to domestic and commercial laundering.

Table -3 Colorfastness to light for 100% cotton shell fabric

Color Name	Fabric Type	Test Method	Grade	Remarks
Royal Blue	100% Cotton Single Jersey	ISO 105-B02	Change in color 3-4	

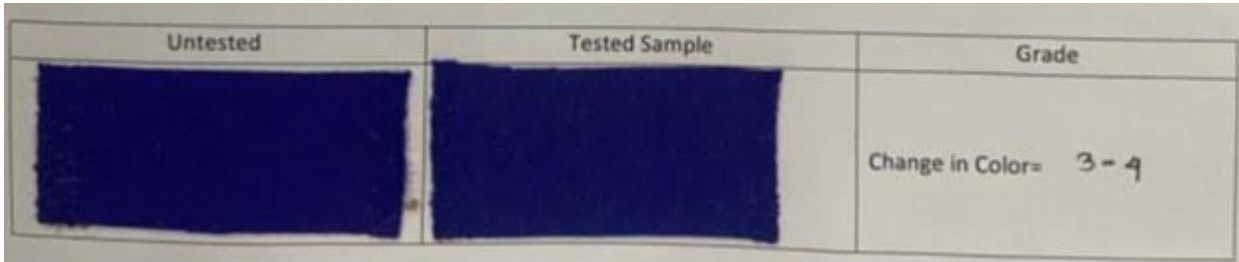


Table 4. Colorfastness to perspiration for underwear elastic fabric in acidic and alkali medium

Color Name		Test Method				
White		ISO 105-B04				
						Grade
Acidic						Change in color
Staining to Multifibre						
Acetate	Cotton	Nylon	Polyester	Acrylic	Wool	
4-5	4-5	4-5	4-5	4-5	4-5	4-5
Alkaline						
Acetate	Cotton	Nylon	Polyester	Acrylic	Wool	
4-5	4-5	4-5	4-5	4-5	4-5	4-5

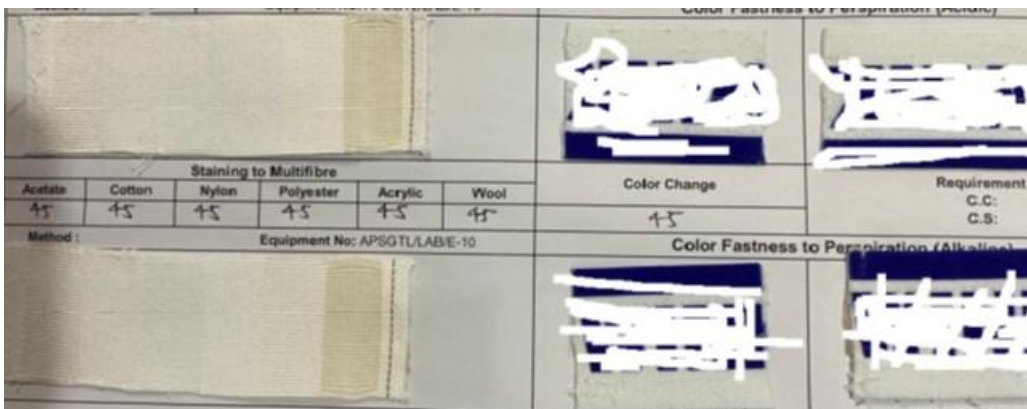


Table 5. Colorfastness to perspiration for underwear shell fabric in acidic and alkali medium.

Color Name	Fabric Type	Test Method				
Royal Blue	100% Cotton Single Jersey	ISO 105-B04				
						Grade

Acidic						Change in color
Staining to Multifibre						
Acetate	Cotton	Nylon	Polyester	Acrylic	Wool	
4-5	4-5	4-5	4-5	4-5	4-5	4-5
Alkaline						
Acetate	Cotton	Nylon	Polyester	Acrylic	Wool	
4-5	4-5	4-5	4-5	4-5	4-5	4-5

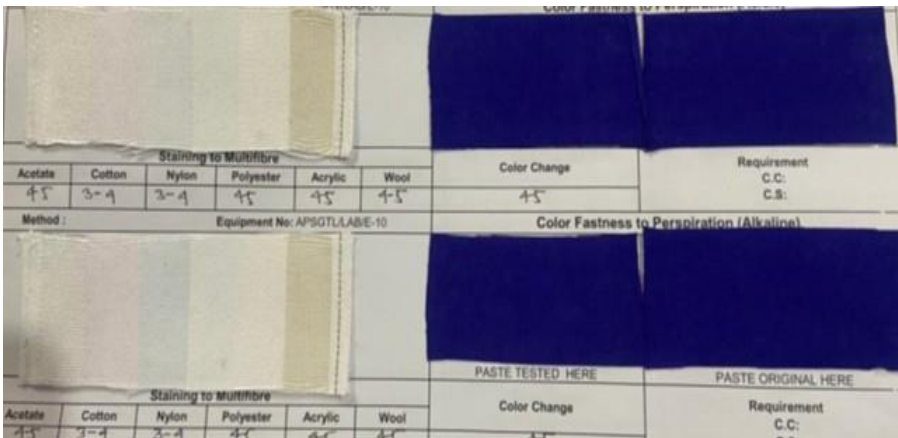


Table 6. Colorfastness to washing for underwear elastic fabric.

Color Name		Test Method				
White		ISO 105-C06 A2S				
						Grade
						Change in color
Staining to Multifibre						
Acetate	Cotton	Nylon	Polyester	Acrylic	Wool	
4-5	4-5	4-5	4-5	4-5	4-5	4-5

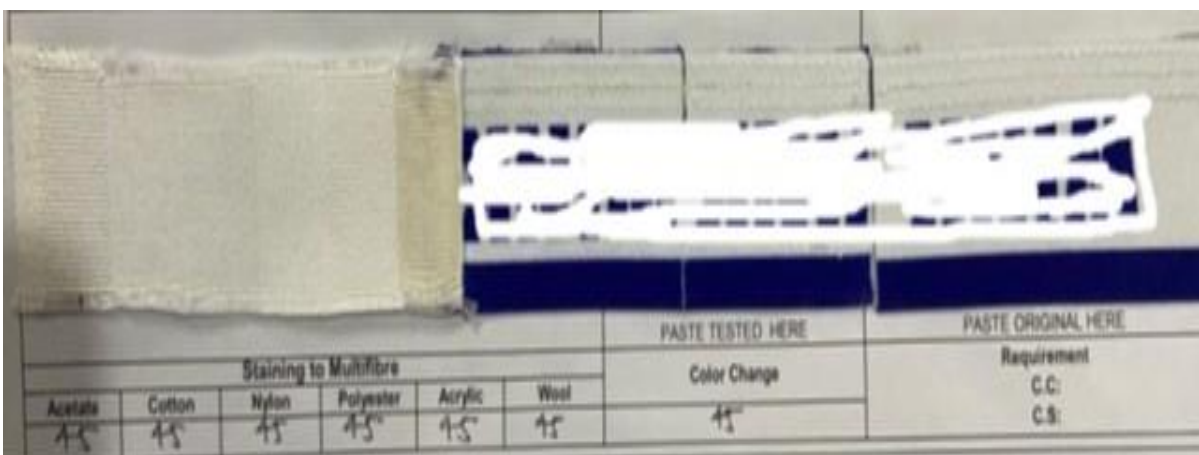


Table 7. Colorfastness to washing and Rubbing for underwear 100% cotton shell fabric

Color Name	Fabric Type	Test Method					
Royal Blue	100% Cotton Single Jersey	ISO 105-C06 A2S					
						Grade	
						Change in color	
Staining to Multifibre						Dry Rubbing	Wet Rubbing
Acetate	Cotton	Nylon	Polyester	Acrylic	Wool		
4-5	4-5	4-5	4-5	4-5	4-5	4-5	2-3



From the table- 3 it can be said that the fastness to light range is within the required range. From table-4 and table-5 it was observed that the colorfastness to washing is acceptable for both the shell fabric and for elasticated fabric in acidic and alkali medium . From table 6 and table -7 it was evident that the color fastness to washing and rubbing (dry and wet rubbing) for both the shell fabric and for elasticated fabric was also within the range.

CONCLUSION:

The study showed that the locally manufactured underwear are produced in a very controlled quality standard which were found from the test results. It would have been very good if more samples could be tested. However, the test results are a good indication that the local manufacturers are capable to promote underwear specially for mens in a large volume. If more entrepreneur step forward then the demand for the underwear can be achieved locally. This will absolutely have an impact in Bangladesh. Furthermore, it should be kept in mind that the quality of the fabric as well as the underwear must be maintained in a regular basis. This will also help the local manufacturers to export their own brands to different countries.

REFERENCES

1. <https://www.thedailystar.net/business/economy/news/underwear-5th-most-exported-item-3170446> Wed Nov 16, 2022 12:00 AM Last update on: Wed Nov 16, 2022 08:10 AM

2. Spencer J David,(2001) Knitting Technology A comprehensive handbook and practical guide.Cambridge: Woodhead Publishing Limited
<https://www.textiletoday.com.bd/bangladesh-lingerie-export-brags-5th-usa/>[https://www.textiletoday.com.bd/ bangladesh-lingerie-export-brags-5th-usa/](https://www.textiletoday.com.bd/bangladesh-lingerie-export-brags-5th-usa/)Posted on January 24, 2022 3:10:09 pm Last updated at January 25, 2022 12:50:49 pm Access Date : 16.11.2002
3. <https://www.bgmea.com.bd/page/AboutGarmentsIndustry> Access Date : 16.11.2002
4. <https://www.bgmea.com.bd/page/AboutGarmentsIndustry> Access Date : 16.11.2002