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Advantages and Applications of Acrylic Fibre in Textiles: A Review

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Abstract: Starting from a mere replacement of wool fibre, acrylic fibre has touched the height of technical & Special purpose fibre category. Its use in aircraft has made history on its own terms. Here in this paper an attempt has been made to highlight different grades of Acrylic fibre, its advantage over other contemporary, fibres general characteristic, different products of Acrylic fibre, end uses & application in various textile fields. Also a glimpse of its properties in a particular denier is given for comparison with other supplementary & complimentary fibres.

Keywords: Acrylic Fibre; Acrylon; Spinning; Grades; Apparel.

Introduction

Acrylic fibre is very versatile fibre, coming next only to polyester and polyamide among synthetic fibres. Acrylic fibre used as a replacement of wool. It is no longer considered a substitute of wool. During the last few years acrylic fibre applications have gone through a dynamic change. Acrylic fibre or acrylic blended with cotton or viscose, imparts softness and warmth along with light weight. Acrylic fibre still has maximum use where bulky appearance, luxurious touch and warmth of fabric are required. Acrylic fabrics do not hold water like cotton fabrics but transport water quickly, roughly at a rate 2 to 3 times that of cotton fabrics and dry quickly. Because of this property acrylic is very popular in athletic socks, sports wear and casual knitwear.

Acrylic fibre has cross section varying from circular, bean shaped and kidney shaped to dog bone shaped, depending upon coagulation bath conditions and spinning process (wet or dry).

Acrylic fibres with non circular cross-section give softer feel. It has very low specific gravity (1.17), high resiliency, moisture regain (2%), moderate tenacity, high elongation and low yarn weight ratio for same cover factor.

Acrylic Fibre: Various grades

- Regular Fibre (Non-shrinkable).
- High Shrinkable Fibre.
- Bicomponent Fibre.
- Micro Denier Regular Fibre
- Hydrophillic Fibre.
- Super Bright Fibre
- Semi-Dull Fibre.
- Gel Dyed Fibre.
- Flame Retardant (Mod Acrylic).
- High Water Absorbent Acrylic.
- Chinon Silk like Fibre.
- Hollow Fibre.
- Antistatic & Conductive Acrylic Fibre.
- Anti Microbial Acrylic Fibre.

Strength of Acrylic Fibre in comparison to other synthetic fibre

Specific properties of Acrylon

A. Strength in use

- Skin friendly

- Good comfort
- Light weight
- Durability
- Easy to care
- Fluffy, soft & warm

B. Strength in properties

- Low pill formation
- Fast & bright colour
- Easy dyeability
- Resistance to sunlight and chemicals.
- Resistance to moths and insects.
- Resistance to abrasion
- No effect of weak acids and weak alkalies as well as oxidizing agent.

C. End uses of Acrylon

- Fabric - Woven, knitted, nonwoven & tufted.
- Apparel – Dress material, overcoats, jackets, shirting, suiting, sarees, sweaters, cardigans, shawls, socks, muffelers.
- Household - Curtains, upholstery, blankets, carpets, towels, velvets.
- Industrial - Bags, shoe padding, filtger cloths, gthermal insulation material, bonded fabrics, felts, filter fabrics, etc.

General characteristics of Acrylic fibre

- Resemblance in feel with wool.
- Good comfort.
- Light weight.
- High bulk.
- Durable and strong.
- Easy to care.
- Fluffy, soft and warm.
- Low pill formation.
- Fast and bright colour.
- Easy dyeability.
- Easy laundering and low maintenance cost.
- Resistance to sunlight and chemicals.
- Resistance to moths and insects.
- Resistance to abrasion
- No effect - Weak acids, weak alkalies, oxidizing agent, dry cleaning solution but sensitive to strong alkalies.
- Economically cheaper than wool.

Acrylic fibre also find use in filter cloth, as a substitute for asbestos and as a precursor for carbon fibre. Above fibres are generally marketed in 1.5 to 15 denier (with some exceptions) in bright/Semidull luster and in various cut lengths and tow.

Products of Acrylic Fibre

Acrylic fibres are being manufactured and generally marketed as below:

Table 1: For cotton spinning and modified cotton spinning

Denier	Cut length (mm)	Luster
0.9D/R	38 44 51	Bright
1.2D/R	38 44 51	Bright/Dull
1.5D/R	38 44 51 64	Bright/Dull
2.0 D/R & HS	38 44 51 64	Bright/Dull
3.0 D/R & HS	- - 51 64	Bright/Dull
5.0 D/R	38 - - 64	Bright/Dull

Table 2: For Worsted Spinning System

Denier	Cut length (mm)	Luster
3.0 D/HS	102 VC	Bright/Dull
3.0D/HS	102 VC	Bright/Dull
5.0D/R & HS	102 VC/ 120	Bright/Dull
8.0D/R	102 VC/120	Bright/Dull
15.0D/R	102 VC/120/150	Bright/Dull
15.0D/HS	102 VC/120/150	Bright/Dull

Tow to Top conversion for woolen/Worsted spinning system.
1.5, 2.0, 3.0, 5.0, 15.0D/HB/HS/NS tops.

Table 3: End Use of Acrylic Fibre

Denier	Count Produced	End use
0.9	80's to 100's	Shirting (Weaving)
1.2	60's	Shifting (Weaving)
1.5	40's to 50's	1/40's T-shirts Circular knitting 2/40's shirting.
2.0	24's to 38's	1/40's Hosiery, valvet 2/24's Flat knitting 2/38's shirting, shawls.
3.0/5.0	All counts <24's	2/4's, 2/6's, 2/8's, 2/16's 4/16's, 3/13's – All are used for hand knitting and fancy uses.
8.0	All counts <24's	2/4's, 2/6's, 2/8's, 2/16's, 4/16's, 3/13's – All are used for hand knitting and fancy uses.
15.0	4's, 6's, 8's, 10's	2/4's, 2/6's, 2/8's, 2/10's Carpet yarn.

Applications of Acrylic Fibre

The various end products developed out of acrylic fibre have been classified in categories of apparel, house hold and industrial uses as tabulated below.

Table 4: Applications of Acrylic Fibre

S. No.	Fabric	Apparel	House Hold	Industrial
1.	Woven	Dress material, dressing gown, over coat, jacket, shirting, suiting, sarees,	Upholstery, curtains, blankets, carpets, towels	Bags and shoe padding, filter cloths, protective materials, thermal insulation, and shock absorber.
2.	Knitted	Pullovers, sweaters, cardigans, swim and sports wear, mufflers, socks, gloves.	Velvets, cloths, curtains	Bonded fabrics
3.	Non Woven & Tufted	Disposable fabrics	Quilt – fitting	Felts, filter fabrics.

Table 5: Properties of Acrylic Fibre (Product 3.0 Denier)

S.No.	Properties	3.0D/R	3.0D/HS
1.	Denier	2.81 – 3.43	2.20 – 2.80
2.	Tenacity (gm/den.)	>2.7	>2.8
3.	%Elongation	33 – 47	20 – 33
4.	%Shrinkage	<3.5	18 – 22
5.	%Moisture	<2.5	<2.5
6.	Crimps (per cm.)	3.0 – 4.5	3.0 – 4.5`
7.	Mean fibre length (mm)	60 – 66	60 – 66
8.	%OLF (by Wt.)	<0.10	<0.10
9.	% Finish	0.30 – 0.31	0.30 – 0.31
10.	Saturation Index	2.10 – 2.20	2.10 – 2.20

Conclusions

Considerably the demanding end uses of Acrylic fibres, the time has come to go for vigorous research on this wonder fibre to make convenient to use for fashionable yarn & fabrics. Apart from that it is highly befitting for flame retardant, hollow & Anti-microbial fibres. The beauty of this fibre is that it can be used for fabrics, Apparel, house hold & industrial products due to its skin friendly quality, comfortably, light weight, fluffy, warmth, Softness and durability. Moreover economically it is cheaper than original wool, which gives an edge over to use it as a most efficient substitute of wool fibre. Starting from shirting to knitted fabrics, its use is abundance in general, fancy fabrics & garment formation. Especially its use in warm clothing's has deburned the use of animal based wool fibre whose production is shinking day by day. Hence this wonder fibre now claims to be one of the best fibre available presently in true sense.

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