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Speciality Fibers for Technical Textile Industries

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Abstract: *The current article highlights the list of specialty fibers used in the manufacturing of difference technical textiles products and also discusses the important fibers manufacturers globally and in India. Technical textile global market is anticipated to grow fromUSD176.83 billion in 2018 to reach USD220.37 billion by2022 with a CAGR of 5.89 per cent.The total market size of technical textile globally is around USD 272 billion and India accounts around USD 22.5 billion. The total trade is USD 126 billion and India trade export figure are USD 2.85 billion. India has huge factories and sufficient capacity for the manufacturing of standard synthetic fibers, but until now, businesses have avoided producing specialty fibers owing to a lack of market demand and the necessary technologies.*

Introduction

High performance textile goods, materials, and fibres that are employed more for functionality than for aesthetics are referred to as technical textiles. Several important sectors, including as aerospace, packaging, hazard protection, shipping, sports, agriculture, defence, healthcare, and construction, use technical textiles in a variety of ways.Large-scale increases in performance, efficiency, resource conservation, cost reduction, environmental protection, and cost effectiveness are all advantages of using technical textile fabrics.

Technical textile global market is anticipated to grow fromUSD176.83 billion in 2018 to reach USD220.37 billion by2022 with a CAGR of 5.89 per cent[1].The total market size of technical textile globally is around USD 272 billion and India accounts around USD 22.5 billion. The total trade is USD 126 billion and India trade export figure are USD 2.85 billion. Over all the penetration of percentage of technical textile goods ranges from 30 to 70% globally and in domestic Indian market it ranges between 10 to 20%.

Some of the factors influencing the growth of the marketare:

1. Rising demand from new application areas
2. Varying consumer preferences
3. Useful physical properties of technical textiles
4. Innovation and R&D
5. Government regulations
6. Climate change and global warming

The manufacturing of fibers with functional properties appropriate for technical textiles has been made possible by advancements in fiber spinning technology, such as melt spinning, wet spinning, etc. The commercial viability of producing specializedfibers has also increased

as a result of technological improvement. However, developed nations like the US, Japan, Canada, and some EU countries account for the majority of the production of specialty variants of regular fibers and high-performancefibers, which make up 30% of the total fibers used in technical textiles. Production has also recently begun to expand in nations like China and Korea.

Nevertheless, India's synthetic fiber portfolio now consists primarily of normal fibers, and while the nation is developing specialty fibers for the market, their quantities are very tiny and nearly non-existent for high-performance fibers. The present paper discusses the list of specialty fibers selected for technical textile manufacturing, their properties, and applications.

Focus On Speciality Fibres[3-8]

The baseline survey of Technical Textiles, Ministry of Textiles, lists around 32 types of specialty fibers having applicationacross different user industries like automotive, defense, industrial applications, construction, etc. Ofthese, the sub-group selected certain fibers and additionally identified 6 more fibers as the focusspecialty fibers based on their application, importance to the economy in the near future, potential forlarge volumes in the future, etc. List of the 23 specialty fibers as identified by the arepresented in the table below:

1 Meta Aramids
2 Para Aramids
3 FR Modacrylic
4 SuperabsorbantFibre
5 High Density Polyethylene (HDPE),/High Modulus Polyethylene (HMPE)
6 Carbon Fibre
7 Polyphenylene sulfide Fibres (PPS)
8 Glass Fibre
9 Flame Retardant (FR) Viscose
10 Flame Retardant (FR) Polyester
11 High Tenacity/ Super high tenacity Nylon (more than 7 gpd)
12 High Tenacity/ Super high tenacity Polyester (more than 7 gpd)
13 High Tenacity/ Super high tenacity Polypropylene (more than 7 gpd)
14 High Tenacity/ Super high tenacity Viscose (more than 7 gpd)
15 Ceramic Fibre
16 Polytetrafluoroethylene (PTFE)
17 PBI Fibres
18 PBO Fibres
19 Anti-microbial/Anti-fungal/Anti-bacterial Fibres
20 Phenolic Fibre
21 Conductive Fibre
22 Fibre for concrete re-enforcement
23 Alginate Fibre

The export of these specialty fibers from India is almost negligible and on the other hand, the import percentage is around 30% for short run products and 11.6% for medium run products. The brief about the above specialty fibers are given the following tables:

A brief about Specialty Fibersin Technical Textiles, properties, applications and manufacturers details[2]:

Sr No	Name of theFiber	Properties	Applications	Global Manufacturers	Indian Manufacturers
1	MetaAramids	Meta-aramid fibers are theheatresistantsynthetic fiber,havinghigh-strength	Flame resistance clothing,helmets, protective vests,bulletproof jackets,bodyarmor, ropes andcables,sporting goods, ballistic bodyarmor, etc.	DuPont (USA) Major, others EU, China, Japan etc.	No indigenous manufacturers
2	Para Aramids	It isknownforitshigh-strength to weight ratio, highmodulus,andexcellentchemicalandthermalstability.	Defense andprotective-clothing like helmets, bulletproof vests, protective handgloves, fire resistantequipment's, etc. Recently ithasalsobeenusedinmanufacturing of tyres.		

3	FRModacrylic	High resilience, easy to dyeto bright shades, abrasionresistant, flame resistant,quick-drying,resistant toacid and alkaline, shaperetentive,etc.	Manufacturingofapparelssuch as children wear, wigs,simulated fur, trims and linings,and deep pile coats, blankets,curtains, carpets, etc. Recentlythisfiberhasfounditsapplication in manufacturing offlame-retardant clothing due toits highheatresistanceproperties.	Solutia Inc (USA), Kaneka Corporation (Japan), YalovaEliat (Turkey), Montefibre (Italy), Mosanto(USA)	No indigenous manufacturers
4	Superabsorbant-Fiber	Super-absorbentfiberabsorbs moisture to severalthousand times its originalweight,undergoingsignificant expansion, andeventuallybecominga gel	Diapers, adult incontinenceproducts, feminine hygieneproducts,	Technical Absorbant Ltd. (UK), Camelot Technologies (Canada), etc	No indigenous manufacturers
5.1	High Density-Polyethylene(HDPE)	HDPEis apolyethylenethermoplastic made frompetroleum. HDPE structurehas a little branching, whichhelps it in giving strongerintermolecularforceandhightensilestrength.	Wood plastic composites andcomposite wood,manufacturingof tubes,chemical-resistant barrier	Mitsui Petrochemical Co. (Japan), Honeywell (USA),Taniyama Chemical Industry (Japan) etc	Reliance Industries, GAIL and Haldia Petrochemicals Limited (HPL)
5.2	High ModulusPolyethylene(HMPE)	Highimpact strengthcomparedtoanyotherthermoplastic.HMPE ishighly resistant to corrosivechemicalsandhasextremely low moistureabsorption. Ithasverylowdegree of friction and is self-lubricating.	Medicalapplicationformanufacturing biometricimplants for hip, knee andspine.Itisalsousedinmanufacturing of bullet proofvests andindustrialapplications suchasmanufacturing of PVC (vinyl) windowsanddoors.		No indigenous manufacturers

Sr No	Name of theFiber	Properties	Applications	Global Manufacturers	Indian Manufacturers
6	Carbon Fibre	Carbon fibers are extremelythin fibers composed fromcarbon-atomsbondedtogether in microscopiccrystals. Carbon fiber hasmany differentweavepatterns andcanbecombined with plastic resin&can be molded to formcom-positematerials.	The inherent strength and light-weight,carbonfibresaremajorly used in racing cars,aero planes, windenergyequipment's and infrastructureindustry.	Toray Industries (Japan), Toho Tenax (Japan), Mitsubishi Rayon (Japan), Zoltek (USA)	RIL set up under process
7	Poly-phenylene-sulfideFi-bres (PPS)	PPS polymer is formed byreaction of sodium sulfidewithdichloroben-zene. Polyphenylene sulfide is likeahigh-performan-cethermoplastic. PPS can bemoulded,extrud-ed,ormachinedtohigh-tolerances.	PPS fiberisusedinmanufactur-ing heat resistanceapplication, bag filter, dryercanvas, liquid filtration cloth,parts for electric products, etc,on the basisofits excellentheatandchemicalresis-tance.	Armoco Fabrics &Fibres Co (USA), Toyobo (Japan), Toray Industries (Japan)	No indigenous manufacturers
8	GlassFibre	Glass fibers are extremelythin fibers of glass which areused as a reinforcing agentfor-manypolymerproducts. It isformedwhenthin-strandsof silica-base-dorotherformulation glassisextruded into many fibreswithsmall-diameterssuitable for textileprocessing. It also has goodpropertiesof thermalinsulator.	Glass fiber is majorly used inthermal insulation, electri-calinsulation, reinforcement ofvarious materials, tent poles,sound absorp-tion,heat-andcorrosion-re-sistant fabrics,high-strength fabrics,automobile bodies, surfboards,etc.	Owens-Corning Fibreglas, Nicofiber (USA), Fibreglass (Canada), Asahi Fibre Glass Co (Japan), Chemi-tex-Anilana (Poland),	Owens Corning (India) Ltd Goa Glass Fibre Ltd, UP Twiga Fibres, etc
9	FlameRe-tardant(FR) Viscose	FRViscoseisa flame-re-tardant cellulose basedfibre whichgives highwearing comfort as well asoptimumprotec-tion.	Protective garments like firefighting clothing, de-fenseclothing, automotive seatfabrics, construction,uphol-stery, fire resistantbarriersand mattress.	Shandong Helon Textile Sci. & Tech. Co. Ltd (China), Lenzing AG (Austria),	No indigenous manufacturers

10	Flame Retardant (FR) Polyester	Flame retardant agent is added during polymerization process Hence it is able to withstand very high temperature.	Indoor decoration, automobile upholstery, seat covers, curtains, carpet, tents with hemming-stitch and auxiliary materials, sleeping bags, special working clothes, flame resistance curtains, mattresses used in commercial complexes such as offices, shopping complexes, etc.	DuPont, Shanghai Jingmao Industrial Co. Ltd (China), Aquafil SpA (Italy), Trevira,	Reliance
11	High Tenacity Nylon	It is a multi-filament polyamide yarns characterized by high tenacity and low shrinkage.	High tenacity nylon filament yarn is used for manufacturing ropes, twines, seat belt webbing, automobile airbags, watch and bag straps, etc.	Junma (China), Kordsa (Turkey)	SRF

Sr No	Name of theFiber	Properties	Applications	Global Manufacturers	Indian Manufacturers
12	Super High TenacityPoly-ester	Strong, resistanttostretching and shrinking,resistant to most chemicals,quick drying, crisporresilientwhen wetor dry,wrinkle resistant, milde-wresistant,abrasionresistant.	Hightenacity polyes-terfilament yarns used for themanufacture of ropes, twines,seatbelt-webbing,geo-textiles,etc.	Performance Fibres (USA), Teijin Twaron (Japan), Toray Industries (Japan)	Reliance and SRF
13	High Tenacity-Polypropylene	High tenacity polypropyl-eneis high strength fibre havinggreaterstability	Ropesusedindifferentin-dustrial and construc-tionactivities.	DuPont (USA), Drake (Fibres) Ltd (UK)	Reliance and Haldia Petrochemical
14	High Tenaci-tyViscose	Viscose fibre is made from-lumber,bulrush, linter orcellolose through a chemi-calprocess. Viscose fibrecon-sistsofflamentandshort fibre. Flament is alsocalledrayonor-tenasco.	High tenacity viscose fibre incord thread and ropes used indifferent industrialandconstruc-tionapplications.	Toyoba (Japan), Glanzstoff Austria GmbH, Lenzing AG (Austria)	Century Rayon Ltd
15	CeramicFibre	It is manufactured fromalu-minasilicateglasswhich-hashigh heatresistanceprop-erties.	Manufacturing of domes-ticheating appliances, furnace,insulation for steam and gasturbines. Recently these fibreswere observedtobe usedinaerospace industry due to itsin-herentstrengthandlight-weight.	Nippon Carbon (Japan), 3M, Techno-Physik Engineering GmbH (Germany)	Unifrax India Ltd
16	Polytetra-fluoroeth-ylene(PTFE)	PTFEhasan excellentdielectric property, it has ahighmelt-ingpoint	It is used in manufacturing ofelectri-calapplications. Recently it has been used inmanufacturingof homeappliances	DuPont (USA), Newton Filaments, Inc(USA), Albany Internation Inc. (USA), Toyobo (Japan)	No indigenous manufacturers

17	PBI Fibres	PBI (Polybenzimidazole) stable fibre is an organicfibre that provides thermalstability. PBI fibre does notburn inair, itdoes not meltor drip, and it will retain itsstrength and flexibility afterexposure-to flame.	PBI findsapplication-sinaerospace, bear-ings,bushings, electrical parts,generalpurpose-hightemperature appli-cations,insulation,in-sulationshield,sealing devices, seals,semicon-ductor mouldingcom-pounds.	Celanese Acetate	No indigenous manufacturers

Sr No	Name of theFiber	Properties	Applications	Global Manufacturers	Indian Manufacturers
18	PBO Fibres	PBO — FibreZylon is said tobe the strongest fibre that iscommercially available. Thetensile strength of this fibreis higher than para-aramid-slike Kevlar and Twaron andhigh-performance polyethylene (Dyneema andSpectra).	Manufacturing of pro-tectiveclothing such as bullet proofvests, body armour, clothingused for firefighting, ballisticjack-ets,etc.	Toyobo Co. Ltd. (Japan)	No indigenous manufacturers
19	Anti-microbial/ Anti- fungal/ Anti- bacterial Fibres	An anti-microbial and/or anti-fungal and/or anti-bacterial fibre comprises of various thermoplastic polymers and additives in a mono-component or bi-component form. The active agent, incorporated into the fibre, prevents and limits the growth of bacteria/ fungi/ microbes.	These fibres are majorly used in manufacturing of protective clothing for doctors, nurses, care staff, employees in food manufacturing and food processing, etc.	Trevira, Montefibre, Brilen, Sterling, Kaneba and Zimmer AG	Reliance and Indo Rama
20	Phenolic Fibre	These fibres are manufactured by using compression moulding followed by hand lay-up technique. It has tensile and flexural properties of coir based hybrid composites were investigated as a function of fibre content and fibre volume fraction.	Phenolic fibres are used in manufacturing of automotive and electrical components.	Phenco (USA), The Vermont Organic Fiber Company (USA)	No indigenous manufacturers
21	Conductive Fibre	These fibres have good properties of carrying electrical signal.	It is used in manufacturing of elec-tromagnetic shielding	Shakespeare Conductive Fibres LLC and Bekaert	Bekaert‟s Indian subsidiary

22	Fibre for concrete re-enforcement	These fibres can be generally polyester or polypropylene, which have high tensile strength and good heat resistance. Hence it is preferred in concrete re-enforcement.	These fibres are used in concrete re-enforcement, as it prevents premature cracks, prolongs life span, increase impact resistance, etc.	Advansa (Turkey) and Sterling Fibres	Reliance Industries Ltd and M/S Zenith fibres and M/S Tufropes
23	Alginate Fibre	Calcium alginate fibres are manufactured from alginate extracted from seaweed. Calcium alginate is used worldwide in the production of wound dressings.	Medical bandages used for wound dressing, food processing industry, etc	SpecialityFibres and Materials Ltd (UK), FMC Biopolymer (USA)	No indigenous manufacturers

Technology Hurdles

The majority of specialty fibershas to be manufactured using expensive, proprietary technologies. Indian players have been discouraged from developing specialty fibres domestically due to high costs and poor demand. But, in the long run, India has to be able to produce the majority of the specified specialty fibers on its own. So, it is necessary to import technology from outside and promote its acquisition. Given that the majority of production occurs in the unorganized sector, there is also a significant technological gap between the technology employed in India and that of rival nations for the manufacture of technical textiles. So, there is room for significant technological advancement. Government may play a significant role by funding or encouraging producers to purchase technologies for the creation of technological textiles. In order to meet the strict and important criteria of performance related product characteristics in the worldwide market, it is also necessary for India to create powerful testing facilities of the highest caliber.

Conclusion

India has huge factories and sufficient capacity for the manufacturing of standard synthetic fibres, but until now, businesses have avoided producing specialty fibers owing to a lack of market demand and the necessary technologies.In order to achieve near self-sufficiency in the essential raw materials needed for the manufacturing of technical textiles, India must pay close attention to the indigenous development of specialty fibers, if it is to grow its share of technical textiles over the course of the next 5 to 10 years.

Reference

- Marketsandmarkets Report - Technical Textiles Market Report – Global Forecast to 2022
- https://www.westbengalhandloom.org/national_fibre_policy/Fibre_Policy_Sub_%20Groups_Report_dir_mg_d_20100608_7.pdf
- https://assets.kpmg.com/content/dam/kpmg/in/pdf/2021/03/technotex-2021-thought-leadership-kpmg-and-ficci.pdf
- Foreign Direct Investment Scenario in Indian Textile Sector, Wazir Advisors, 2016
- Global Textile, Apparel, and Sporting Goods Team: Technical Textiles Resource Guide, Department of
- Commerce, United States of America, 2020
- Government of India's Initiatives in Technical Textiles & Notification of HSN Codes for Technical Textilesby Ministry of Textiles, Government of India, 2019 (MOT)
- Grand View Research (GVR) Industry Analysis, Technical Textiles Market, 2020