4.1 Service and Test Bed Providers for Future Collaboration

Minna Varheenmaa** & **Taina Kamppuri

This chapter details service providers in Europe and North America for sustainable nonwovens, focusing on testing and piloting services sourced from the members of EDANA and the Nonwoven Research Institute, as well as trade fairs. It categorises these services by common nonwoven technologies, briefly described using EDANA's resources.

Our aim was to map global testing, research, and piloting services for nonwoven applications that companies and research organizations provide for their customers and collaborative business partners. These companies are typically equipment providers, manufacturing companies, and commercial or non-commercial testing and research organizations as well as research units of technical universities and universities of applied sciences. However, it is quite common that services are only available to business partners working in close collaboration with the service provider. The close collaboration can be a common international project, or an acquisition of an equipment. However test assignment type acquisitions typically are available for any customer interested in, and in the need of, an impartial testing service. The biggest companies are often multinational organizations.

Nonwoven testing and piloting services were studied based on the information found on the company webpages of the members of EDANA and the Nonwoven Research Institute in Europe and North America. In addition to these, trade fairs Technical Textiles 2022 in Frankfurt, MiniExpo 2022 in Borås, and ITMA 2023 in Milano introduced some stakeholders active in the nonwovens industry. In Nordic and national projects concerning nonwovens from mechanically recycled fibres, closed loop test bed for textiles and textile value chain. steps were taken to prepare the textile industry towards recycling of textiles, circular economy, and digitalisation. National operators providing testing and piloting services on closed loop test bed for textiles were categorised and listed in a VTT report. This general description of the test bed system includes also web forming and binding of fibres for nonwovens. (Heikkilä, 2022; Heikkilä, 2020).

The service providers for pilots, research, and tests in Europe and in North America are presented in Table 1. The services are categorised based on the most common nonwoven technologies, and additionally whether the service provider is an equipment provider, microbial, or biodegradation test provider, and whether they are certified or not.

Brief Descriptions of the Main Nonwoven Technologies

Airlaying technology is for short fibres where an airstream helps to mix fibres to form a randomly oriented web on a moving belt (EDANA, n.d.).

In the **drylaying** method, opened and blended fibres are conveyed to a card by airstream. A carding machine combs the fibres into a web either parallel – in machine or cross direction – or in random order depending on the strength properties required in the end use product. The web is then consolidated using a suitable method determined by the fibre type used and end use purpose. (EDANA, n.d.).

The **wetlaying** method resembles the manufacturing of paper. A thin slurry of long fibre and water is laid on a moving wire screen where water is drained off and fibres form a web. The remaining water is removed from the web by pressing in between rollers and drying. The web can be impregnated with binders at a later stage. Strength properties are rather uniform in all directions of the planar web. (EDANA, n.d.).

In **spunmelting** technology, thermoplastic polymer chips are melted, and a nonwoven web is directly formed through a spunlaid or meltblown process, or as a combination of these methods. Molten polymer chips are extruded through spinneret, and the filaments are stretched and quenched before placing onto the conveyor belt for forming the web. The term spunbonded refers to thermobonded spunlaid. In the meltblown process, the filaments are attenuated by hot air streams instead of quenching. This helps to get finer filaments. Even finer fibres can be achieved with sub-micron spinning such as meltblown, centrifugal spinning, solution spinning, and electrospinning. (EDANA, n.d.).

Thermal bonding technologies include calendering, through-air in hot air stream, drum and blanket systems, or ultrasonic. The thermoplastic properties of fibres are exploited through either the fibres in the web, or through the addition of low melting fibres or bicomponent fibres into the web. Pressure binds the fibres into the web. (EDANA, n.d.).

A web can be consolidated through interlacing fibres mechanically, either by the **needlepunching** method using special needles, or by the **hydroentanglement** method (spunlace) using fine water jets of high-water pressure. The latter is often used for carded or wetlaid webs. (EDANA, n.d.).

In **chemical bonding**, a liquid-based chemical bonding agent is applied to the web. Application can be made by impregnation, coating, spraying, or intermittently, as in print bonding. (EDANA, n.d.).

A range of finishing treatments can be used for tailoring or functionalising the nonwoven for specific purposes. These include mechanical stretching, perforating, crimping, or changing the haptics or repellency properties by treating the fibre surface or the nonwoven chemically. (EDANA, n.d.).

Finally, the nonwoven roll goods are converted into a version closer to the final product by slitting, cutting, folding, sewing, or heat sealing. (EDANA, n.d.).

Table 1. Service providers for pilots, research, and tests in Europe and in North America (SB = spunbond, MB = meltblown, Slace = spunlace)

Equipm/ Technol	Research center	Testing	Piloting	Biodegrade-ability	Micro-biology	Certified	Carding	Airlaid	Drylaid	SB	MB	Submicron	Wetlaid	Slaced	Needle-punched	Thermo-bonded	Chemically bonded	Other	Company name	Country
E			x				x	x					x	x	x	x			ANDRITZ Laroche S.A.	France
E			x					x											Anpap Oy	Finland
T	x	x	x							x	x							Bioplastics for nonwovens	Biome Bioplastics	UK
		x																	BRACHI TESTING SERVICES SRL	Italy
E																		Sensors, systems	BTSR INTERNATIONAL SPA	Italy
		x			x														BTTG® / BTTG -Testing Certification	United Kingdom
E		x						x											CAMPEN Machinery A/S	Denmark
	x	x		x	x														CENTEXBEL	Belgium
	x																		Centre Européen des Textiles Innovants	France
	x	x			x													Paper, board, MFC	CENTRE TECHNIQUE DU PAPIER (CTP) (Centre Technique du Papier - The Pulp and Paper Research & Technical Centre)	France
E	x											x						Fine fibers NW, filtration, polymers for medical, recycling of CF	DITF Deutsche Institute für Textil- und Faserforschung Denkendorf	Germany
		x		x	x													Cosmetics, agro, interlinings	EUROFINS ATS	France
		x			x													Cosmetics, personal, hygiene	EUROFINS CONSUMER PRODUCT TESTING GMBH HAMBURG	Germany
T			x															Treating NW hydro-, oleophobic, nanocoatings	Europlasma NV	Belgium
T						ISCC Plus, Oeko-Tex, ISO 9001, ISO 14001 and ISO 50001, BRCGS, EcoVadis, HALAL				x	x								Manufacturer	Fibertex Personal Care A/S	Denmark
T						ISO 9001, ISO 14001 and ISO 50001, BRCGS, EcoVadis, HALAL												Printing, Prototyping	https://innowoprint.com/	Germany
T	x	x	x				x	x										Fiber manuf., the global leader in developing, manufacturing and marketing polyolefin staple fibers for nonwoven applications	FiberVisions	USA
T																		Supplier contacts	Fi-Tech, Inc.	USA
									x		x		x	x	x				Freudenberg Performance Materials (FPM)	
T						ISO-9001, ISO-9002, ISO-14001, Ford Q1, TS 16949									x				Manufacturer	GDC	USA
T		x	x																Fiber-X Finland Oy	Finland
		x			x													Hygiene, sanitary	GALAB LABORATORIES GMBH	Germany
E																		Felting and structuring needles, tools, accessories	Groz-Beckert (Lainto Engineering in Finland)	Germany
E		x	x							x	x								Hills, Inc.	USA
T		x	x			ISO 9001, SHARP, FSC, OSHA VPP, ISO 14001, ISO 50001, ISO 45001, ISO 45003, AS9001D, IATF 16949	x	x	x	x	x	x	x	x	x	x	x		Hollingsworth & Vose	USA
		x																	HY-TEC - HYGIENE TECHNOLOGIE GmbH	Germany
		x			x														IFTH - INSTITUT FRANCAIS DU TEXTILE ET DE L'HABILLEMENT	France
		x		x	x													Paper and textile	INNOVHUB STAZIONI SPERIMENTALI PER L'INDUSTRIA	Italy
	x																		ITA GROUP	Germany
T																		Manuf of diapers and wipes	Kimberly-Clark Corp	USA
T	x					ISO 9001, ISO 14001, ISO 50001, ISO 45001												Styrenic block copolymers (SBC), pine chemicals	Kraton Polymers	Netherlands
		x			x														LUKASIEWICZ RESEARCH NETWORK - TEXTILE RESEARCH INSTITUTE	Poland
E																		Process monitoring	Mahlo GmbH + Co. KG	Germany
E																		Nonwoven winding, stacking, accumulating, cutting, packing	Matthys nv	Belgium
T										x	x							Biopolymer PLA	NatureWorks	
E		x			x		x	x	x	x	x	x	x	x	x	x			NONWOVENS INNOVATION & RESEARCH INSTITUTE (NIRI)	United Kingdom
T						Oeko-Tex 100, FSC													Norafin Industries	Germany
T		x	x							x	x					x	x	Manufacturer of nonwovens	PFNonwovens	Czech Rep.
E		x	x							x	x								Reifenhauser Reicofil	Germany
E																		Components, card clothing	Rieter	Switzerland
	x	x		x							x								RISE RESEARCH INSTITUTES OF SWEDEN AB	Sweden
E		x																	SDL Atlas / Cromocol Sweden	Sweden
		x																	SGS FRANCE	France
		x																	SGS INSTITUT FRESENIUS GMBH	Germany
		x		x	x														Shirley® (subsidiary of BTTG)	United Kingdom
		x				x													STFI - SÄCHSISCHES TEXTILFORSCHUNGSINSTITUT e.V.	Germany
T		x																Polymer provider	Sukano Polymers	Switzerland
	x	x	x				x								x				TAMPERE UNIVERSITY OF APPLIED SCIENCES LTD	Finland
T		x	x															Additives for nonwovens	Techmer PM	USA
E	x						x							x	x				DILO Inc.	Germany
E	x		x				x	x											The DiloGroup	Germany
E	x		x				x	x							x				The DiloGroup / DILO Machines GmbH	Germany
	x	x	x							x	x			x	x	x			The Nonwovens Institute	USA
E		x																	Thwing-Albert Instrument Company	US
		x		x		x													TUV AUSTRIA BELGIUM NV/SA	Belgium
		x				x													TÜV RHEINLAND LGA PRODUCTS GMBH	Germany
	x	x		x															UNIVERSITY OF LEEDS	United Kingdom
	x	x	x		x								x						VTT Technical Research Centre of Finland	Finland
E	x	x	x				x						x	x		x			Trützschler Nonwovens & Man-Made Fibers, Egelsbach	Germany
			x					x											The loop factory	Sweden

References

EDANA. (n.d.). *How are nonwovens made?* European Disposables and Nonwovens Associations. Accessed 23.2.2024. https://www.edana.org/nw-related-industry/how-are-nonwovens-made

Heikkilä, P., Määttänen, M., Jetsu, P., Kamppuri, T., & Paunonen, S. (2020). *Nonwovens from Mechanically Recycled Fibres for Medical Applications.* VTT Technical Research Centre of Finland. VTT Research Report No.VTT-R-00923-20.

Heikkilä, P., Heikkilä, J., Kallio, K., Kurki, S., & Harlin, A. (2022). *Tekstiilien suljetun kierron testbed.* VTT Technical Research Centre of Finland. VTT Tutkimusraportti Nro VTT-R-01091-21.