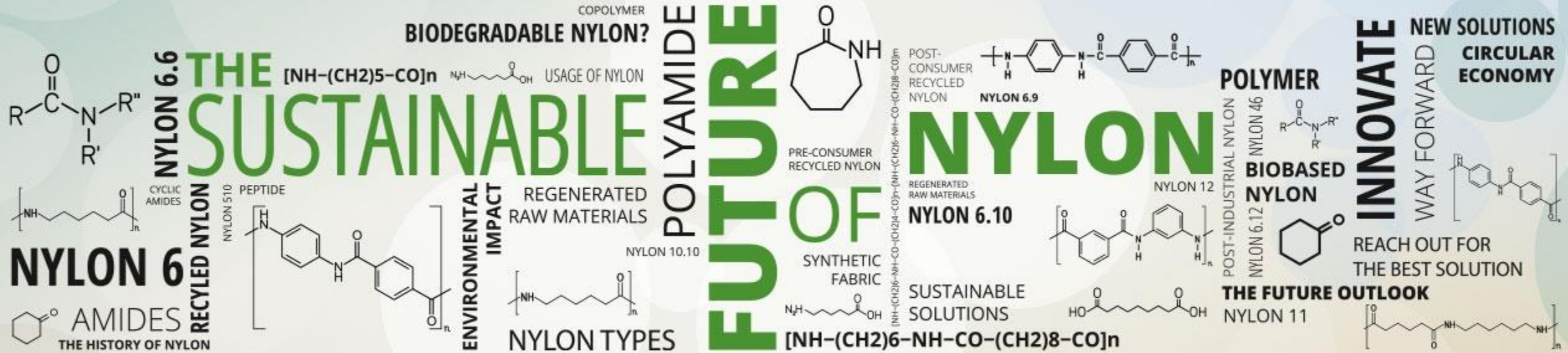
FUNCTIONAL FABRIC FAIR
NOVEMBER 2021

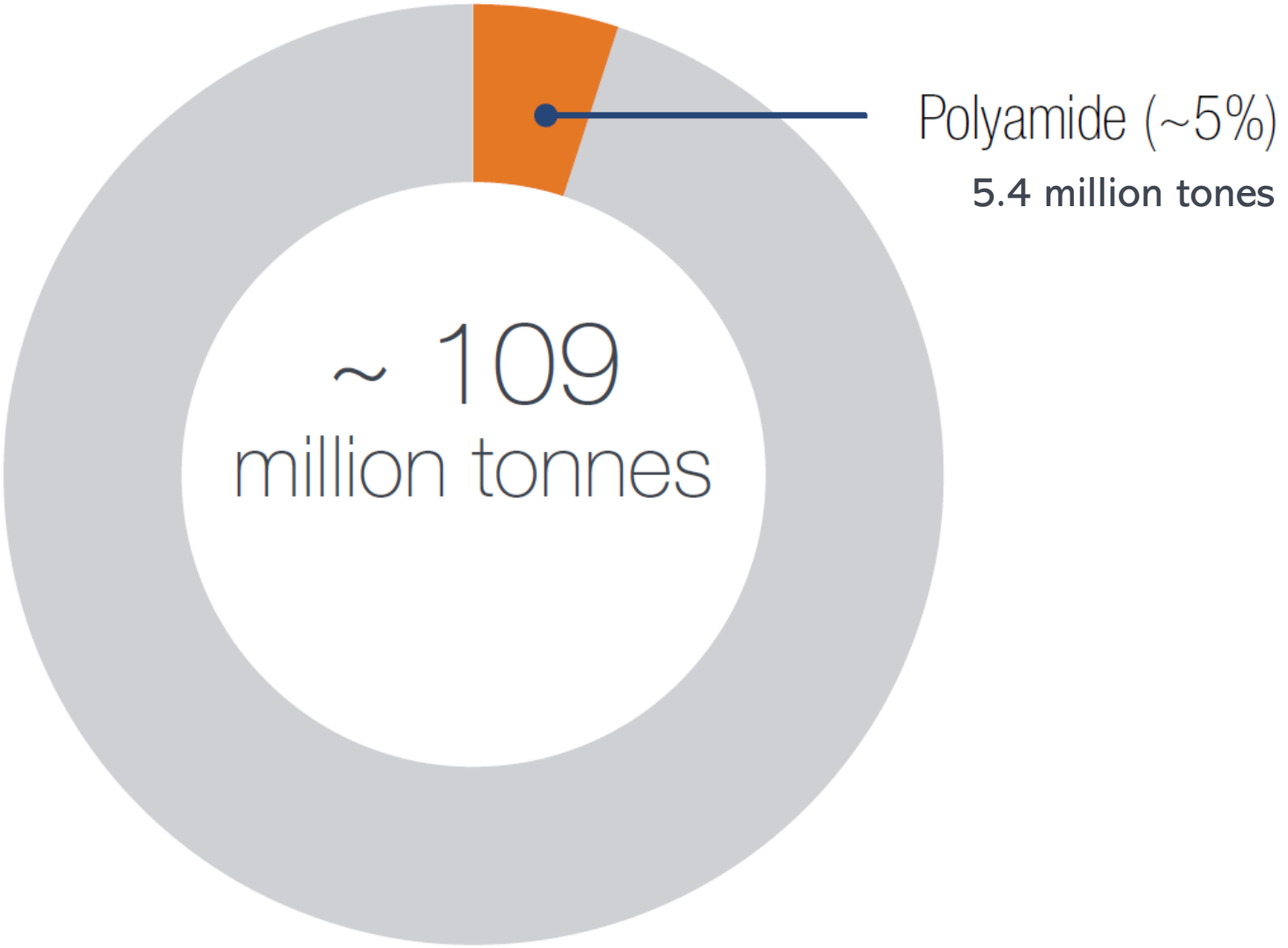


René Bethmann – Innovation Manager & Consultant of VAUDE Academy for Sustainable Business

rene.bethmann@vaude.com

NYLON

GLOBAL FIBER PRODUCTION 2020



Source: Textile Exchange Preferred Fiber and Materials Market Report 2021

FIRST-EVER “TRUE SYNTHETIC TEXTILE FIBER”

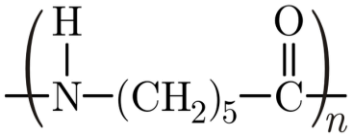
Source: Courtesy Hagley Museum and Library

NYLON TYPES

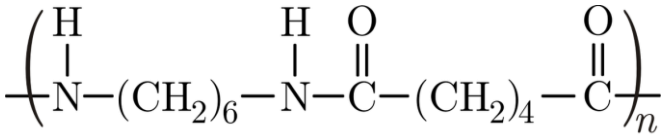
NYLON REFERS TO A GENERIC MATERIAL GROUP – NOT TO A SINGLE MATERIAL TYPE

NYLON 6 AND **NYLON 6.6** ARE THE **PREDOMINANT** NYLON TYPES IN THE SPORTSWEAR INDUSTRY

NYLON 6 IS MADE OF A **SINGLE MONOMER**: CAPROLACTAM



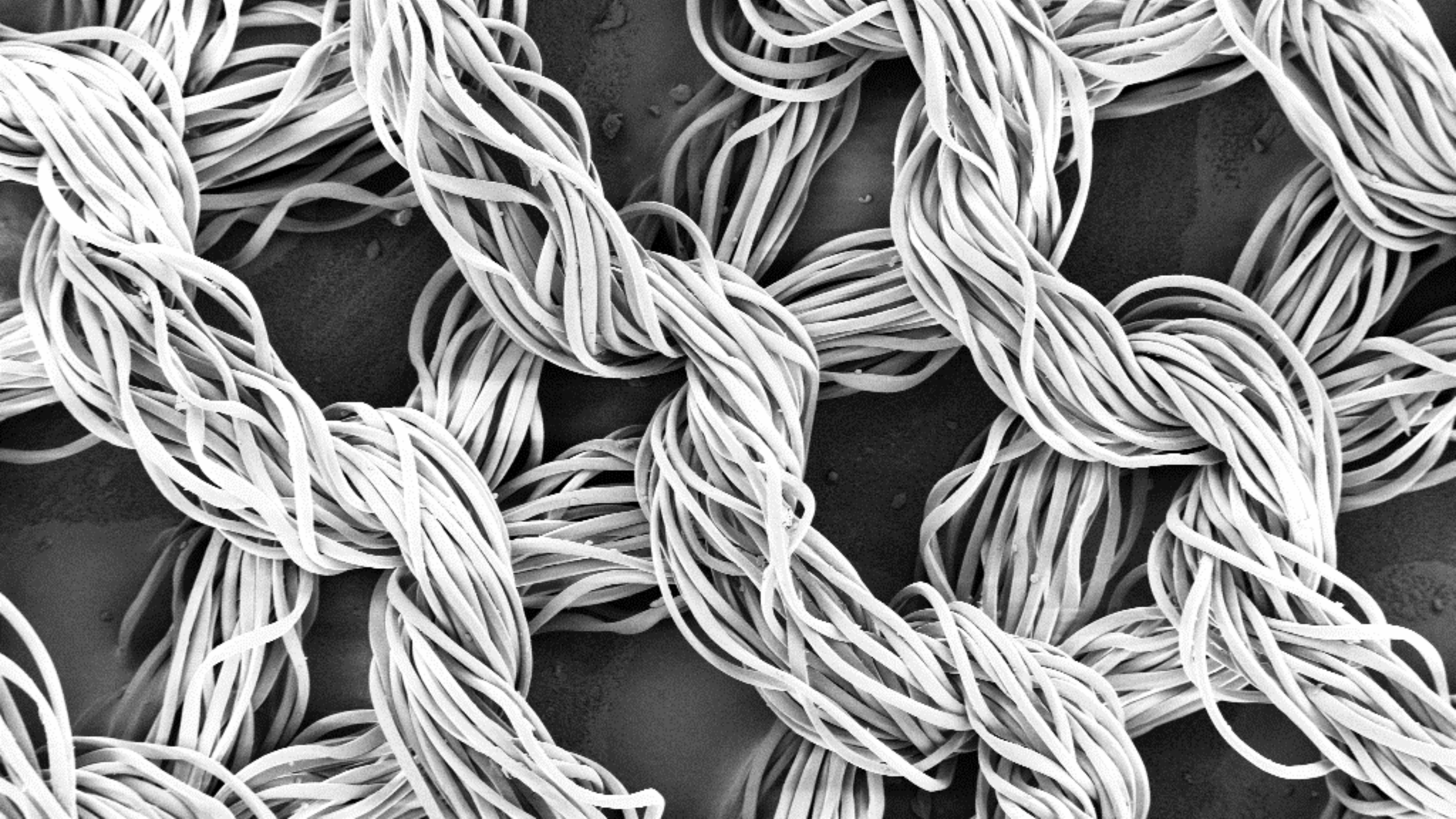
NYLON 6.6 IS MADE OF **TWO MONOMERS**: HEXAMETHYLENE DIAMINE + ADIPIC ACID

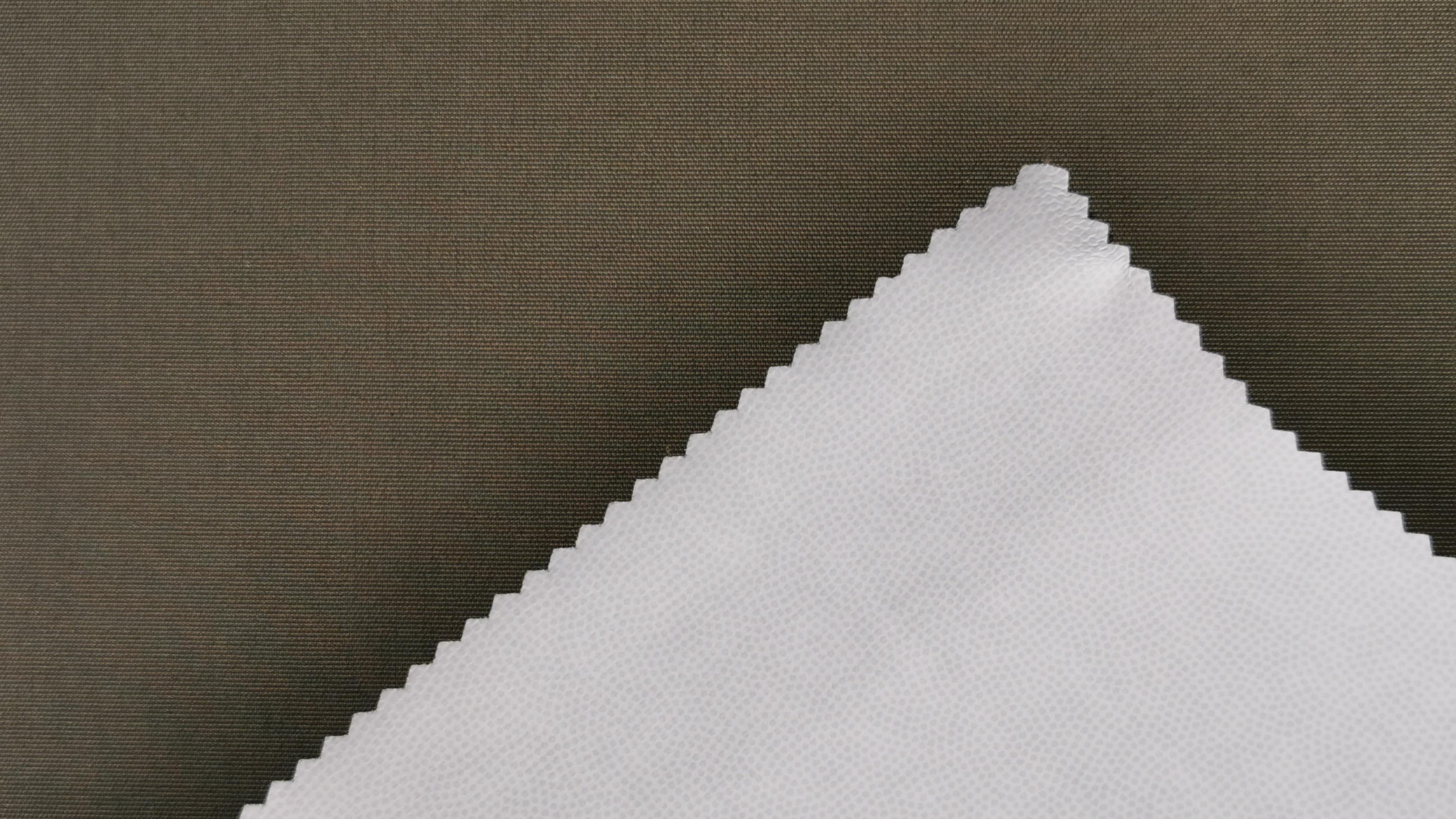


Topic	Abbreviation	Monomers	Calculated bio based / carbon content %	Biobased feedstock	Feature (selection)	Textile	Hard plastic / Molding	Film / Coating / Foam	Suppliers Product (selection)	Spinning mills (selection)	CO_2 Footprint Indication*
Nylon 6	PA 6	Caprolactam				X	X		various	various	XXX
Nylon 6.6	PA 6.6	Hexamethylene-diamine, adipic acid				X	X		various Invista Cordura®	various	XXX
Nylon 4.10	PA 4.10	Diamino butane, sebacic acid	70	Castor oil	high temperature resistance	X	X		DSM EcopaXX®	Acelon (Taiwan)	XX
Nylon 5.6	PA 5.6	Pentamethylene diamine, adipic acid	45	Corn	flame retardance	X			Cathay Biotech TERRYL®	Far Eastern New Century (Taiwan)	XX
Nylon 5.10	PA 5.10	Pentamethylene diamine, Sebacic acid	100	Corn, Castor oil	low water uptake	X			Radici Biofeel® Cathay Biotech TERRYL®	Radici (Italy)	X
Nylon 6.10	PA 6.10	Hexamethylene diamine, Sebacic acid	62	Castor oil	high strength/ elasticity	X	X		Evonik Vestamid Terra HS® Toray Ecodear® PA 6.10 Arkema Radici Radilon® / Biofeel®	Chainlon (Taiwan) Toray (Japan) Radici (Italy)	X
Nylon 10.10	PA 10.10	Sebacic acid	100	Castor oil	low weight	X	X		Evonik Vestamid Terra DS® Arkema Rilsan® PA 10.10 T	Fulgar (Italy)	X
Nylon 11	PA 11	Aminoundecanoic acid	100	Castor oil	bacteriostatic	X	X	X	Arkema Rilsan®	FCFC (Taiwan) Unitika (Japan)	X
Nylon 12	PA 12	Aminododecanoic acid or laurolactam			lowest water uptake		X	X	Arkema Rilsamid™ Evonik Vestamid® L EMS-Grivory Grilamid L		XXX
Nylon 6.6	PA 6.6	Hexamethylene-diamine, adipic acid			accelerated degradation	X			Solvay Amni Soul Eco®	Fulgar (Italy)	XXX
Nylon 6.6	PA 6.6	Hexamethylene-diamine, adipic acid			accelerated degradation	X			Nilit Sensil® Biocare		XXX

*indication based on available LCA data

USAGE OF NYLON





SUSTAINABLE SOLUTIONS


RECYCLED NYLON

POST-INDUSTRIAL / PRE-CONSUMER RECYCLED NYLON


NYLON

POST-CONSUMER RECYCLED NYLON

BIOBASED NYLON

POLYAMIDE FAMILY

PARENTS
PA 6
PA 6.6

CLONES
Bio-PA 6
Bio-PA 6.6

CHILDREN
PA 4.10
PA 6.10

COUSINS
PA 5.10
PA 10.10
PA 11

effective

A NEW ERA OF FIBERS AND PLASTICS

Bringing bio-based solutions to everyday life

The world´s first 100% biobased Polyamide 6

www.effective-project.eu

Funded by the Horizon 2020 Framework Programme of the European Union

BIO-BASED INDUSTRIES Public-Private Partnership

Bio-based Industries Consortium

This project has received funding from the Bio Based Industries Joint Undertaking (JU) under grant agreement No 792195. The JU receives support from the European Union's Horizon 2020 research and innovation program and the Bio Based Industries Consortium.

lululemon Partners with Leading Sustainable Materials Innovator Genomatica to Bring Bio-Nylon to Products

Renewably Sourced Materials to Help Replace Petrochemicals in Apparel for a Healthier Planet

VANCOUVER, BC and SAN DIEGO, CA—August 18, 2021 – lululemon athletica inc. (NASDAQ:LULU) today announced a multi-year collaboration with sustainable materials leader Genomatica to bring renewably-sourced, bio-based materials into lululemon's products. This represents lululemon's first-ever equity investment in a sustainable materials company and Genomatica's largest partnership within the retail industry. Together, the two companies will create a lower-impact, plant-based nylon to replace conventional nylon, which is the largest volume of synthetic material currently used to make lululemon products.

Source: https://www.genomatica.com/lululemon-partners-with-genomatica-on-plant-based-nylon

NYLON – A THERMOPLASTIC MATERIAL

SUITABLE FOR DIFFERENT RECYLCING SCHEMES

October 16, 2019

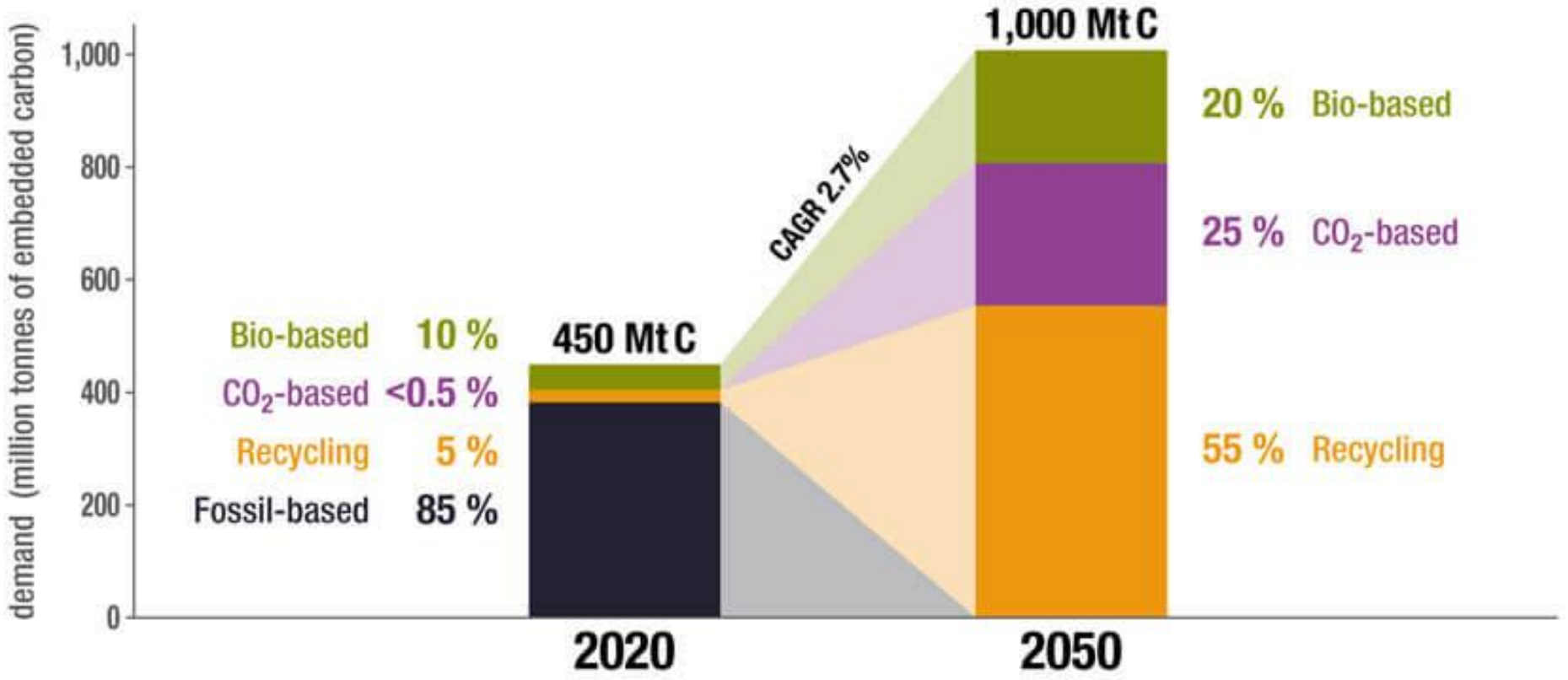
NAPAPIJRI REVEALS IN LONDON “INFINITY”: THE FIRST 100% RECYCLABLE AND RETURNABLE JACKET!

Source: https://theblondesalad.com/en/fashion/napapijri-reveals-in-london-infinity-the-first-100-recyclable-and-returnable-jacket/

FUTURE OUTLOOK

Global Carbon Demand for Chemicals and Derived Materials

in 2020 and Scenario for 2050 (in million tonnes of embedded carbon)



available at www.renewable-carbon.eu/graphics

RECOMMENDATIONS FOR ACTION

→ PHASE OUT VIRGIN FOSSIL-BASED NYLONS

→ SET TARGETS FOR THE USE OF RECYCLED AND RENEWABLE NYLON

→ SELECT RECYCLING TECHNOLOGY BASED ON WASTE INPUT TYPE AND QUALITY

→ DISCOVER THE VARIETY OF BIOBASED NYLONS

→ A MONO-MATERIAL DESIGN PHILOSOPHY WILL SUPPORT RECYCLABILITY

→ COMPARE ENVIRONMENTAL DATA TO DETERMINE NYLON'S FOOTPRINT

THANKS

FOR YOUR ATTENTION!

René Bethmann – Innovation Manager & Consultant of VAUDE Academy for Sustainable Business

rene.bethmann@vaude.com