

European Good Practices in Eco-creativity, natural fibres, short value chains

**Renewable natural fibre resources – an important
tool of the EU technology platform for textiles on the way
into the bioeconomy and circular economy era**

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5th RESET Seminar on
“Eco-creativity, natural fibres, short value chains”
Lodz, 17th October 2017



Blends of Natural and Biosynthetic Fibres for Eco-efficient Yarns and Home Textiles



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EVROPSKÁ UNIE
Evropský fond pro regionální rozvoj
Operační program Podnikání
a inovace pro konkurenceschopnost



Institut für
Textiltechnik und
Lehrstuhl für
Textilmaschinenbau

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WE ARE LIVING IN A CHANGING WORLD

Rising population x limitation of fossil resources x at risk of scarcity of resources and water

Extensional growth of industrialization enter the era of **knowledge based economy**

From the economy based on „make – use – go to waste“ causing the scarcity of (fossil based) resources
we tend towards **the circular economy**

To stop pollutions we need to extend use of **cleaner productions**
To foster the innovations we need to care about **sustainability of resources**

BIOECONOMY

An integral tool of knowledge based circular economy includes two challenging instruments:



1. Tremendous development of industrial biotech as one of KET's
2. Integrated crop production subprogram

Both instantly support the progressive changes of textile innovations



TEXTILE INNOVATIONS

Textile – historically one of leading manufacturing sectors determining evolutionary trends of industrialization

- From extensional growth
- Consumption of huge volumes of energy and water
- Depletion of non-renewable resources
- Accompanied by high volumes of pollutants

We shift to be „greener“

Biobased industry – „learning by nature“ – one of key partners

Competitive global market & expanding use of radically new bio-based materials and processing

Offer:

- resource efficient products = sustainability of resources
- shorter processes – saving water, energy, less pollutants = efficiency

Influenced by strict envi legislation (REACH) and commitment of retailers (ZDHC) and NGO's (DETOX, MRSL-Greenpeace)



TEXTILE – RESOURCE SUSTAINABILITY

70% of all textile fibres actually and most processing chemicals are fossil-based

Mainly used plant fibre – cotton

Due to the large consumption of water and pesticides

- not the sufficient envi friendliness
- long-distance supply chain less efficient for on-demand customised production
- potential risk of availability problems influenced by
 - changed climate of traditional Aral-Sea landscape
 - extensional markets of production countries
 - systematic support of local use („Make it in India“ etc.)



Natural fibres of local (EU) origin can play a key role in the TC resources sustainability

Joint – cluster strategy based on

farmers – crop processing – industrial end users

towards complex, waste-less utilization of crop and produced biomass

support of rural economy

Cutting the existing strong dependence on imports and fossil based resources

NATURAL RENEWABLE FIBRE RESOURCES

One of key elements of TC sustainable development

NF of EU origin: bast fibres - revitalization of flax, hemp

- waste less utilization of oilseed flax – fibres

novel qualities of regenerated cellulose fibres

resulting from massive (Scandic) program of
forest biomass utilization

(bio-based, ionic-liquids, potentially direct fibre
elementarization of wood cellulose)

Consequently – new bioprocessing encourage the circular economy concept
by recycling of cellulosic wastes–reduction of communal landfill volumes

B2C consumers market: fashion, function & comfort
rising customer demand to go greener
significant set up of bio-based materials in the daily life

B2B technical market: natural and emerging bio-based fibres incl.
nanofibrous structures as new end-products for
new markets
fibre reinforcement – in combination with bio-resins
- bio-composites – tool of modern industry,
step forward to the circular economy
related to the forestry biomass:
lignin – natural resin, potentially new way to efficient C-fibres
(alternative of synthetic PAC)

ETP TC - BioTEX

BioTex

A JOINT RESEARCH ROADMAP FOR THE EUROPEAN INDUSTRIAL
BIOTECHNOLOGY AND TEXTILE & CLOTHING SECTORS



In 2005 first long-term strategy of sustainable development became to be launch as the „**European Technology Platform**“

Biobased products selected by EC to be **one of LMI** (Lead Market Initiatives)

TC – one of first industrial branches using biobased materials (fibres) and processings (enzymes)

Close multidisciplinary cooperation – key to the fast and efficient innovation based on these facts

Biotex R&D roadmap - a joint research roadmap for the European industrial biotechnology and textile & clothing sectors (February 2009) – long term joint program of Euratex and Europa Bio

Bioeconomy and industrial biotech became to be one of **KET's** in Horizon 2020

TFE (Textile Flagship of Europe) – specific programs of ETP TC started activities:

TFE-1 Sustainability of resources

TFE-2 Sustainable efficient processing contain specific tools based on biotech, incl. NF

ETP FTC - SIRA

„TOWARDS 4TH INDUSTRIAL REVOLUTION OF TEXTILES AND CLOTHING“

In October 2016 an upgrade of the initial ETP document has been launched

In which: **The Innovation Theme III – „Circular economy and resource efficiency“**

Comprises 5 research priorities:

- 3.1. Novel flexible process technologies to save water, energy and chemicals
- 3.2. High-tech textile recycling for circular economy concepts
- 3.3. Sustainable substitutes for hazardous textile processing and chemicals – biochem based textile processing
- 3.4. **Bio-refinery concept using EU agricultural and forestry resources, waste or by-products for textile fibres and developing their processing and application aspects**
- 3.5. **Greater use of EU origin natural fibres and improving their processing and application aspects**



ETP FTC - SIRA

THEME III: „CIRCULAR ECONOMY AND RESOURCE EFFICIENCY“

FIBRE RESOURCES RELATED TASKS:

Res. Priority 3.4.: BIO-REFINERY CONCEPT

- 3.4.1. Biorefinery routes and the generation of optimized building blocks
incl. efficient synthesis of PET and PA monomers for biomass and
generation of fibres with controlled features and end-of-life
- 3.4.2. Processing of biobased polymers

Res. Priority 3.5.: GREATER USE OF EU NATURAL FIBRES AND IMPROVING THEIR PROCESSING AND APPLICATION ASPECTS

- 3.5.1. Development of weather independent methods of fiber degumming to
improve uniformity of flax/hemp fibres extracted from fibrous plants
- 3.5.2. Functionalization of linen/hemp fibres/textiles with use of inherent fibre properties

AND WASTE-LESS UTILIZATION OF OILSEED FLAX BY USE OF EXTRACTED FIBRES ESSENTIALS OF CORNET – BleNaBis EC Project (2016-2018)



BleNaBIS

Blends of Natural and Biosynthetic Fibres for Eco-efficient Yarns and Home Textiles

Replacement of synthetic (PA) fibres by renewable natural (flax) and biobased (Bio-PA) fibres in home textiles and carpets

Waste less utilization of oilseed-flax fibres –
intensification of field retting process by enzymatic „bio-retting“

Intensification – extraction and elementarization of
fibres from robust oilseed flax stalk
elimination of seasonal climate changes on yield and quality

Bio-PA (PA 4.10; 6.10) use – processability, blending of renewable components
- containing bio-based natural (castor oil based) 1,10-decane-dioic acid (sebacic acid)

Design of constructions, dyeing

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BleNaBis

Aim: new biobased yarn for
carpets and hometextiles

Use of linseed straw
(+) Low price
(-) Mechanical requirements
are not fulfilled

Use of biobased polyamide
(-) High price
(+) Mechanical requirements
are fulfilled

Approach:
Combination of linseed straw and
biopolyamide

Processability
Spinning – Weaving – Tufting - Finishing

Eco-design

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ETP Fibres Textiles Clothing
EUROPEAN TECHNOLOGY PLATFORM



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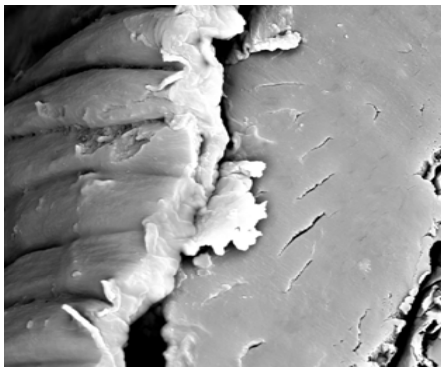
Bio-retting:

an enzymatically boosted field retting process

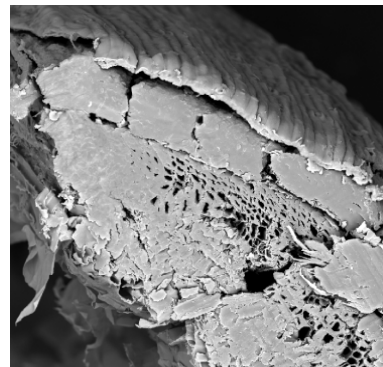
special enzymes developed **TEXAZYM SER** series (**INOTEX**)

effective application by spraying on the field

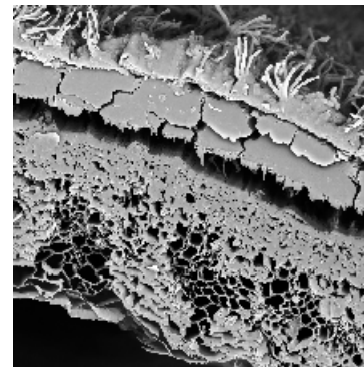
**Simplified extraction of oilseed flax fibres, confirmed process ability
by spinning and wet processing (bleaching, dyeing)**



stalk OSF-pulled



OSF TEXAZYM SER 7
10 days



OSF TEXAZYM SER 7
16 days



BleNaBis

Mechanical treatment - OFC device



HELPS
TO OPEN compact structure of the stalk by mechanical power
&
SEPARATION fibrous and wooden parts

BleNaBIS

Compatibility of natural oil-seed flax fibres with synthetic PA/PES and their replacement by bio-based PA (Bio PAX-DSM made by use of 70% renewable resources – ricinus oil - *Ricinus communis* – non food crop production land)

First steps by spinning

evaluation of wet process ability
(bleaching of oilseed flax – Bio PA)
dyeing optimization

Potential step forward into the

- resource sustainability
- circular economy



Guaranteed waste-less utilization of nutrient/technical plant (linseed fibre) and bio-based raw material with 0 food security impact

Co financed by:



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Oil seed flax:
(Bio-retted)

BioPA 6.10
Vestamid Terra HS (Evonik)

50:50

Home textiles prototyping



twisted yarn



carpet

Waste-less utilization of oilseed flax fibre by single step bioretting

Proof of concept achieved (spinning, weaving, carpets)

Wet processability – bleaching, dyeing, special effects ready for scale-up

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Dyeing - twisted yarn



Polyester / oilseed flax



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Dyeing (fabric) comparison PAD 66 and BioPA 6.10

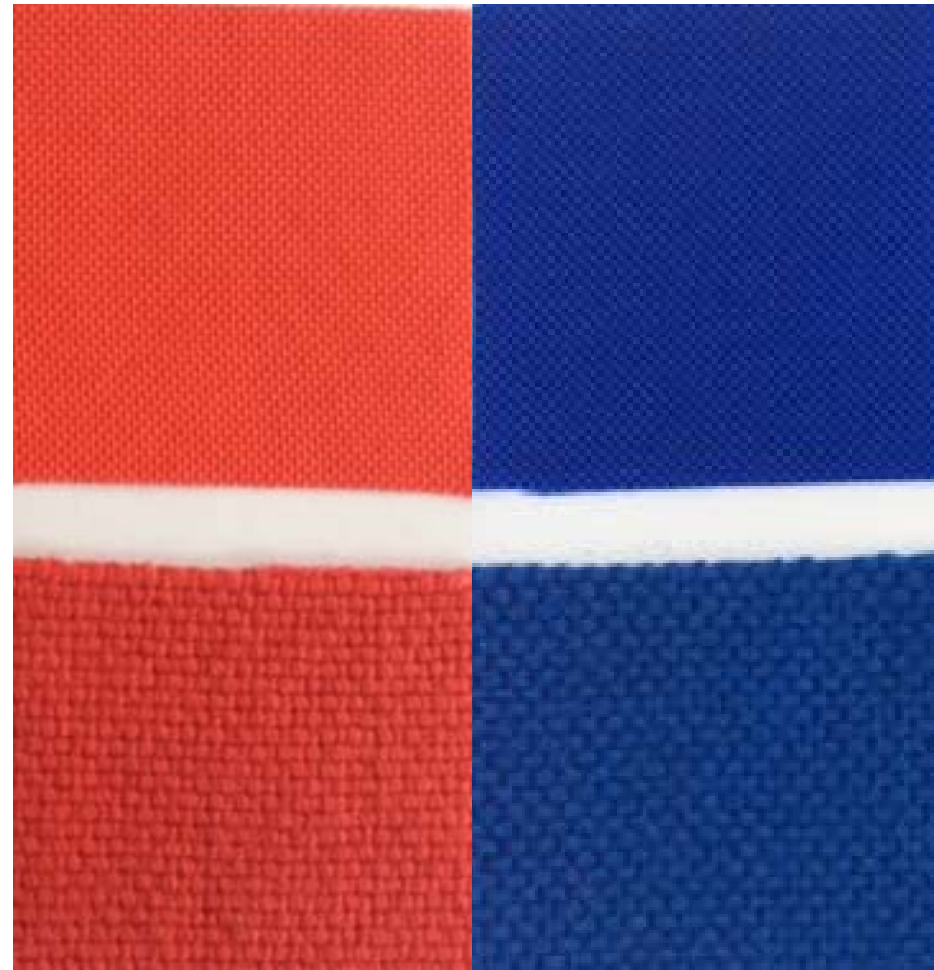
Disperse dyes



PAD
610

PAD 66

Acid dyes



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Dyeing (fabric)
comparison PAD 66 and BioPA 6.10



Metal komplex
dyes

PAD
610



PAD
66



- **Resource sustainability by renewable resources**
 - **Biobased materials as a key to the circular economy**
- +**
- ecodesign**

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Thank you!



Project smedia