T3Nel

EU strategy for sustainable textiles - *(Feedback period: 05 January 2021 - 02 February 2021)*
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The challenge for textile industry: to reconcile performance and sustainability

A prerequisite for efficiency: a circularity of matters opened towards other sectors and an innovative design of new materials, easily decomposable to build other materials back up. Finally, we are only “matter users”...

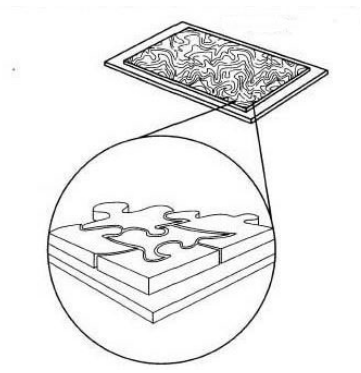
Introduction

We have to consider new textile industry with a new innovation approach, not to keep economic competition in non-stop offering new products, but with a dynamic led by real human needs of consumers.
Without for all that taking a backwards step!
Natural fibres exist since human origins. Artificial fibres were designed with the dream of mimicking silk. Thanks to advance in chemistry, synthetic fibres enabled to meet needs of consumption society. Today, new functional fibres are not only alternative, but a new material which plays a key role in advanced technologies. For instance, protective masks made with petrochemical polymers (synthetic matters) are banned a year ago, but are proved to be essential and irreplaceable under the current circumstances of health crisis.

We have to consider that we acquired knowledge in developing synthetic fibres. These fibres gradually flooded not only traditional textile markets but entered new markets and contributed to their growth. The intrinsic versatility of synthetic fibres - regarding polymers - and high speed production process were key assets to enter textile markets.
Formerly, leading industrialized countries were compelled to import cotton and wool as raw materials and dependent on supplier countries. They could manufacture their own fibres from available resources as coal, oil and cellulose afterward. Now synthetic fibres are ever more produced in Asia which is a threat for provision of supplies.
Chemistry brings to easy-to-live fabrics: light, stretchy, even breathable. Spandex or elastane was synthesized for the first time in 1959 and it’s all over clothes (flexibility). Even natural fibres (cotton, wool) undergo a treatment to be suitable to wear (dye, finishing...).

Today, how to reconcile complexity of textile materials and matters circularity?
The challenge involves designing ecologic textile solutions suitable to human beings with an affordable cost and easy to process.

An approach of sustainable or ecologic design has 4 even 5 options:



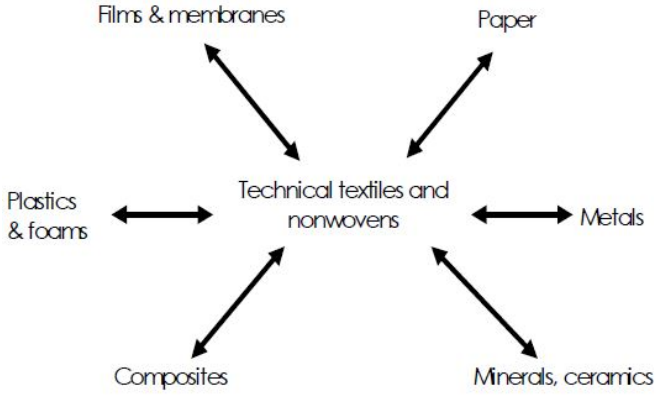
- To maximize use of matter in designing long-lasting (lifespan) products (for instance: knitted pullover made of hard-wearing wool)
- To make more with less materials in improving their specific performances (concrete, metals, polymers)
- To forecast recycling channel of matter within the framework of an open ecosystem once product end-of-life (this recycling will be profitable only if there is a sufficient deposit)
- To make object with biodegradable material. Product is not designed to long last and matter from which it’s made will not be recycled but composted.
- To design new materials easily decomposable to build other materials back up

Recycling, subject of entire strategic reconsideration:
Coming from recycling, secondary materials are often of lower quality than the primary materials from which they were derived. This fact affects value of recycle products and recycling economy. Therefore new materials recycling are an economic, energizing and societal concern.

How to have the best use of matter?

Nowadays strategy for designing high performance materials aims for the best use of matter to fulfil function. After fabless ideology over the last decade, inspired by computing and electronic sector, materials come up as key actors in technologic innovation. So, **comparative approach is significant in designing new materials** with multi-criteria decision analysis.

A key approach is the synergy of material areas in jointly working on synthesis of new polymers while maximizing assembly of materials as they stand. When we regard textile as a flexible material, the field of applications is wide and joins up with the area of nonwoven and composites. That's why a cross-sector joint effort is required between industrial sectors. There are numerous interfaces and overlap areas with other material technologies which take part in wealth and complexity of textile material industry:



For example, viscose is the fibre which grows at the faster rate and equals the higher investment of biobased economy. So, big papermakers realign their production because cellulose pulp is used in processing viscose (Sappi, Södra, Biocell...)

It's worth maximizing matters circularity in combining recycling dynamics with research on new biobased polymers which will provide new functions for primary or secondary matters. First of all, we have to organize the sector of raw materials production with the aim of renewable and recyclable biopolymers. The European textile industry has to master fibres production line in close relationship with chemistry groups. It has to identify new sources for raw materials (sugar, starch, cellulose...) and to strengthen pacts to secure supply, making its technological advance profitable in this way.

The same applies to new technology of surface functionalization which adds unusual functions on textile through work on fibres architecture, mastery of morphology and surface functionalization (water-base, sol-gel, bioplastics). The challenge is to lead to new functionalities at an affordable cost, easily industrializable and ecologic.
In matter transformation processing, the tuning of eco-efficient method is the answer to sustainability. It will have to design methods to quick industrialization of this process which will reduce investment costs especially if they are easy to optimize and maintain.

Machines play a key role:
In this new industrial age, machines play a key role to produce textile materials, especially their adaptability to make new matters derive from recycling or biochemistry. The flexibility of production lines enables to offer a wide range of textile products, in compliance with specifications of each customer. Equipment is ever more modular and adaptable, involving software which enables to reconfigure production process to suit the accurate demand required by the product to make.

The specific case of nonwoven :
As paper, nonwoven material scouts challenges, trends and social questions which its industry has to answer: cellulose chemistry, biobased materials, applications for hygiene and health, packaging for future, print electronics and smart textiles, waste repurposing and optimization of industrial process.
Defining features of nonwoven are changeability of manufacturing process which enables to work natural fibre or synthetic fibre just as well. We also can work at the scale of polymer granule to diversify fibres. Only the purpose of use makes specifications necessary to characterize the suitable structure of matter.

To bring natural fibres and synthetic fibres back together
Nature has a few elementary bricks but it blends infinity of fibrous and porous architectures in which it uses only polymers and ionic solutions, because it is constrained by development temperatures.
Cotton and wool become technical with smooth, crumpled, washed, coated or iridescent effects. Long fibres are suitable for stabilizing natural matters. Textile industry operates and spreads matter potential in heightening which Nature makes. Even though sustainable development and material recycling are a biomimetic approach, the assets of synthetic fibres can lead the development of new biobased fibres, even the optimization of naturel fibres features.
We are witnessing the comeback of flax and hemp. These plants have the advantage of needing less water and input than cotton. Flax and hemp are less expensive to produce. Furthermore processes have been developed to soften fibres which are very straight by nature.

An ecosystem of industries using textile materials

We have to invest in digital platforms to boost cross-connect of material sectors. Today each material sector implements its own platform to identify the main features of secondary raw materials (SRM) from recycling and to connect recyclers producing SRM with manufacturers of products from which they are made.
Recyclers gradually will see the deposit of well-worn textiles evolve. The amount of petrochemical fibres will decrease in aid of more biobased fibres. But this ecosystem will be supportable only if consumption is reduced in addition, cultivated areas being used for feeding people first and foremost.
According to FAO, the word area of cultivated areas is estimated at 1 650 million hectares, so that's 11% of planet area. Cereal farming takes up 55% and provide half of food proteins.

Exciting opportunity to break down the barriers between matter sectors:
Ecodesign and recycling will enable maximizing of matter circularity only if we equip ourselves with devices to break down the barriers between matter sectors. Textile materials markets are hierarchizes by application areas (medical, sport, transport...) which can be compartmentalizing and a brake on the spread of cross-sector matter innovation. This division in sectors is usually used in Europa and it doesn't consider: kind of fibre, manufacturing

process (nonwoven, composite), level of intervention in textile sector (spinning, finishing), properties of final product (carpet, rope).
Sustainable development is a cross-disciplinary theme and should enable networking of application industries.

Characterization of all sorts of textile matters is a key issue for spread of textile engineering. It will help propagation of textile solutions developed in a sector towards other application areas. The design of the most suitable product requires calculation on forecast and modelling of textile materials behavior in involving fast prototype. Processing data bases on characterization of primary and secondary textile materials is an essential requirement for a comparative approach of materials.
Why not to suggest using a new term as "texturgie" for the sector of textile materials, primary and secondary, just like "plasturgie" or "métallurgie" in French.

Materials underlie most of the great technological and industrial revolutions: steel for railway, copper for electricity, aluminum for planes, plastics and polymers for after war consumer goods, silicon, semi-conductors and optic fibres for digital technology. Around middle of 20th century we went to an approach for materials characterization and modelling thanks to digital technology, with growing multifunctional nature. All materials are involved within a complex and self-competitive substitute network. The boom in materials research marked a turning point in the 20th century. Sustainability is the paradigm / paradox in 21st century. Finally, we are only "matter users".