Hyperflax: New applications by high added value flax functionalities

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Hyperflax: Context

• Fibre consumption from 72 till 90 Mill Tons is not sustainable
• Bast fibres, especially flax should recover the position where it belongs.
• Less is more strategy: less fibres, more value
Flax Supply Chain

- Established fibre and established (but fragmented industry)
- Active but confusing image with the consumer based on unclear focus of the supply chain
- Potential of growth in a rotational agriculture in Europe
Barriers to Overcome

• Flax grades not aligned to end-use characteristics, breeding based on agricultural economics
• Complex and unreliable extraction process and too high fibre price
• Uneven performance of the fibre due to mechanical properties
Everyone sleeps

- Bedlinen is where linnen belongs
- Hyper flax enables optimal sleep comfort
- Optimizing mechanical properties
- Adding biochemical properties
4 Building Blocs

- Development of new plant varieties based upon increased knowledge of the biological processes underlying fibre length and fineness and optimized lignine profile
- Development of a two step (partly enzymatic) extraction process using the fundamental understanding of lignin catalysis occurring in the plant growth
- Optimize mechanical properties of flax during the entire manufacturing process
- Strengthen bio–medical properties of flax by grafting flax extracts, in particular lignans.
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## Objectives and Bench-Mark

<table>
<thead>
<tr>
<th>Yarn Properties:</th>
<th>Substantial finer yarns derived from 12 in pure long fibres, 16 in blends of short fibres. Higher hydrophilicity and moisture transport (+30%), increased heat absorption (+20%), higher tensile strength (+10%) at lower weights (-30%) lower creasing by lignin reduction, faster drying time after washing (-20%).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lignan Grafting:</td>
<td>Three working functionalities (cooling fabric, anti-skin-rash and sunburns, regulation of sebum secretion) with controlled release and control of mechanisms of reloading functionality after wash and wear.</td>
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<tr>
<td>Plant:</td>
<td>Create a family of high value plants (fibre price € 2,00-2,20) and strengthen the EU agriculture as supplier of bast fibre material of choice.</td>
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<tr>
<td>Process:</td>
<td>Reduction of Yarn Price at € 5-7 Kg (Comp. € 6-9 kg now -15%) Reduction of energy (-30%) and water consumption and chemistry use.</td>
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</tbody>
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**Property**
- Lignanes
- Cellulose
- Pectin
- Lignine

**Objective**
- Maintain or reintroduce
- Strengthen Host-properties (encapsulation/grafting)
- Purify in fine Micronage Long Fibre
- Reduce/Modify through Gene Knock-Down
- Reduce by Identification of Defective Gene
- Characterize and Remove Enzymatically

**Impact**
- Improve Value through Bio-Chemical Functionalities
- Improve Value through Mechanical Functionalities
- Reduce Cost of Processing and Reduce Share of Waste

**Property**
- Objective
- Impact
Monolignol biosynthesis pathway in angiosperms

Monolignol biosynthesis pathway in angiosperms

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Coupling of monolignols in the wall

H-Lignins

β-O-4-unit + β-5-unit → 5-5-unit → 4-O-5-unit
Lignans State of the art

- Lignan is host to range of medical compounds
- Podophyllotoxin, Lariciresinol, secoisolariciresinol... circa 3% in flax oil
- Mostly studied from flax seed and oral consumption but also in creams on the skin
- Effect on skin ageing, roughness, fungal and bacterial activity
Developing a Lignan System

- Secondary extraction to increase concentration to 5–20%
- Enclose in a cosmetic oil system
- Encapsulate in cyclodextrine
- Enzymatic grafting to the fibre
Conclusions

• Hyperflax is an example of an approach
• Aim natural fibres to large markets
  3 Mln Tons for Bast Fibres
• Re-establish a coherent supply chain in a PPP approach
• Be part of the last Mohicani
The Mohicani of Natural Fibres

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