



The Advantages of Flax Fibers in Composites

17 – 18 June 2009, Frankfurt

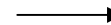
The Advantages of Natural Fibers – why should we use them?

- The use of natural fibers in the manufacture of technical textiles and nonwovens addresses the needs of our times
 - ✓ The end user's demand for natural fibers is growing
 - ✓ Increased environmental awareness
 - ✓ Biodegradable or recyclable materials are getting more important taking process efficiency/environmental concerns into account

By 2015, at least 85% of the average weight of a vehicle will have to be reused or recycled at the end of its life (source: Materials Magazine, Issue February 2009; Market Data from Textiles Intelligence (year 2008))

In the U.S., sales for organic fiber linens and clothing climbed to USD 203 million by 2006, up nearly 27% from the year before (source: Organic Trade Association)

- ✓ Bionics have gained much importance
- ✓ Nature is Norafin's model



The Advantages of Flax Fibers - why flax?

- Advantages regarding the cultivation of flax
 - ✓ In order to cultivate flax, no special soil conditions are needed
 - ✓ Compared to other natural fibers, such as cotton, less water and less chemicals are needed
 - 7100l/Kg cotton versus natural precipitation for flax
 - ✓ Good availability of flax fibers within Europe (France and Belgium are the most important producing regions within Europe) as well from quality prospective

Geographic Report of Linen Production (2003) – 11 predominant producers

Country	Cultivated surface (Ha)	Quantity in long fibres Process (To)	% in long fibre production
France	76,600	113000	46,7%
Belgique	19,250	29000	12,0%
Egypte	36,000	33000	13,6%
China	133,000	26000	10,7%
Rusland	118,000	10000	4,1%
Bielorussie	60,000	10000	4,1%
Netherlands	4,600	6900	2,8%
Ukraine	36,000	5000	2,1%
Pologne	6,000	4200	1,7%
Lituanie	10,000	3000	1,2%
Czech Republic	6,000	2100	0,9%
Total 11 countries	505,450	242200	100%

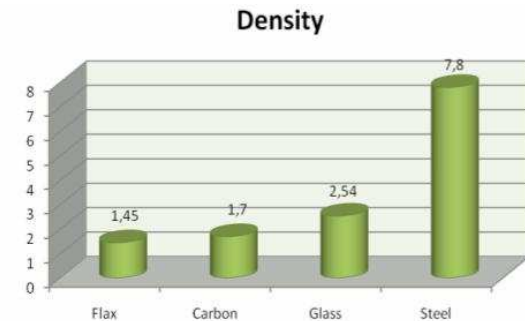
Source : Etude de marché des nouvelles utilisations des fibres végétales, Ernst&Young ADEME d'après AGPL, 2005

The Advantages of Flax Fibers - why flax?

- advantages of flax fiber
 - ✓ Great tensile strength (for a nature fibre)/low elongation
 - ✓ Vibration absorbing properties
 - ✓ Ultraviolet rays blocking properties
 - ✓ High Water retention (almost 50% fibres+pectines) -Morvan C; et coll.(1989)

Fiber Properties (source: IFTH)

	Flax	Glass	Kevlar	Carbon
Length of the plant	20 to 140 cm			
Length of the elementary fiber	4 to 66 mm			
Diameter of the elementary fiber	12 to 76 µm	10 to 25 µm	12 µm	16 to 50 µm
Density in g/m ³	1.4	2.6	1.4	1.48
Tenacity in N/tex	0.52			
Elongation in traction (%)	1.6	4.5	2.8	1.4
Constant of break in Mpa	800 - 1500	400	2300	2300
Specific Constraint (Mpa)	1034	980	2250	2111
Module of elasticity in Gpa	60 to 80	73	131	228
Specific module (Gpa)	55	309	91	12
Rate of Resumption in %	12			
Degree of polymerisation	2300			

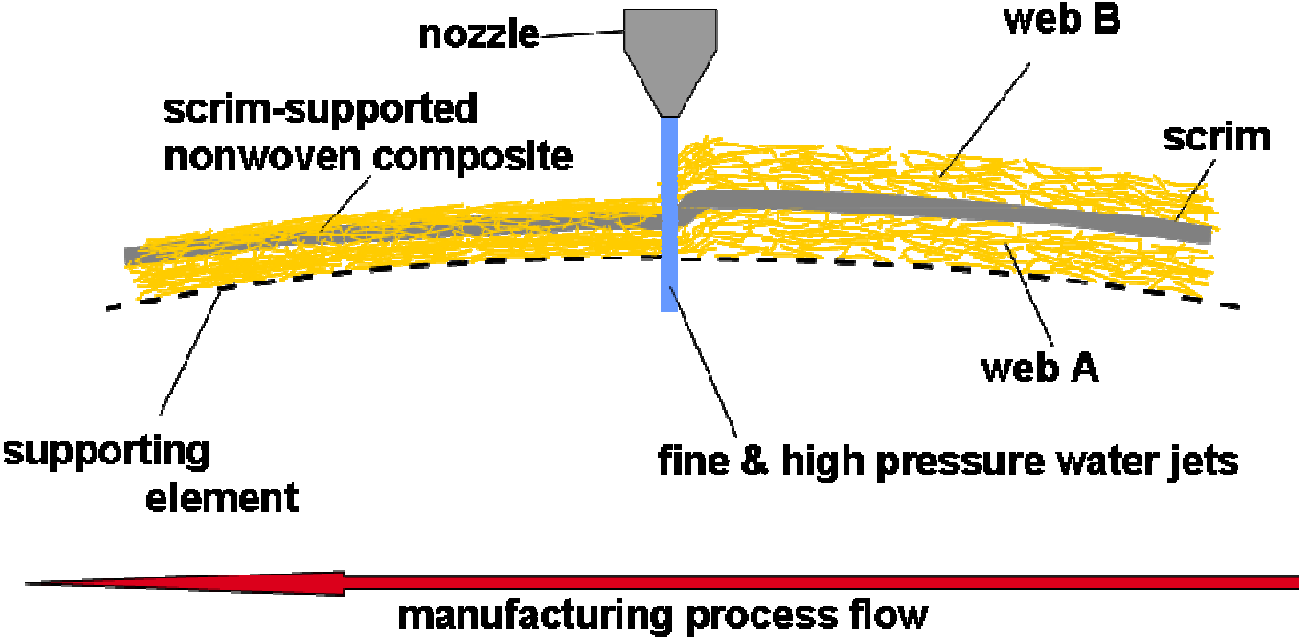


Pros and Cons of Flax Fibers In Composites Construction

- Pros:
 - ✓ Great tensile strength (for a nature fibre)/low elongation
 - ✓ Vibration absorbing properties
 - ✓ Water retention (conductivity)
 - ✓ Cost/Kg
 - ✓ Ecologically friendly

- Cons:
 - ✓ Bad adhesion due to all the cements present in the compound (pectin,...)
 - ✓ Degradation of the fibres above 200 degree C (392 Degree F)
 - ✓ Limitation of the external applications due to humidity retention
 - ✓ Regularity of the base material characteristics

The Processing of Flax Fibers – Norafin’s Spunlace Technology



The Processing of Flax Fibers – Norafin’s Spunlace Technology

Pros
efficient production (directly from the fiber to the web)
thanks to the pectin within the fiber, the material gets stiffer through spunlacing
the fibers get split during the spunlacing process
Cons
flax is a natural fiber and therefore has an irregular shape (long fibers vs. short fibers)
elutriation of the fibers is a risk in spunlacing
the cleaning of the water cycle represents a challenge



Applications - High breathability roofing membranes

- **Properties: hard-wearing and long lasting**
- **Valuable alternative to synthetically manufactured membranes in the roofing sector**
- **A 125 g/m² weight nonwoven material made of 100% flax, yielded a tensile strength of 220 N/5 cm**
- **If a scrim made of natural fibers ,PET , or fiberglass is included into the nonwoven material:**
 - ⇒ **180 gsm Flax PET Reinforced :**
 - strength value of 450 N/5 cm (CD)**
 - strength value of 600 N/5 cm (MD)**

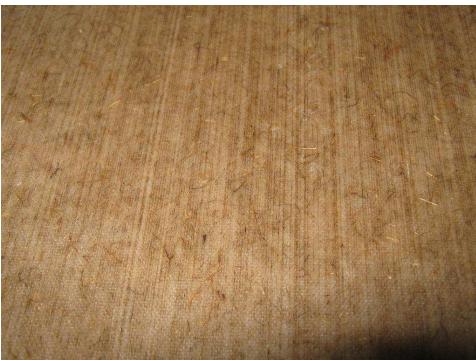


Applications – Composite for Leisure

- Infusion Process
 - ✓ (good processability)
 - ✓ Under mechanical evaluation



Source : Lineo
<http://www.lineo.eu/>



Complex with Cork



Other Applications

- Flax composites as a valuable alternative in the filtration industry
- Packaging, such as biodegradable bags and covers
- Use in the field of wind energy
- Sports equipment (light weight, resistance, fashion)



Source : Lineo
<http://www.lineo.eu/>



Challenges

- Unstable flax fibre pricing
- Narrow the fluctuation in “characteristic” of the flax fibre
 - ✓ Team up with the producer
- Define the fibre preparation versus the production process
- The development of novelty products needs time
- Trust in new products needs time to be established
- Our task will be to show the market that flax composites are not only an eco-friendly trend, but a valid alternative to the existing products within the market
- ...

Future Trends

- Composites that are a 100% biodegradable
 - ✓ If flax is used within composites that use natural resins only, the product advantages are even more evident
 - The material represents a strong product solution
 - The good recyclability of the fiber allows the reutilization of the material (eg. cellulose paper)
 - Bio-refining processes are being explored



Thank you for your attention!

Norafin
Your Solution Provider

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