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Neocon 2011 program

Specifying Rapidly Renewable Natural Textiles – from natural wool to innovative new bast fiber fabrics

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This NeoCon 2011 program is approved for one GBCI CE hour toward LEED Green Associate or certified LEED AP

Specifying Rapidly Renewable Natural Textiles,
Camira Fabrics.

1. Market composition by fiber type

The worldwide market by fiber type and fabric composition is driven by petro-chemical synthetics, in particular polyester, amassing 32 million tons annual consumption in 2007 compared to just 1 million tons natural wool.

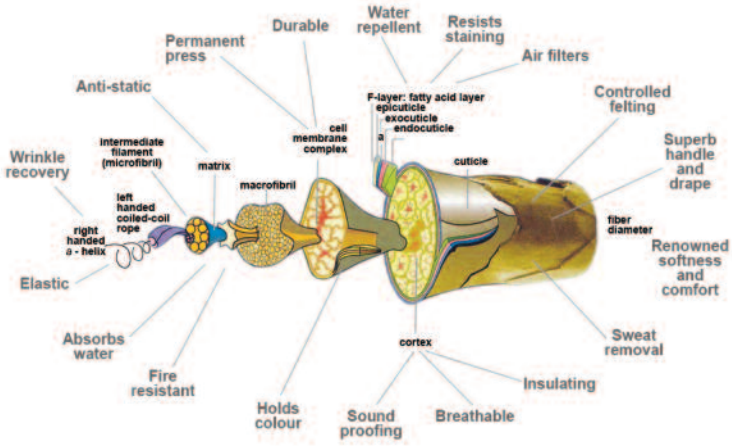
Fibre type	Tons	Percentage
Polyester	32 m	43%
Cotton	24 m	32%
Polypropylene	8 m	10%
Nylon	4 m	6%
Acrylics	3 m	4%
Cellulosics	2 m	3%
Wool	1 m	2%

(Source: Chemical Fibers International Yearbook 2008).

The North American market is dominated by polyester and nylon, which are both finite oil-based synthetics, which deplete natural resources and add to non-degradable waste. Natural fiber products are made from annually renewable wool and innovative new bast fibers derived from harvested plants. The fibers occur naturally rather than having to be synthesized from natural polymers, such is the case with viscose, bamboo and PLA. Natural fiber textiles are unique not just in terms of environmental properties, but also in relation to actual performance in use.

2. Wool

Wool is an extremely complex, intelligent, technical and environmental fiber that has evolved from nature over thousands of years. It is widely used in the contract furnishing industry thanks excellent performance properties that are genetically built into each fiber strand which no man-made creation has ever been able to duplicate.



(Source: CSIRO – Commonwealth Scientific and Industrial Research Organisation)

2.1 Environmental attributes

Wool is grown, not man-made, on sheep which live a free range life as part of the farming landscape. The supply of wool is limited only by the number of sheep on the planet, estimated to be approximately 1 billion, with major producers including New Zealand, Australia, Argentina, USA, China, South Africa and Great Britain. Some key environmental characteristics include:

Rapid renewability – a typical sheep's fleece will produce some 10 yards of fabric, enough to cover 10 task chairs or a large sofa. With up to 30,000 sheep on a single farm, the amount of cloth from a single flock is huge.

Biodegradability – wool is a keratin-based protein fiber, like human hair, and will biodegrade completely, fulfilling optimum lifecycle benefits. Wool has been used as a fertilizer on arable land, thanks to its high nitrogen content, cropped fibers are used as animal bedding, and one of the latest, more unusual applications is the Natural Legacy coffin by AW Hainsworth & Sons Ltd.

Traceability – the new LaneveTM brand from Wools of New Zealand provides complete traceabililty back to identifiable farmers who comply with an independently authenticated Integrity Program.

Lower energy and CO2 footprints – wool has demonstrably less impact in terms of energy consumption per lb of finished fiber, as compared to any of the man-made petro-chemical synthetics (see information in section 4 below).

2.2 Performance attributes

Wool is often referred to as Mother Nature's miracle fiber, with multiple smart abilities which make it an unrivalled performance fiber for safety, long-term appearance retention and other performance benefits.

Flame retardancy – wool is difficult to ignite and resists flaming without chemical treatment. Instead of buring freely it forms a char against the flame and in a severe fire situation will not melt, drip or give off noxious fumes. It is also self-extinguishing and will stop burning when removed from the source of fire.

Appearance retention - wool has a microscopic armour like coating which helps prevent dust and dirt from penetrating the fabric surface and which preserves its beautiful appearance for longer. Its natural crimp also allows compression and recovery, rather than flattening and dulling out.

Breathability / air filter – the natural cell structure of wool makes it a feelgood, breathable fiber which can absorb and evaporate moisture for natural climate control and user comfort. It also acts as an air filter, with verified reductions of VOCs in the indoor environment, including formaldehyde, sulphur dioxide and nitrogen dioxide by absorbing them irreversibly into its structure.

3. Bast fibers

Wool is the perfect accompaniment to natural bast fibers which are obtained from harvested plants. In bast fiber plants the textile fiber occurs naturally in the stem of the plant just inside the outer bark rather than in a cotton seed boll. Examples include flax, jute, ramie, hemp and the common stinging nettle "urtica dioica". As with wool, these natural fibers have been used for thousands of years, long before the advent of synthetics, but competence in their cultivation and manufacture has largely been lost due to the incessant rise in cotton and polyester consumption. UK textile manufacturer Camira therefore worked with bast fiber research specialist De Montfort University in Leicester, UK, on a ground breaking UK government funded project to design, develop and commercialize an innovative new sustainable fabric made from wool and nettles.

3.1 Sting project

The Sting project began in 2005 with the planting of 30,000 nettle plant cuttings on Lindridge Hall Farm in Leicestershire, UK, the first time ever that nettles had been grown commercially, in bulk, on UK farmland. The Sting name was creatively coined to stand for "Sustainable Technology in Nettle Growing" and involved scientific and academic research into nettle cultivation, harvesting and fiber extraction; fiber processing, blending, weaving and dyeing; technical performance evaluation and life cycle assessment.

3.2 The agriculture

Nettles are a perennial crop which grow rapidly from springtime onwards, reaching up to 8 feet by the time they're harvested. They grow easily - without the need for pesticides or herbicides - on land which is often unsuitable for other crops, such as floodplains and even on brownfield sites. In doing so they create their very own diverse eco-system by providing a natural habitat for rabbits, birds, butterflies, insects, moths, even frogs and toads. They're harvested in late summer and left to dry out on the field while their leaves naturally decompose and provide nutrients for the following year's crop. The nettle stems are then baled and taken away for mechanical decortication, whereby the textile fiber is

extracted from the stem of the plant.

3.3 Decortication

The fiber in bast plants is located between the outer bark (epidermis) and the central woody core of the stem, arranged in bundles held together with pectins. Traditionally, a water or enzyme retting system has been employed to separate the usable fiber, requiring the stems to be soaked in water and / chemicals, but giving rise to potentially negative environmental impacts and requiring effluent to be properly treated. The mechanical system begins by the stems undergoing a crushing and beating motion, then the flexible fiber is separated from the brittle woody parts by cylonic air flow, allowing the lighter fiber to progress while the heavier woody portion drops out. The woody remnants are then sold as a by-product, as biodegradable animal bedding.

3.4 Wool-nettle fabric

Wool and nettle fiber are blended together, spun into fiber, woven into upholstery fabric and then piece-dyed. Technical evaluation found a 75% wool 25% nettle composition to be the optimum fiber blend, producing a fabric suitable for heavy duty contract use, meeting all relevant standards in terms of abrasion resistance, color fastness and fire retardancy. It is in this last area, where wool – nettle fabric excels, outperforming both wool and synthetics in the same weight of cloth, to give an inherently fire retardant upholstery solution, meeting higher level FR standards.

3.5 Knowledge transfer

The successful outcome of the Sting project is translating into the development of other sustainable bast fiber fabrics derived from hemp and recycled jute. Hemp benefits from an even faster growth to harvest cycle compared to nettles and can be sown from seed rather than cuttings. Fiber extraction uses the same mechanical decortication process.

Recycled jute comes from used hessian coffee sacks which are blended with wool to creative an innovative new fiber blend for upholstery for a major US coffee retailer. Using a premium pure new wool, in a ratio of 60% wool 40% jute, helps manage the variability of the hessian input material – in terms of coarseness, overprints and sewing threads – and also helps prevent the shedding of short jute fibres which easily separate and fly away as airborne particles.

4. Environmental footprinting

Just two environmental indicators are energy consumption and carbon dioxide emissions which indicate the lower impact of natural fibers compared to the petro-chemical synthetics. The information below is largely based on averages collated by Barber and Pellow who examined previous research undertaken by numerous different sources.

Fiber type	Energy consumption kWh / kg fiber	CO2 emissions in kg per kg fiber	Energy consumption kWh / lb fiber	CO2 in lb per lb fiber emissions
Nylon	69	37	31	17
Acrylic	49	26	22	12
Polyester	35	19	16	9
Polypropylene	32	17	15	8
Viscose	28	15	13	7
Cotton	15	8	7	4
Wool	13	7	6	4
Nettle	9	5	4	2
Hemp	5	3	2	1

(Source: Barber & Pellow, Life Cycle Assessment – New Zealand Merino Industry (2006), except Nettle and Hemp Energy Consumption: Central Science Laboratory, Comparative LCA Nettle, Flax, Hemp.)

CO2 emissions based on Defra's UK grid rolling average (0.537kg CO2 per KWh)

5. Information sources

Barber & Pellow (2006) - The AgriBusiness Group
Life Cycle Assessment – New Zealand Merino Industry

British Textile Technology Group (1999)
Textile Mass Balance and Product Life Cycles

Cherrett et al (2005) - Stockholm Environment Institute
Ecological Footprint and Water Analysis of Cotton, Hemp & Polyester

Australian Wool Innovation
www.wool.com

British Wool Marketing Board
www.britishwool.org.uk

International Wool Textile Organization
www.iwto.org

Wools of New Zealand
www.woolsnz.com