Nettles

Introduction

The nettle is a perennial flowering plant genus in the family Urticaceae, which brings together 30–45 species. This plant is very widespread and it is found in different parts of the world. The group of Urticaceae (Urereae) includes some species commonly exploited to obtain fibre like *Boehmeria nivea* (ramie), *U. dioica* and *G. diversifolia* (also called Himalayan nettle or Nepalese nettle). Stinging nettles' (*Urtica dioica L.*) habitat is widespread in throughout the temperate regions of Europe, Asia, America and is the most prominent species in Europe. It grows on phosphates and nitrates rich soils, preferably on soils with adequate moisture and pH 6.5 in shady habitat. In favourable conditions it grows rapidly. Nettle is considered a weed and is resistant to pests and, therefore, does not need pesticides even if it had been cultivated deliberately.

Fiber extraction

The fibers can be extracted via different methods such as chemical extraction, water retting, microbiological and enzymatic extraction, which can be applied on entire nettle stalks and/or unretted decorticated fibers. During project SUSTEX unretted nettle stalks were decorticated and manually carded. The nettles were harvested at three different times in 2021 and 2022.

June 2021

July 2021

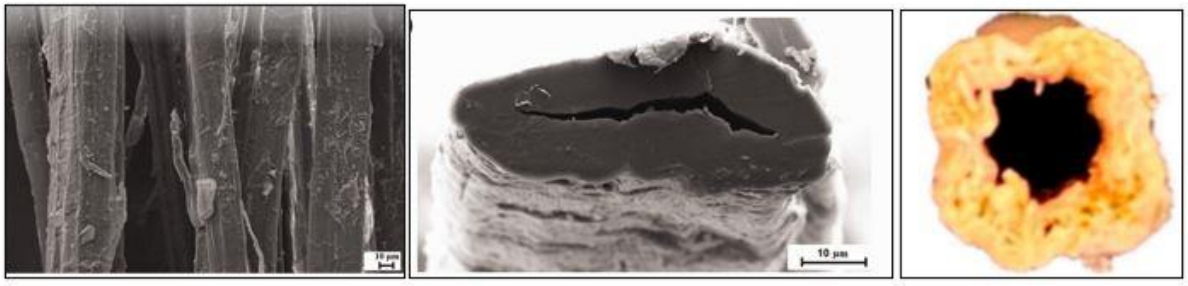
Fiber composition and properties

The cellulose content of the nettle fibers exceeds 80% and may vary with the year of cultivation (1st or the 2nd) and stalk positions (i.e. more % at the bottom).

	1st year fiber	2nd year fiber		
		Bottom	Middle	Top
Cellulose (%)	83.5 ± 5.0	83.6 ± 4.5	79 ± 2.2	81.3 ± 3.8
Hemicellulose (%)	6.5 ± 5.8	8.3 ± 5.2	12.5 ± 3.1	7.2 ± 1.1
Lignin (%)	4.1 ± 1.8	4.4 ± 0.4	3.8 ± 0.9	3.5 ± 0.2

Previous studies reported large variation of the fiber diameter, length, tensile strength and elongation depending on the extraction method (Bacci et al. 2011) and also on different stalk (from the 2nd cultivation year) positions (Bacci et al. 2008).

	Bottom	Middle	Top
Mean (range) diameter (μm)	47 (31-63)	32 (21-42)	19 (10-26)
Mean (range) length (mm)	43 (27-60)	50 (39-63)	58 (40-73)
Mean (range) tensile strength (cN/tex)	24 (12-40)	62.1 (38-98)	58.7 (24-98)
Mean (range) elongation (%)	2.6 (1.5-3)	2.3 (1.3-3.5)	2.5 (1-6)



Thilagavathi et al., 2019 Viotti et al., 2022

The length and the mechanical properties of the fibers extracted in the SUSTEX project from unretted nettle stalks decorticated and manually carded showed significant differences depending on the harvesting periods.

	Mean* + STDEV					
	June 2021	July 2021	Sept 2021	June 2022	July 2022	August 2022
Fineness (tex)	10,3 ± 5,3	3,3 ± 2,1	5,2 ± 1,8	2,3 ± 1,0	1,6 ± 0,8	2,5 ± 0,7
Lenght (mm)	53,4 ± 6,9	72,3 ± 9,7	86,8 ± 23,4	67,7 ± 11,2	94,2 ± 21,4	88,6 ± 14,6
Tenacity (cN/tex)	16,2 ± 6,8	23,9 ± 11,9	33 ± 16,1	32,8 ± 14,6	59,2 ± 32,3	41,5 ± 12,1
Elongation (%)	2,3 ± 0,9	2,9 ± 0,1	2,6 ± 1,6	2,1 ± 1,5	2,0 ± 1,0	4,3 ± 2,8

Conclusion and outlook

- Limited amount of material was tested, reproducibility has to be confirmed
- Optimization of the extraction procedure needed
- SUSTEX-library: yarns Nm 28/1-50/1 in blends 30/70 nettle/ cotton yarns (cultivated by NFC Nettle Company and processed by HAVETEX).