

Cannabis: Fibre, Properties and Uses Before the Industrial Era

Cannabis fiber is a natural lignocellulosic fiber with a documented history of use spanning millennia in textiles, ropes, and sails.

Its high cellulose content and favorable strength-to-weight ratio determined its mechanical properties and principal uses before the industrial era.

INTRODUCTION

Cannabis plant fibre is a natural lignocellulosic fibre with documented use spanning thousands of years. Before the development of synthetic fibres, it was one of the principal natural raw materials used to produce textiles, ropes and sails, owing to its mechanical properties and relatively high durability.

This article examines the characteristics of cannabis fibre, its anatomical origin, composition and physicommechanical properties, as well as traditional processing technologies and its uses before the industrial era.

ANATOMICAL ORIGIN AND COMPOSITION

Cannabis plant fibre is a bast fibre found in the outer part of the stem, surrounding the inner woody core (hurds). In this respect, it belongs to the same group as flax, jute and ramie. Fibre cultivation is carried out at high planting densities, which encourages upright plant growth, limited branching and longer fibres.

Chemically, the fibre belongs to lignocellulosic materials and consists mainly of cellulose (~66–78%), hemicellulose (~14–22%), lignin (~2–6%) and pectin. Cellulose, organized into microfibrils, determines the strength and stiffness of the fibre, while pectin and hemicellulose act as binding materials between the elementary fibres.

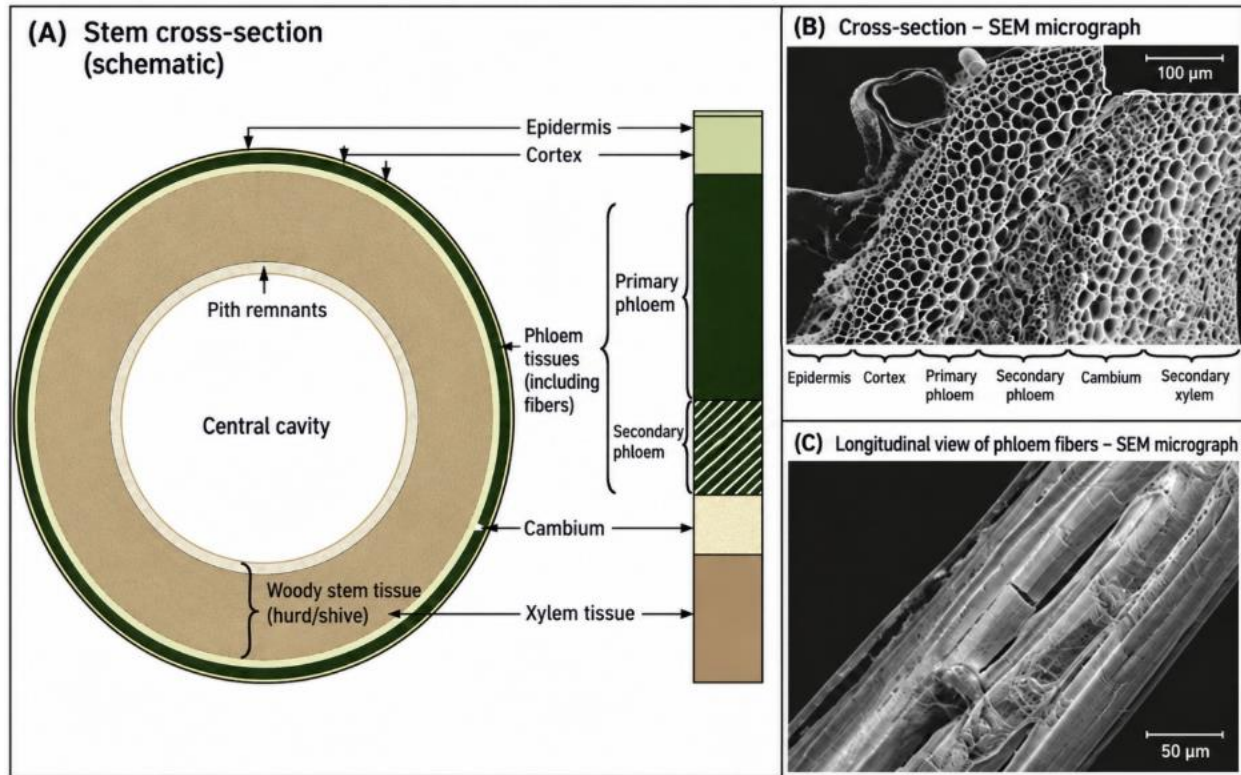


Figure 1. Cross-section of the hemp stem and location of the bast fibres. Adapted from Mavinkere Rangappa S, Parameswaranpillai J, Siengchin S, eds. *Plant Fibers, their Composites, and Applications*. Woodhead Publishing/Elsevier; 2022. Ch. 10, Fig. 2. © Elsevier.

PHYSICOMECHANICAL PROPERTIES

Cannabis fibre is characterized by a high strength-to-weight ratio. Elementary fibres are approximately 15–25 mm long, while technical fibres, consisting of bundles of joined fibres, can reach several metres. Tensile strength is reported to range approximately from 390–920 MPa, with a low density ($\sim 1.5 \text{ g/cm}^3$), values that help explain its early use for ropes and fabrics subject to high loads.

The fibre is hygroscopic and readily absorbs moisture, a property that increases its suitability for clothing. At the same time, its high cellulose content gives it relatively good resistance to moisture, salt and degradation compared with many other natural materials, making it particularly valuable in marine environments.

TRADITIONAL PROCESSING TECHNOLOGIES

The extraction of fiber from the stalk involves several consecutive processing stages. The key stage is controlled retting, during which microorganisms degrade the pectin that binds the fiber bundles

to the woody part of the stalk. Traditionally, two main methods have been used: dew retting and water retting.

After retting, the woody part is mechanically broken, followed by scutching (removal of woody residues from the fibre) and combing (separation and cleaning of the fibres). The resulting fibre was then spun into yarn and woven into fabric. These operations remained essentially unchanged from antiquity until the pre-industrial era and were carried out mainly by hand.

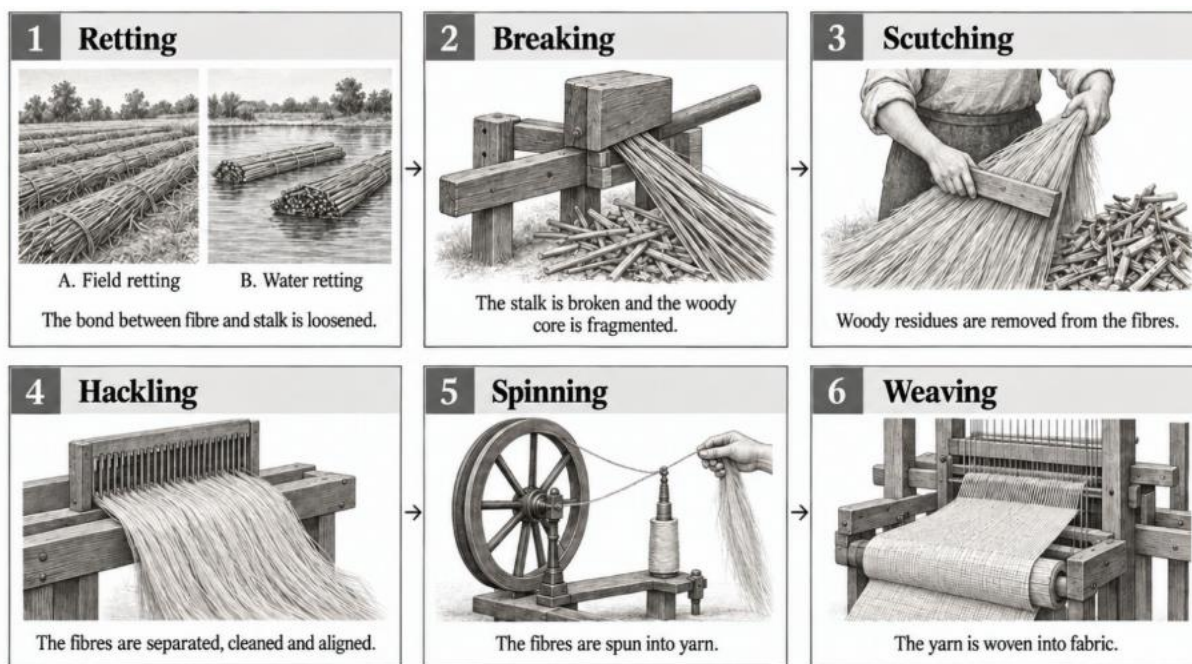


Figure 2. Traditional hemp-fibre processing chain, from harvest to weaving. Adapted from Zimniewska M. Hemp Fibre Properties and Processing Target Textile: A Review. *Materials*. 2022;15(5):1901. doi:10.3390/ma15051901.

USES BEFORE THE INDUSTRIAL ERA

Its mechanical properties and durability determined the range of uses. Cannabis fibre was used to produce ropes, sacks, nets, coarse fabrics and clothing, as well as early forms of paper. Coarser and shorter fibres (tow) were used for caulking ships, filling gaps between planks to make them watertight.

One particularly important use was maritime. During the age of sailing, ropes and sails were widely produced from cannabis fibre because of its durability under marine conditions.

The demands of sailing were considerable: a single sailing vessel required large quantities of fibre for ropes, anchor cables and sails, making cannabis an economically and militarily important raw material whose supply maritime powers sought to secure. An important technical advantage was

that the fibre retained a substantial proportion of its strength even when wet, making it suitable for long-term use in marine conditions. Beyond the maritime sector, it was also widely used in everyday life for twine, coverings and fishing equipment, where mechanical durability was more important than fibre fineness.

REFERENCES

- [1] Fike J. The history of hemp. In: Williams DW, editor. Industrial hemp as a modern commodity crop. Madison (WI): ASA, CSSA, and SSSA; 2019. p. 1–25. doi:10.2134/industrialhemp.c1
- [2] Crini G, Lichtfouse E, Chanet G, Morin-Crini N. Traditional and new applications of hemp. In: Crini G, Lichtfouse E, editors. Sustainable agriculture reviews 42. Cham: Springer; 2020. p. 37–87. doi:10.1007/978-3-030-41384-2_2
- [3] Bouloc P, Allegret S, Arnaud L, editors. Hemp: industrial production and uses. Wallingford (UK): CABI; 2013. doi:10.1079/9781845937935.0000
- [4] Zimniewska M. Hemp fibre properties and processing target textile: a review. Materials (Basel). 2022;15(5):1901. doi:10.3390/ma15051901
- [5] Visković J, Zheljazkov VD, Sikora V, Noller J, Latković D, Ocamb CM, et al. Industrial hemp (*Cannabis sativa* L.) agronomy and utilization: a review. Agronomy. 2023;13(3):931. doi:10.3390/agronomy13030931
- [6] Manaia JP, Manaia AT, Rodrigues L. Industrial hemp fibers: an overview. Fibers. 2019;7(12):106. doi:10.3390/fib7120106

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