



DSTF
DIPARTIMENTO DI SCIENZA E
TECNOLOGIA DEL FARMACO
UNIVERSITÀ DEGLI STUDI DI TORINO



**UNIVERSITÀ
DI TORINO**

Università degli Studi di Torino
nis
NANOMATERIALS FOR INDUSTRY
AND SUSTAINABILITY



processes

an Open Access Journal by MDPI

PROF. DR. GIANCARLO CRAVOTTO

Editor-in-Chief of *Processes*

C'è canapa e ... canapa

La ricerca applicata quale elemento di congiunzione tra
mondo agricolo e mondo industriale

GREEN
INNOVATION

19 aprile 2023



SATIVA



INDICA



RUDERALIS







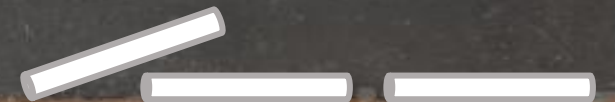
Δ^9 - TETRAHYDROCANNABINOL (Δ^9 -THC)

Flowers	10 - 12 %
Leaves	1 - 2 %
Stem	0.1 - 0.3 %
Roots	< 0.03 %



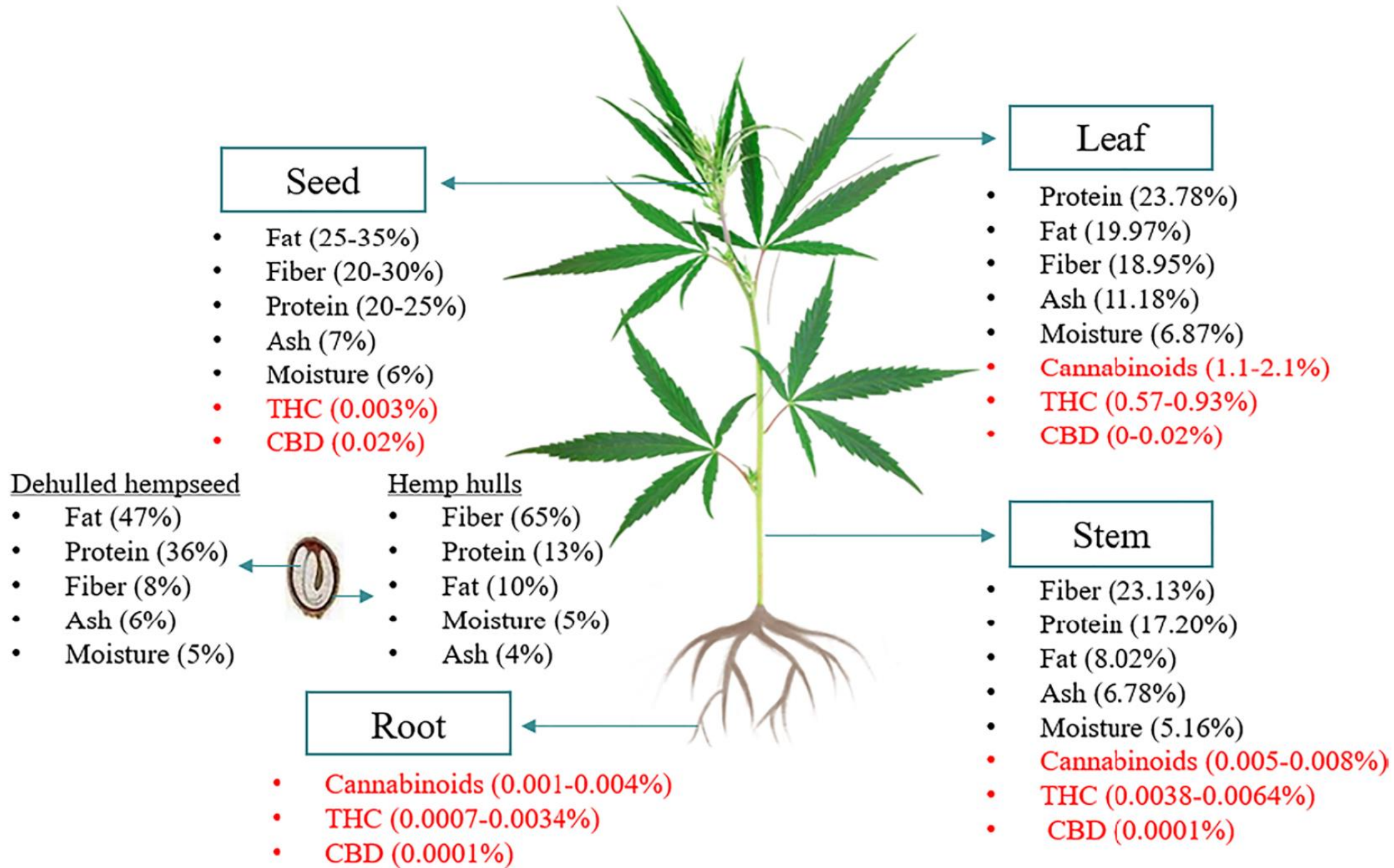
Canapa industriale

The international market for hemp was worth
5.66 billion USD in 2020,
according to *Verified Market Research*, and is predicted
to reach
27.72 billion USD by 2028



energy consumption renewable urban planning energy alternative production world transport crisis econ
global warming urban planning energy alternative urban planning transport cr
SUSTAINABILITY
energy law green emissions management
climate change eco b
consumption
inequality eco energy
alternative planet
world inequality urban planning carbon
Earth resources emissions climate change government transport resources gement
economy alternative
rth
ecology
sustainability management carbon-neutral global warming
global warming inequality
human needs ecology planet
world





THE MANY USES OF HEMP



TEXTILES

- Clothing
- Diapers
- Handbags
- Denim
- Shoes
- Fine Fabrics

INDUSTRIAL TEXTILES

- Rope
- Canvas
- Tarps
- Carpeting
- Netting
- Caulking
- Moulded Parts

PAPER

- Printing
- Newsprint
- Cardboard
- Packaging

FOODS

- Hemp Seed Hearts
- Hemp Seed Oil
- Hemp Protein Powder
- EFA Food Supplements

BUILDING MATERIALS

- Oil Paints
- Varnishes
- Printing Inks
- Fuel
- Solvents
- Coatings
- Fibreboard
- Insulation
- Acrylics
- Fiberglass Substitute

BODY CARE

- Soaps
- Shampoos
- Lotions
- Balms
- Cosmetics



HEMP USES & PROPERTIES



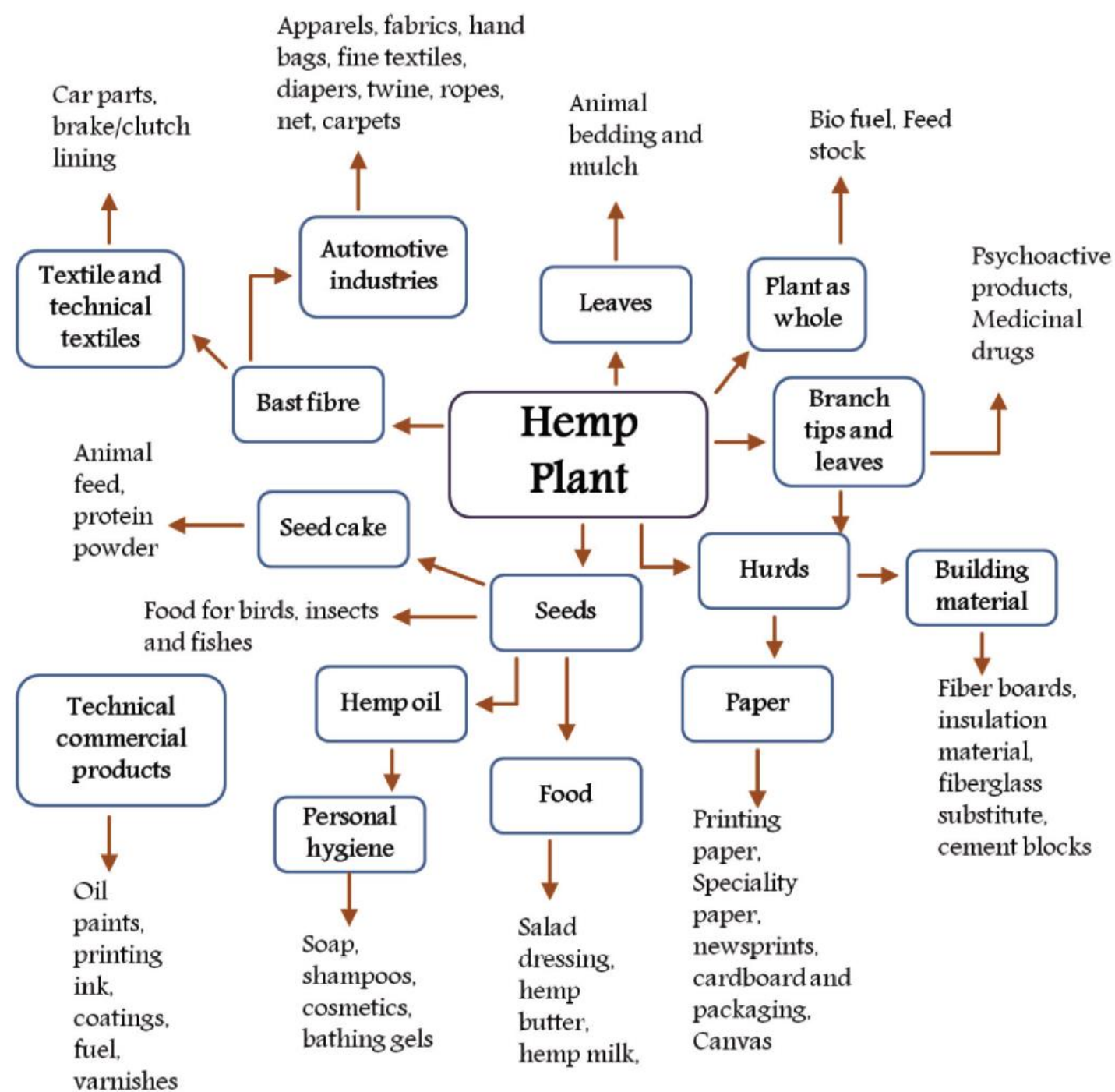
**HEMP IS THE STRONGEST
NATURAL FIBRE IN THE WORLD**

IT'S KNOWN TO HAVE OVER 50,000 DIFFERENT USES!

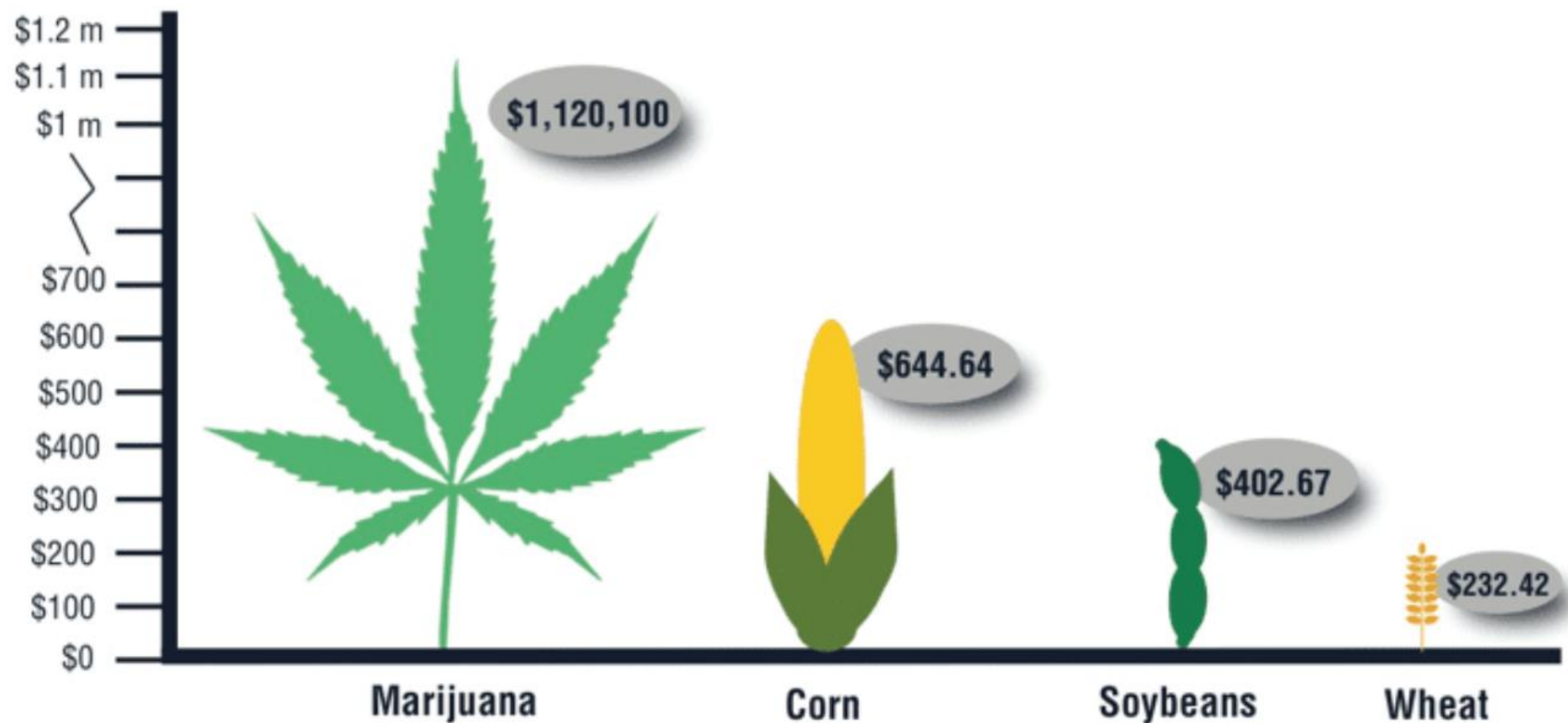
CANNABIS IN GREEN ECONOMY



Food, pharmaceutical, textile, paper, building, energy, and other industries found hemp to be a promising solution for synthetic-based and green economy



Comparative Yield per Acre



Sources: USDA, The Rand Corporation, Correspondence with Marijuana Cultivators in Oregon



The best hemp in the world was grown in Romagna (Italy)

J. H. Maiden

Agricultural Gazette of New South Wales, 1983

- In 1919, Italian hemp exports accounted for 50% of all world hemp exports
- 1982 the prohibition
- French varieties were reintroduced in 1998

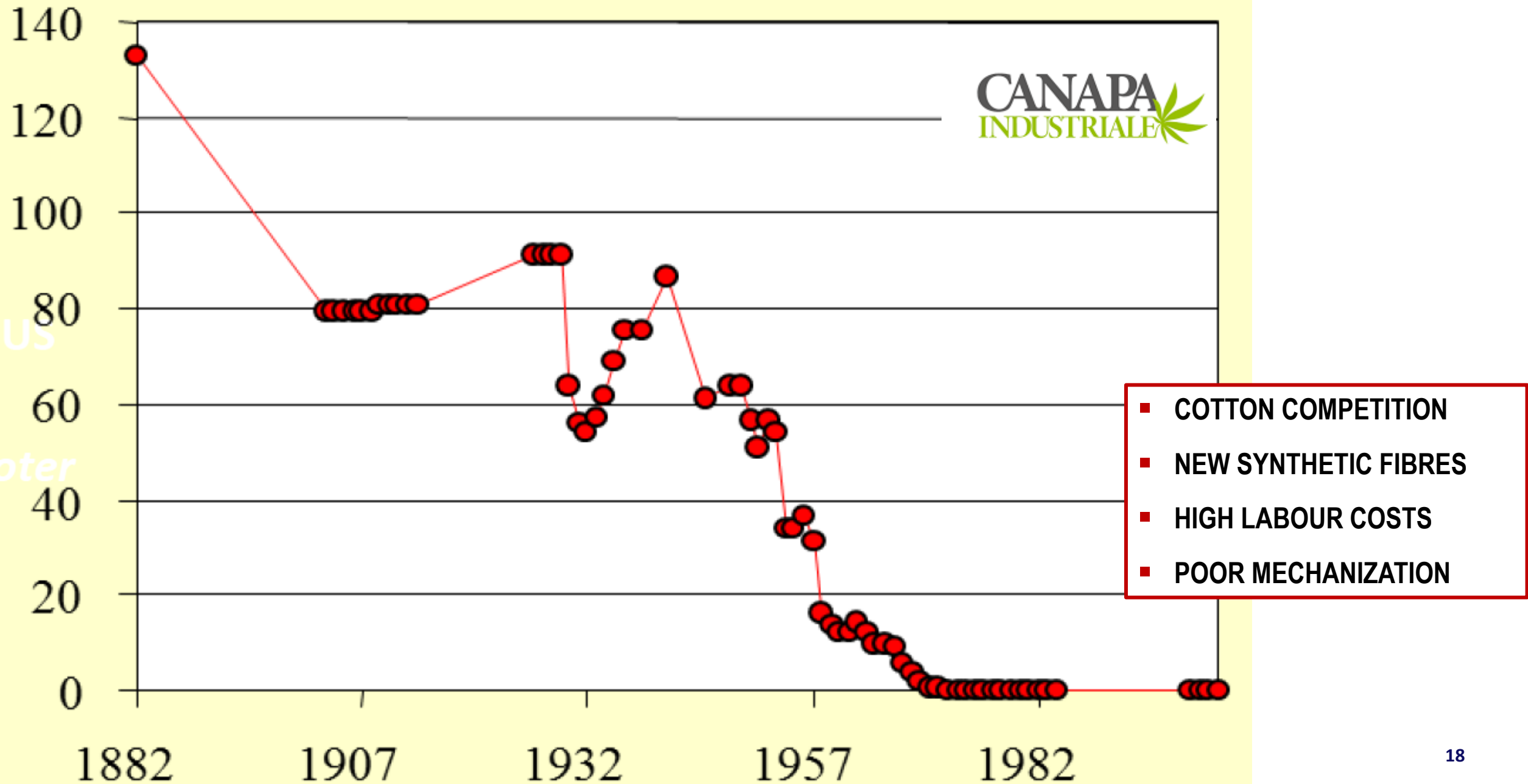






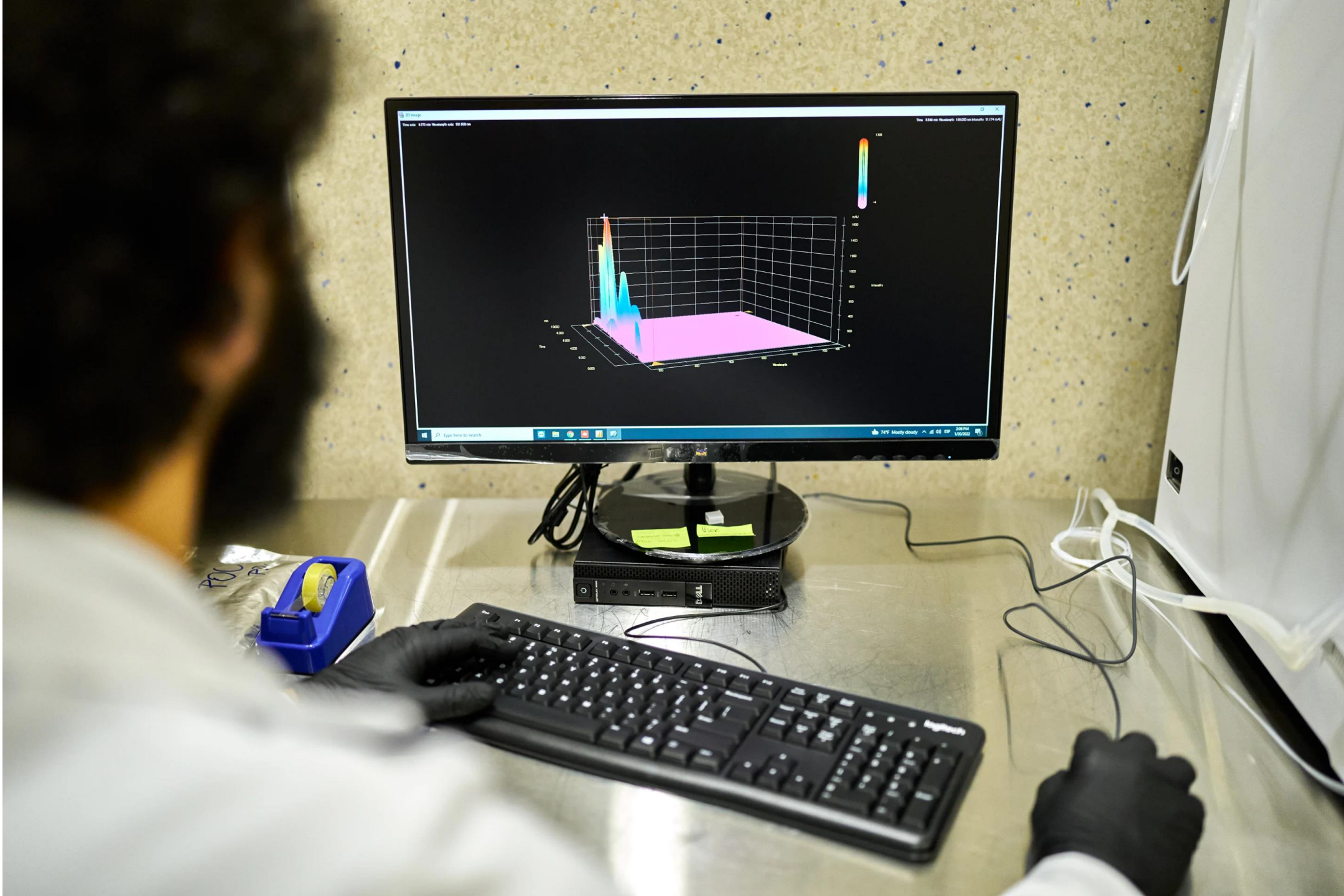


Produzione in Italia (ha 10³)









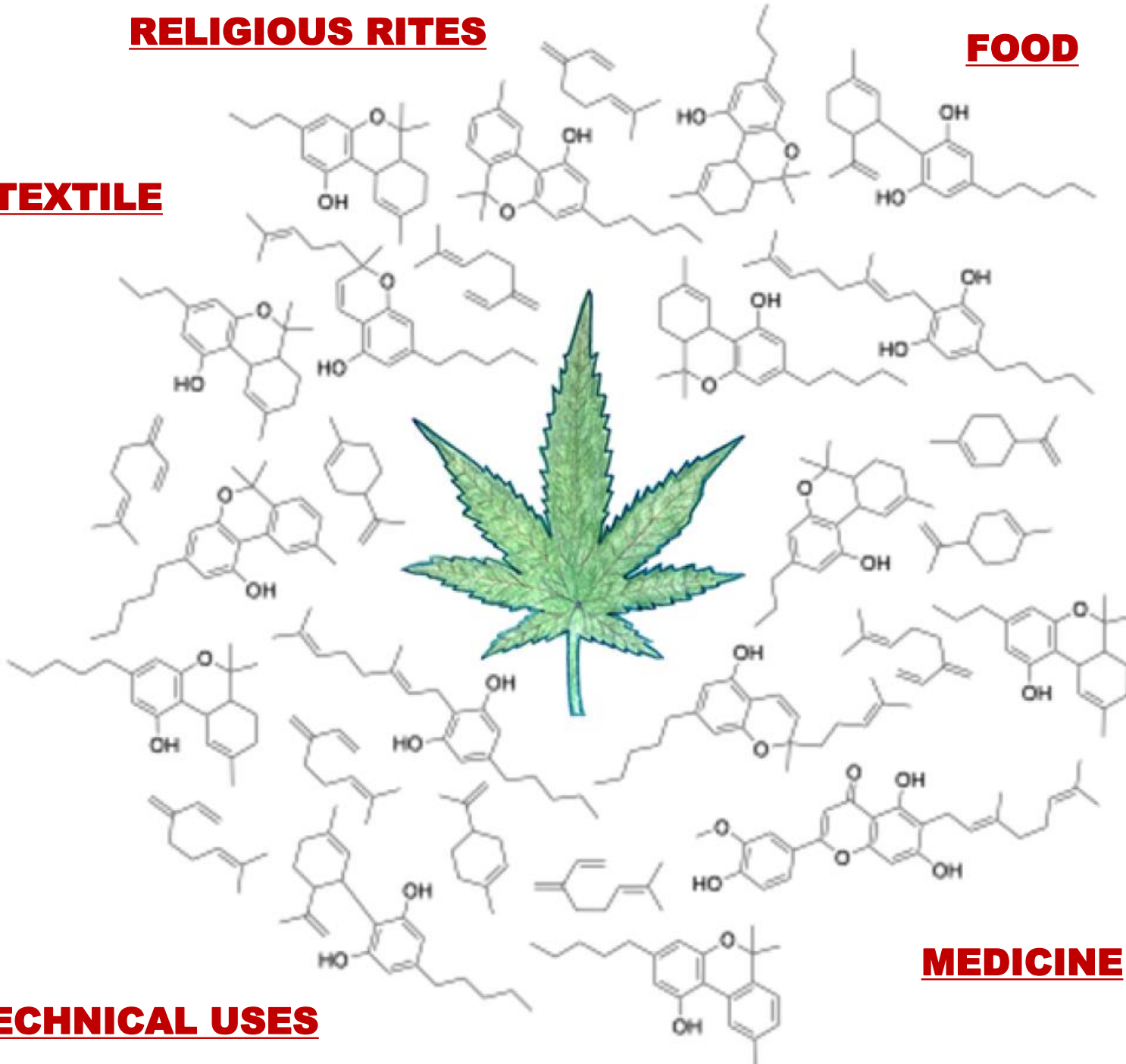
Chemistry of Cannabis



RELIGIOUS RITES

FOOD

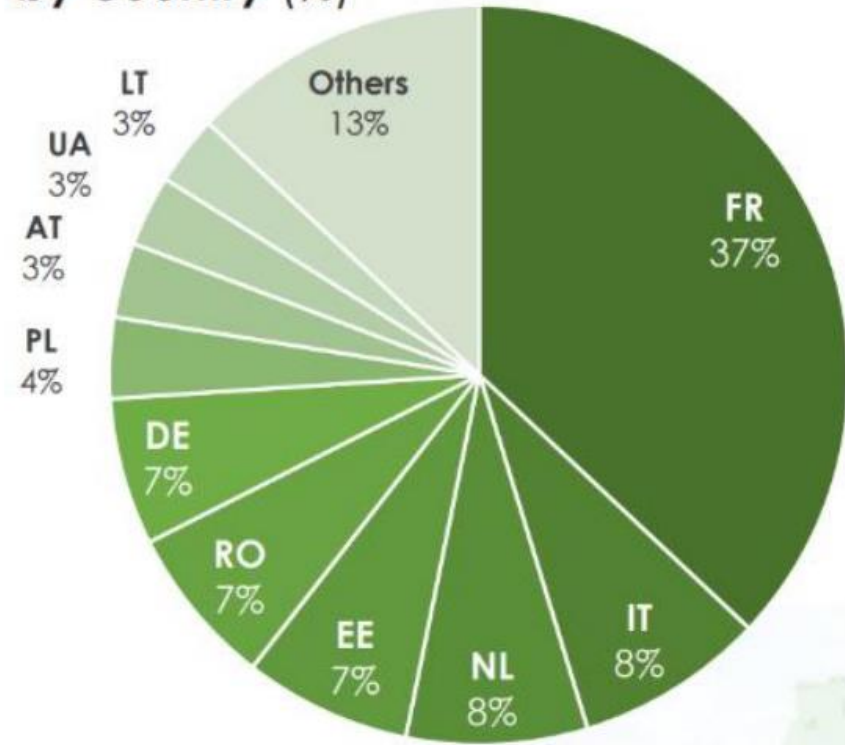
TEXTILE



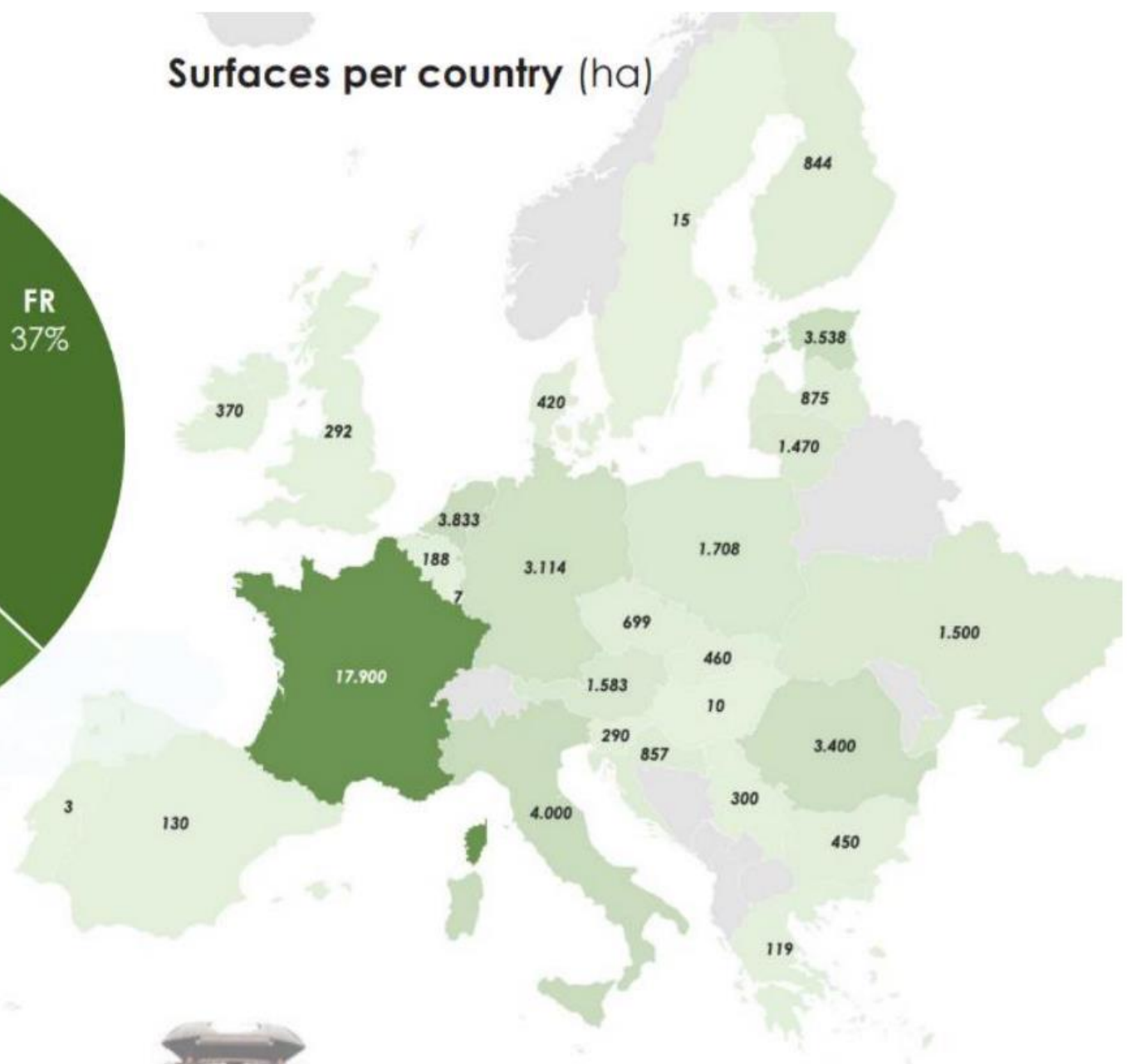
MEDICINE

TECHNICAL USES

Share of surfaces by country (%)



Surfaces per country (ha)



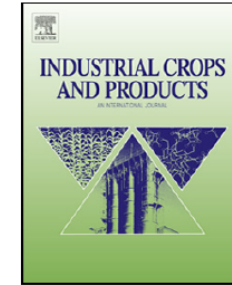
Source: European Industrial Hemp Association (EIHA) - Data from 2018



Contents lists available at [ScienceDirect](#)

Industrial Crops and Products

journal homepage: www.elsevier.com/locate/indcrop

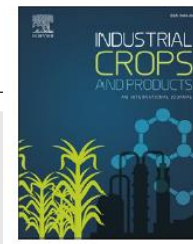


Evaluation of European developed fibre hemp genotypes (*Cannabis sativa* L.) in semi-arid Mediterranean environment



- **Excellent in crop rotations**
- **Weeds, diseases and pests control**





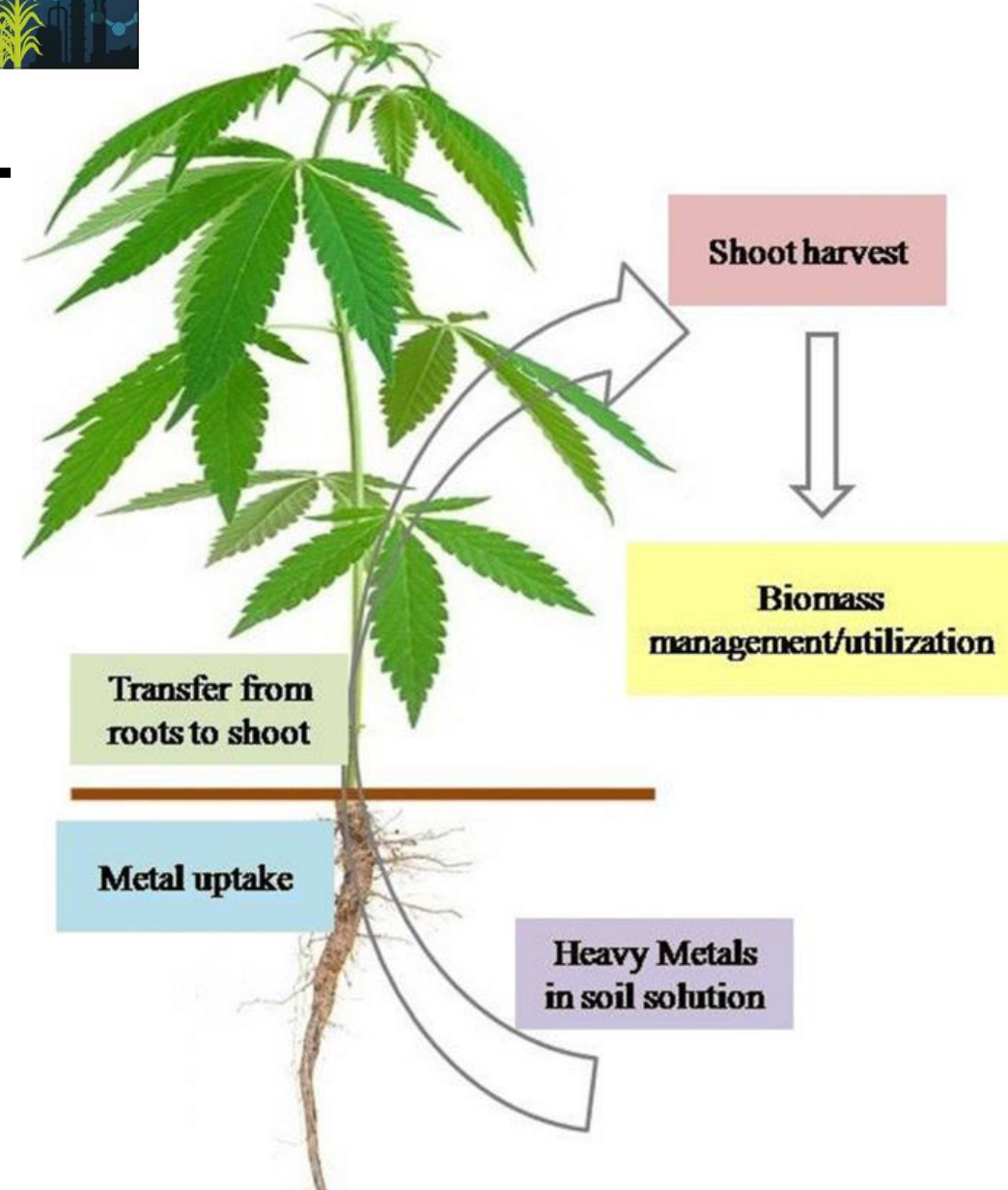
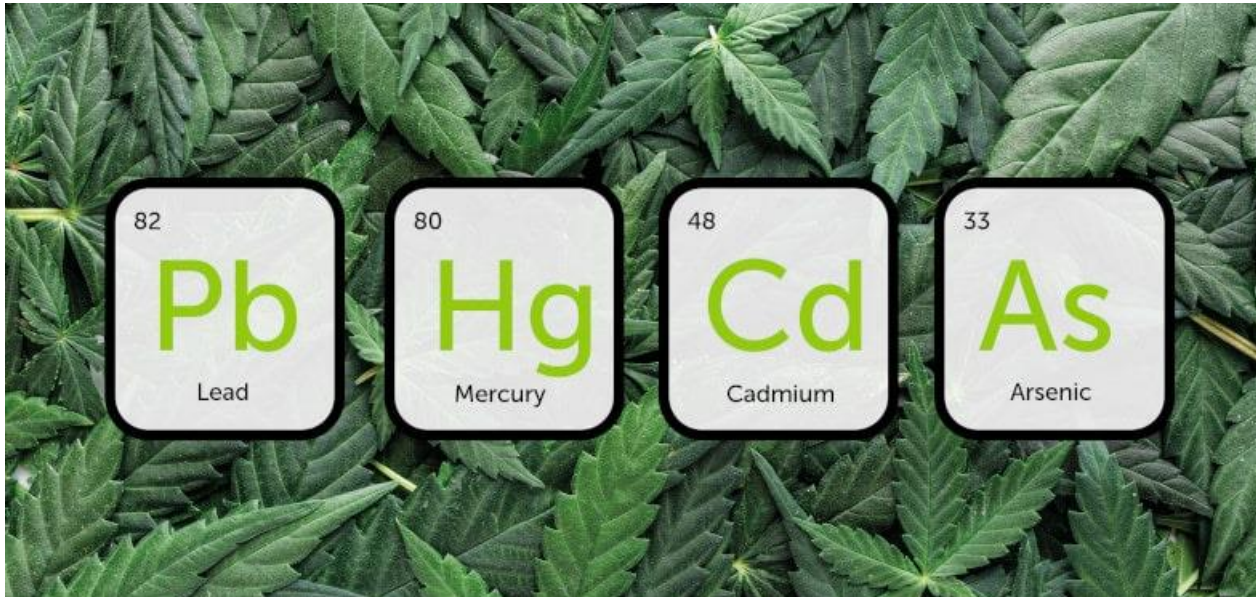
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Industrial Crops & Products

journal homepage: www.elsevier.com/locate/indcrop

Industrial hemp (*Cannabis sativa* L.) in a phytoattenuation strategy: Remediation potential of a Cd, Pb and Zn contaminated soil and valorization potential of the fibers for textile production

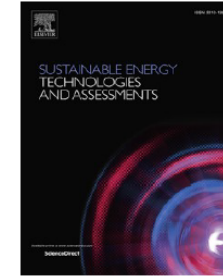




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Industrial hemp (*Cannabis sativa* L.) for phytoremediation: Energy and environmental life cycle assessment of using contaminated biomass as an energy resource

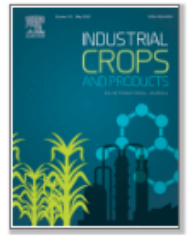


The crop-residue of fiber hemp cv. Futura 75: from a waste product to a source of botanical insecticides



Industrial Crops and Products

Volume 147, May 2020, 112238



Acaricidal properties of hemp (*Cannabis sativa* L.) essential oil against *Dermanyssus gallinae* and *Hyalomma dromedarii*



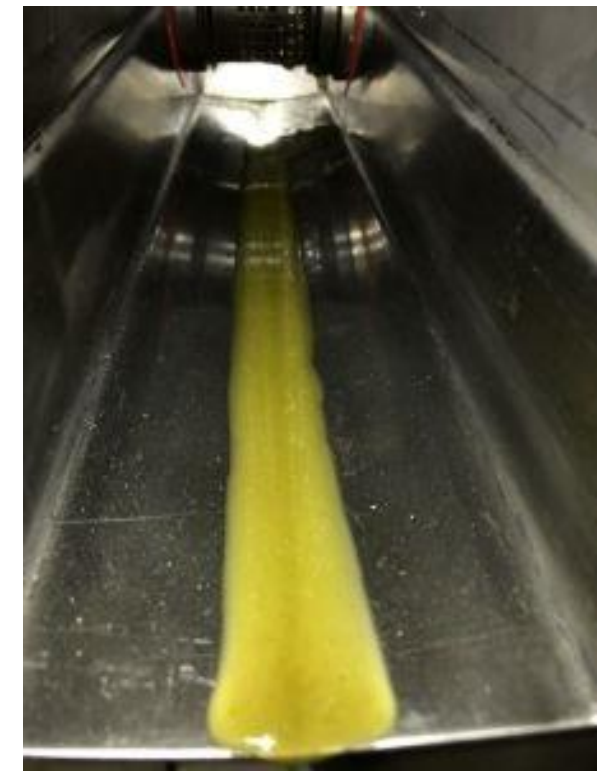
MANUFACTURING CYCLE OF HEMP OIL

 **HEMP**
FOUNDATION



REVIEW

Hemp (*Cannabis sativa* subsp. *sativa*) Chemical Composition and the Application of Hempseeds in Food Formulations



Hemp oil PUFAs (~80-90% essential fatty acids - EFAs), mainly **linoleic acid (LA)** and **α -linolenic acid (ALA)**.



Ferretting out the secrets of industrial hemp protein as emerging functional food ingredients

PROTEIN CONTENT

HEMPSEEDS	20–25%
HEMPSEED CAKE	35–50%
DEHULLED SEED	30–40%

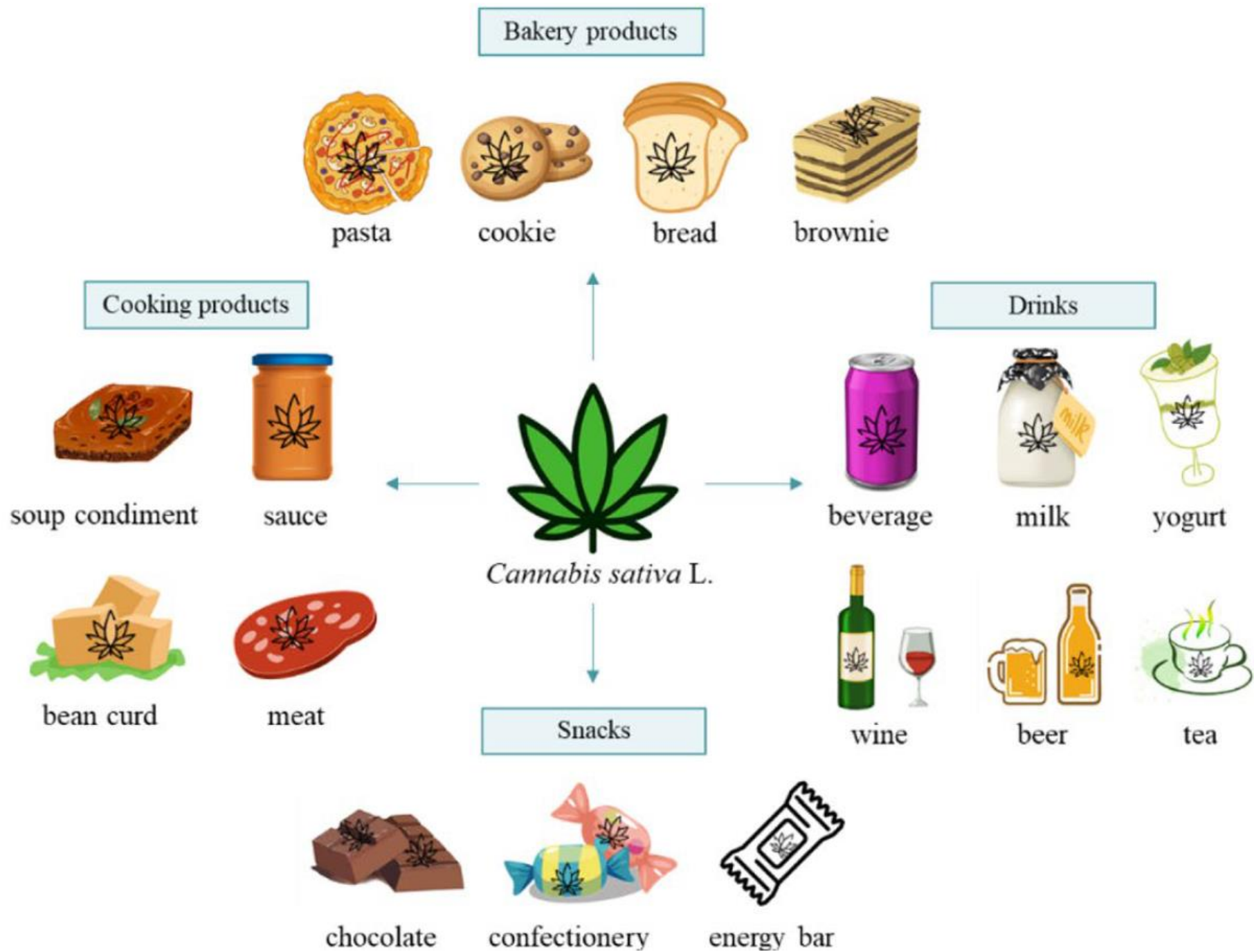
AMINO ACIDS PROFILE

Methionine, phenylalanine, arginine, glutamic acid, leucine, isoleucine, valine, threonine, histidine, lysine, cysteine

Tryptophan in little concentration (0.22 g/100 g)

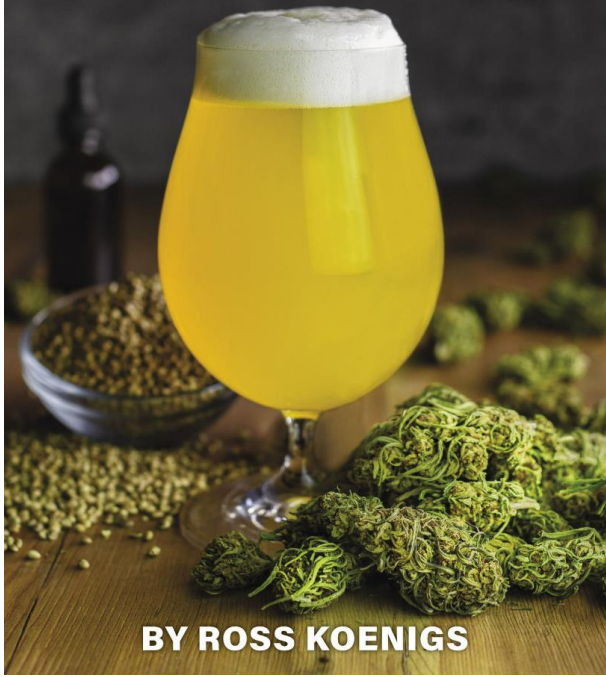
Hempseed protein mainly consist in globulins and albumins (60–80%)

Higher digestibility (61%) when compared to lentil (52%) or whole wheat (40%)



BREWING WITH HEMP

THE ESSENTIAL GUIDE



BY ROSS KOENIGS



HEMP-AROMATISED BEER







GROWN FROM THE SOIL HEMP CAR

One of Henry Ford's first cars ran entirely on Hemp ethanol. The body was also constructed from Hemp plastic, which was 10X stronger than steel.

Unfortunately, Hemp was outlawed due to the damaging effect it would have on many powerful industries at that time; including the oil, plastics & paper industries.



"Why use up the forest which were centuries in the making and the mines which required ages to lay down, if we can get the equivalent of forest and mineral products in the annual growth of the fields?"

— Henry Ford —

1941

HOW HEMP WILL REVOLUTIONIZE THE AUTO INDUSTRY



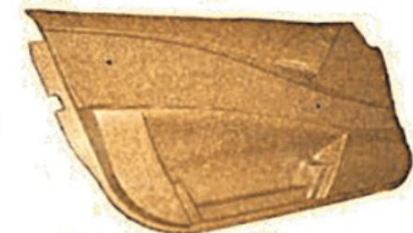
Hemp Fiber



Non-Woven Mat



Finished Door



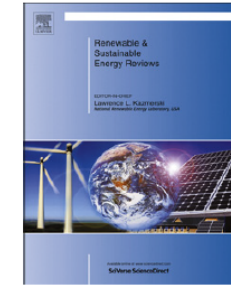
Pre-Finished Door



Contents lists available at [ScienceDirect](#)

Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser



Energy and environmental assessment of industrial hemp for building applications: A review



[Materials Today: Proceedings 45 \(2021\) 6369–6371](#)



Contents lists available at [ScienceDirect](#)

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr



A study report on carbon sequestration by using Hempcrete

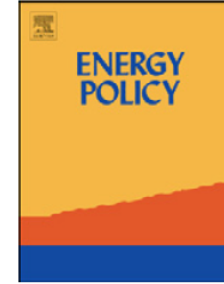


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journal homepage: www.elsevier.com/locate/enpol



Hemp: A more sustainable annual energy crop for climate and energy policy



Industrial Crops & Products 170 (2021) 113780

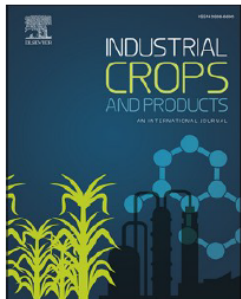


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Contents lists available at ScienceDirect

Industrial Crops & Products

journal homepage: www.elsevier.com/locate/indcrop



From Wood and Hemp Biomass Wastes to Sustainable Nanocellulose Foams





ELSEVIER

Contents lists available at SciVerse ScienceDirect

Resources, Conservation and Recycling

journal homepage: www.elsevier.com/locate/resconrec



Life cycle greenhouse gas emissions of hemp–lime wall constructions in the UK

The major advantage of using hempcrete in houses and constructions is that it sequesters carbon dioxide from areas of construction and provides greenhouse negative atmosphere to live in. *Cannabis* is said to sequester **around 249 kg of carbon dioxide per ton of hemp** used. Hempcrete is thermally stable and makes house fire-resistant (Singh and Mamanian, 2018).



A Review: Natural Fiber Composites Selection in View of Mechanical, Light Weight, and Economic Properties

Heliyon 8 (2022) e08753



Contents lists available at [ScienceDirect](#)

Heliyon

journal homepage: www.cell.com/heliyon



Review article

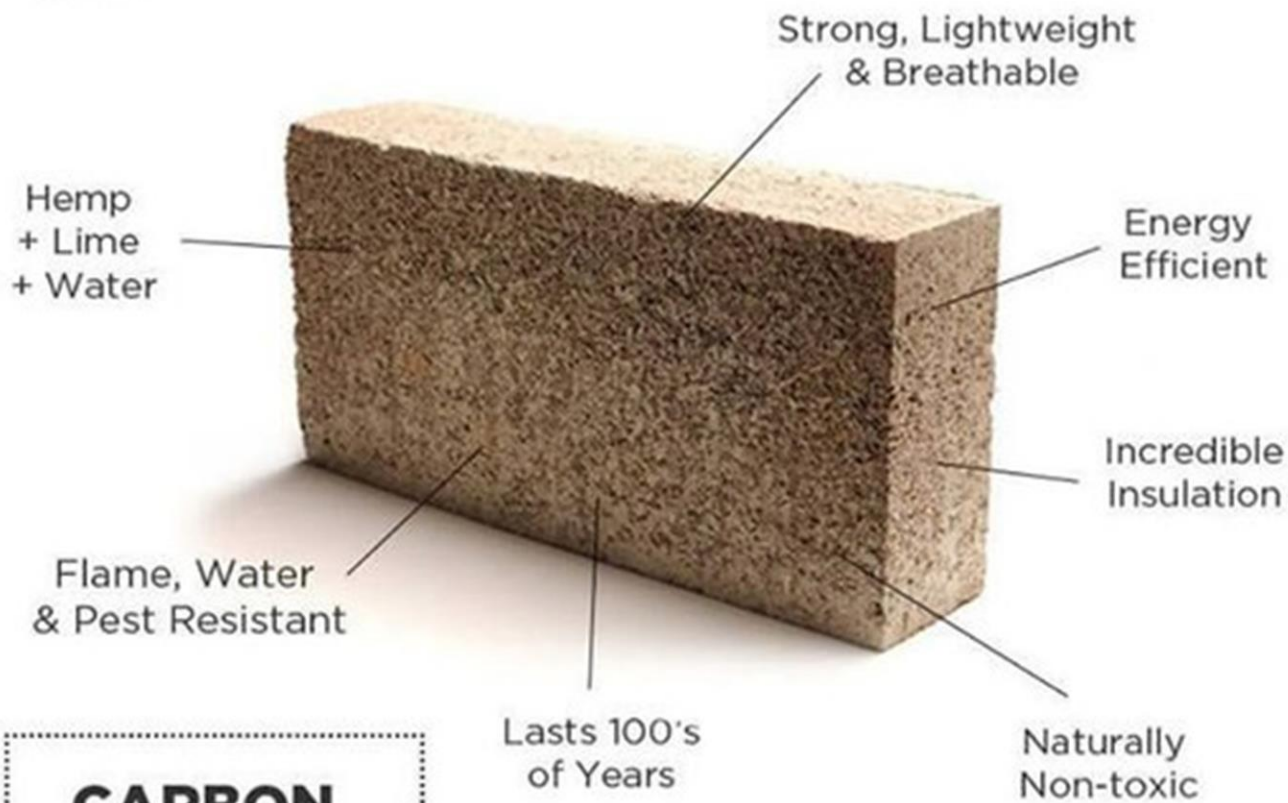
Hemp as a potential raw material toward a sustainable world: A review





Designed to build, not to smoke.

HEMPCRETE



**CARBON
NEGATIVE**



Hempcrete blocks in construction



Sound studio with hempcrete



Hempcrete blocks with load bearing blocks

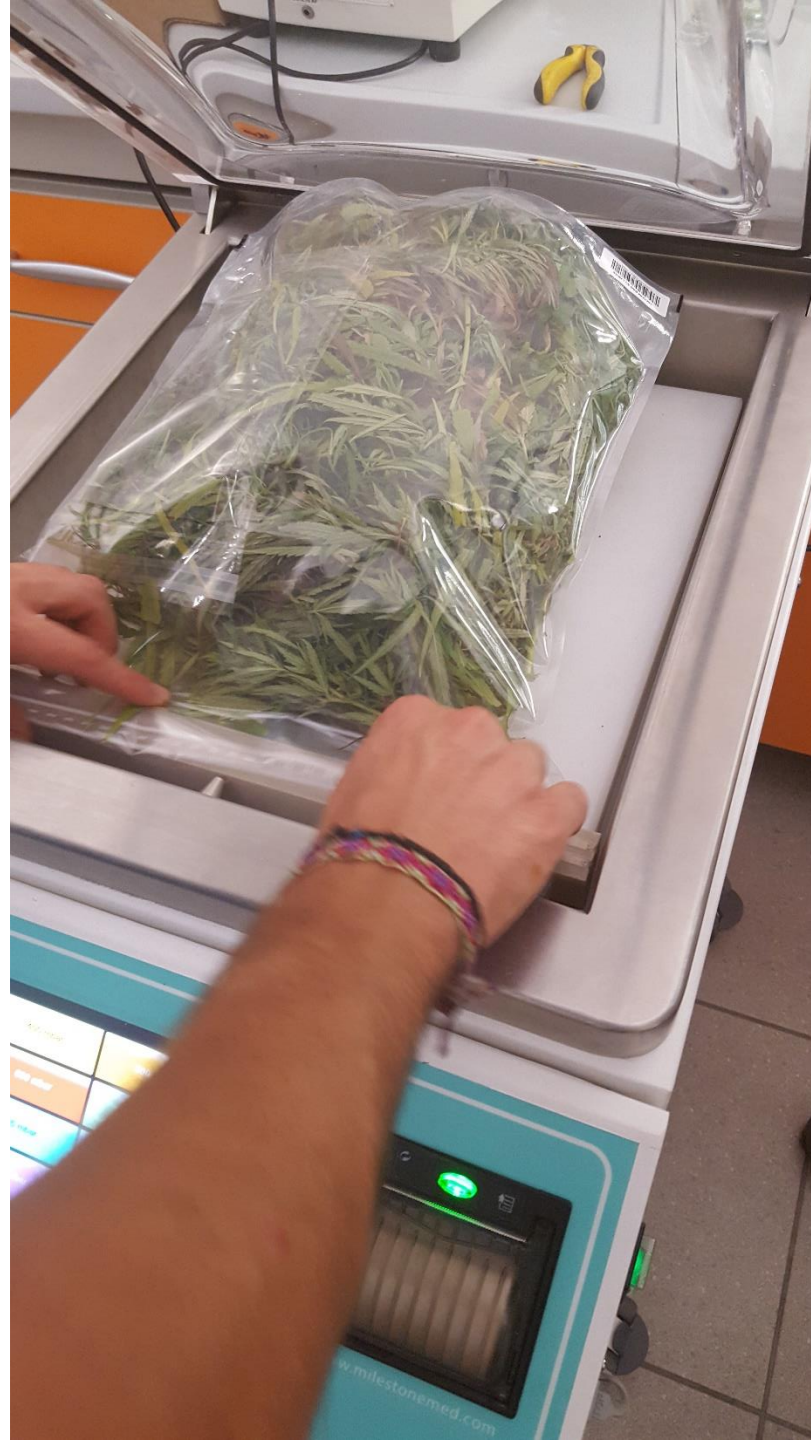


Firewall built with hempcrete

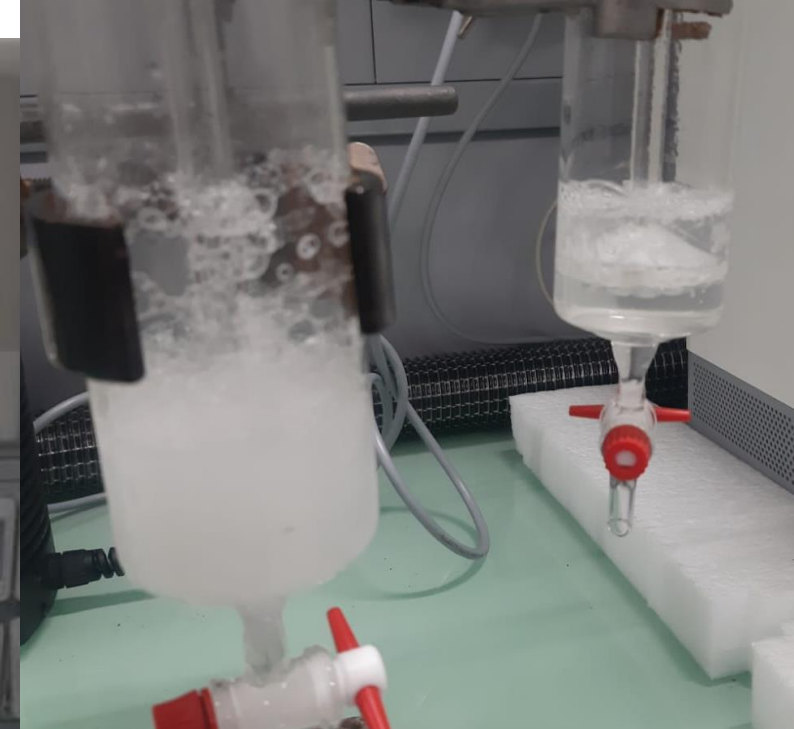


Interior partition with hempcrete blocks

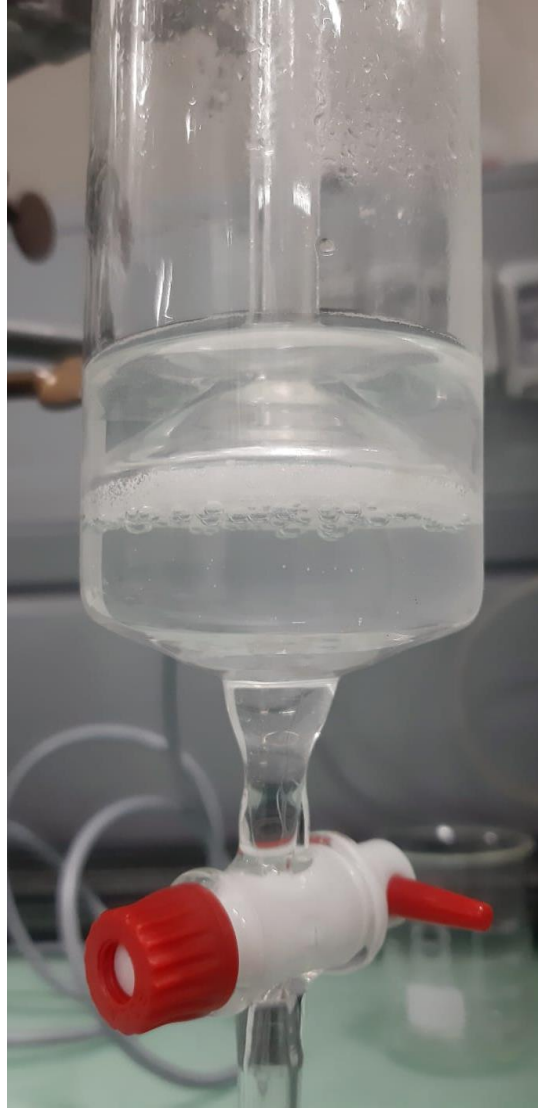






MICROWAVE REACTOR



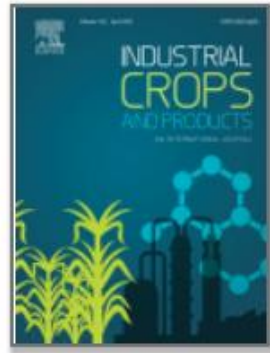
water / oil flavouring



Selective recovery of terpenes, polyphenols and cannabinoids from *Cannabis sativa* L. inflorescences under microwaves

Veronika Gunjević^a, Giorgio Grillo^a, Diego Carnaroglio^b, Arianna Binello^a,
Alessandro Barge^a, Giancarlo Cravotto^a  

Industrial Crops and Products

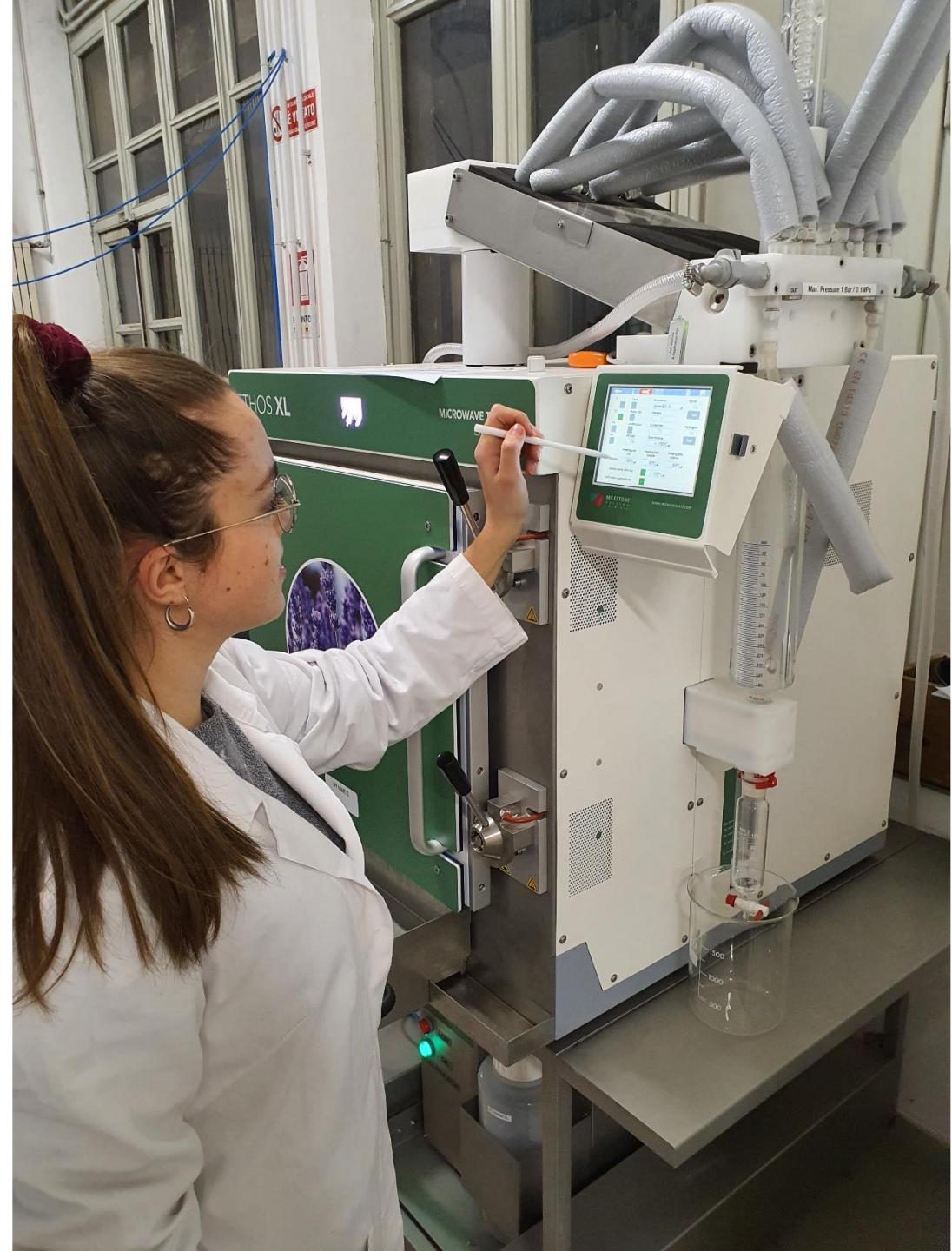


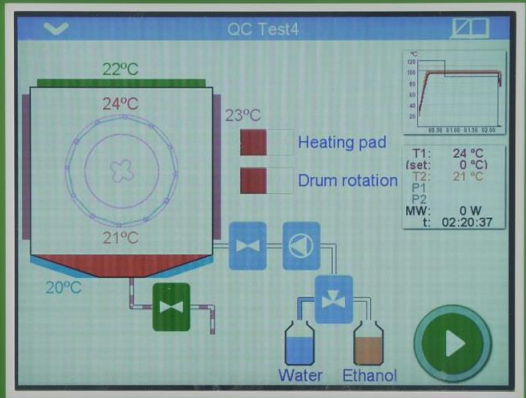
Volume 162, April 2021, 113247



MW-ASSISTED EXTRACTION & HYDRODISTILLATION







MILESTONE
HELPING
CHEMISTS

www.milestone srl.com

ETHOS XL

MICROWAVE TERPENE
EXTRACTION



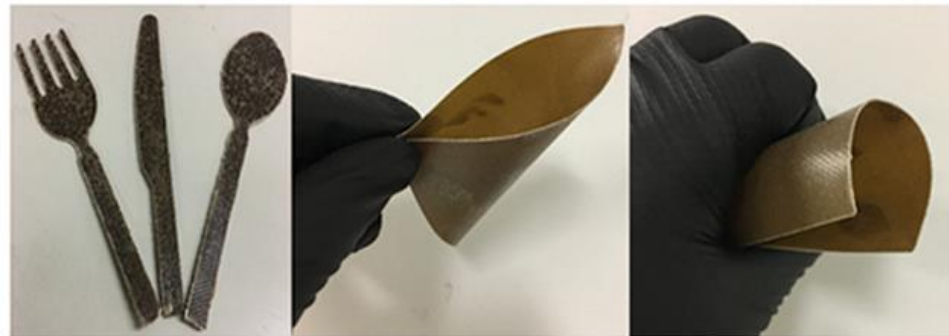
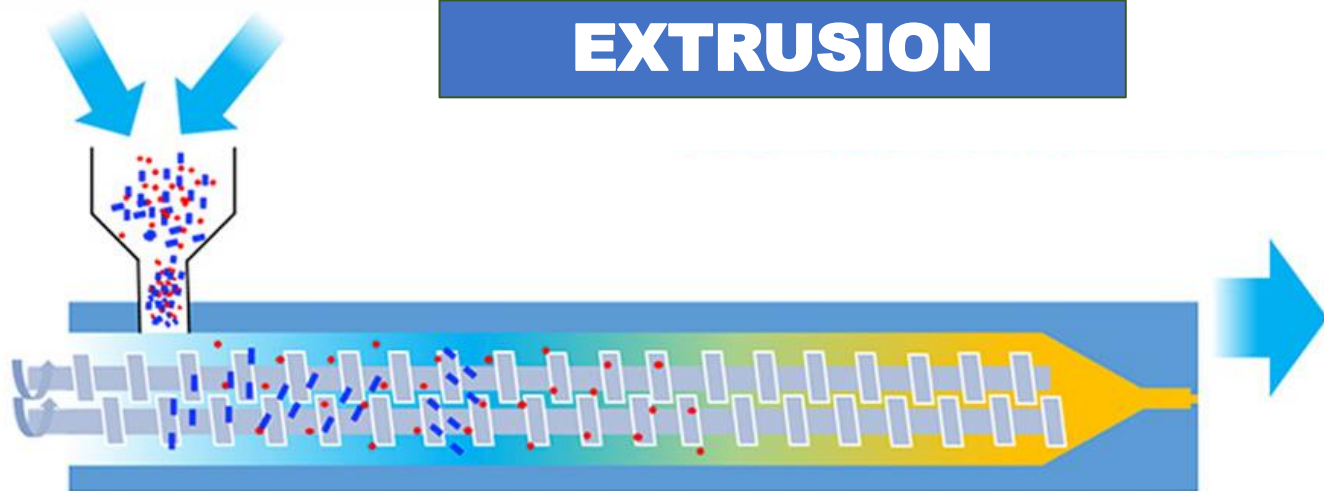
H50-7000

Lab Tech





EXTRUSION



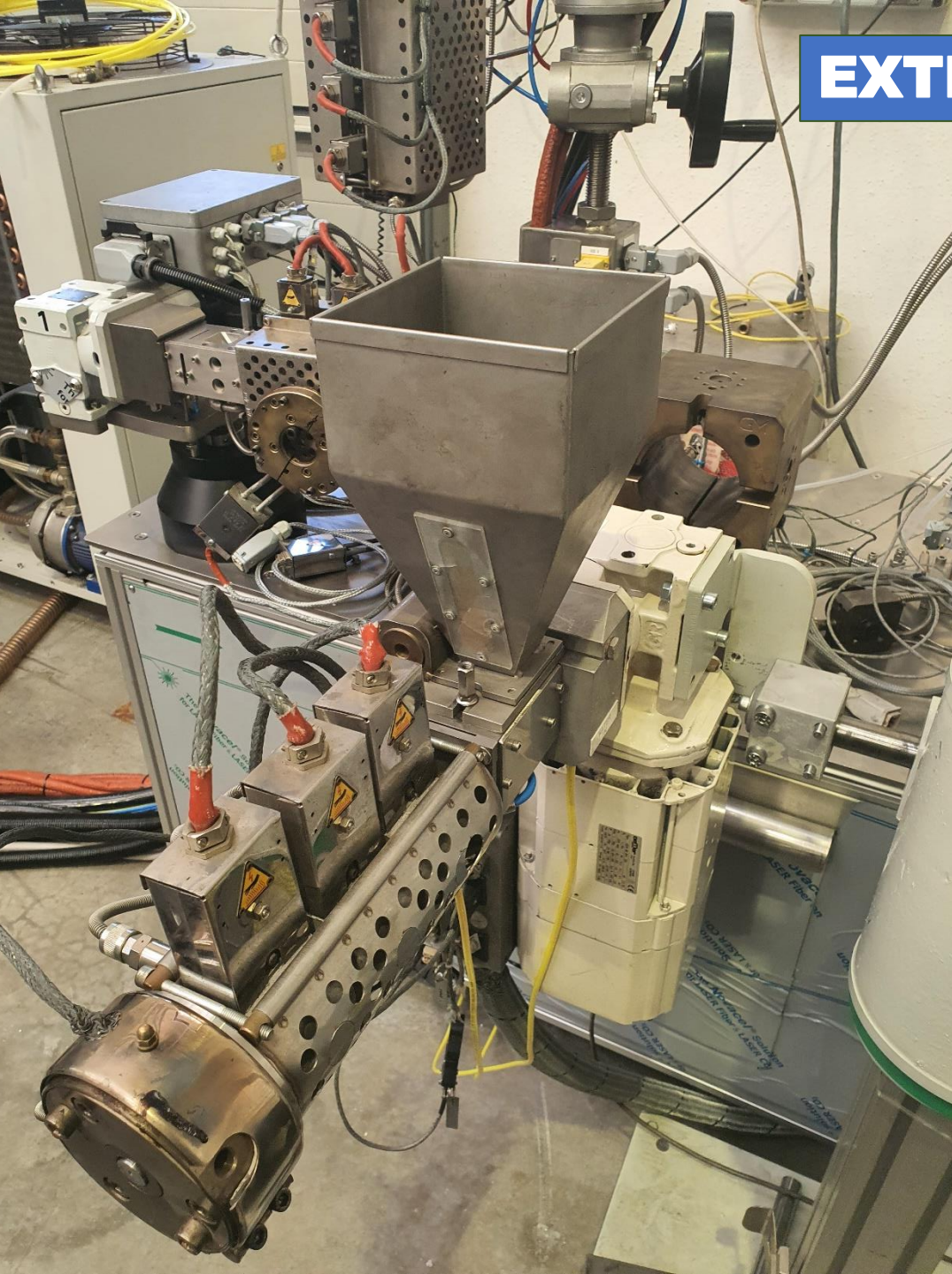
FABRIC/ NON-FABRIC



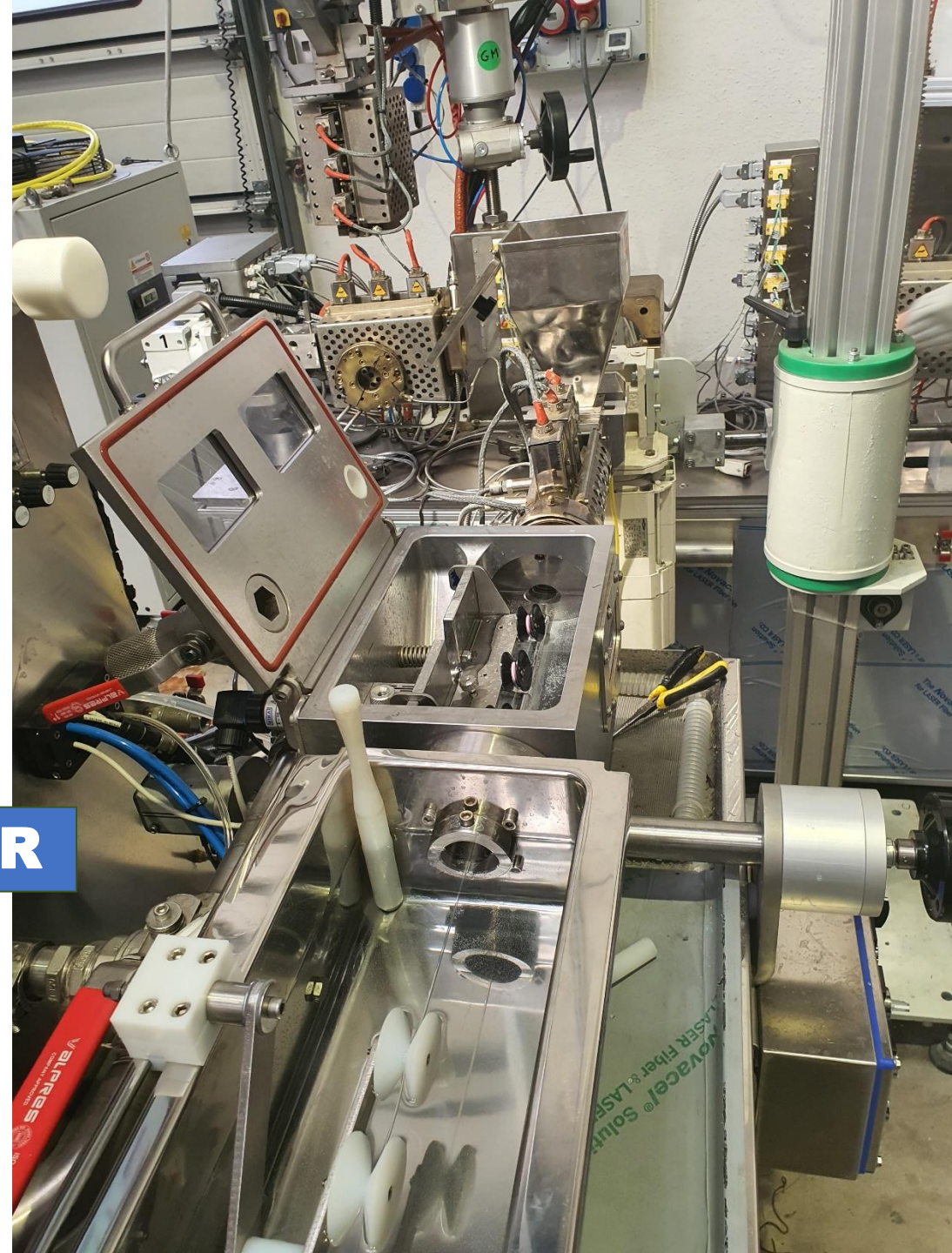
PANELS



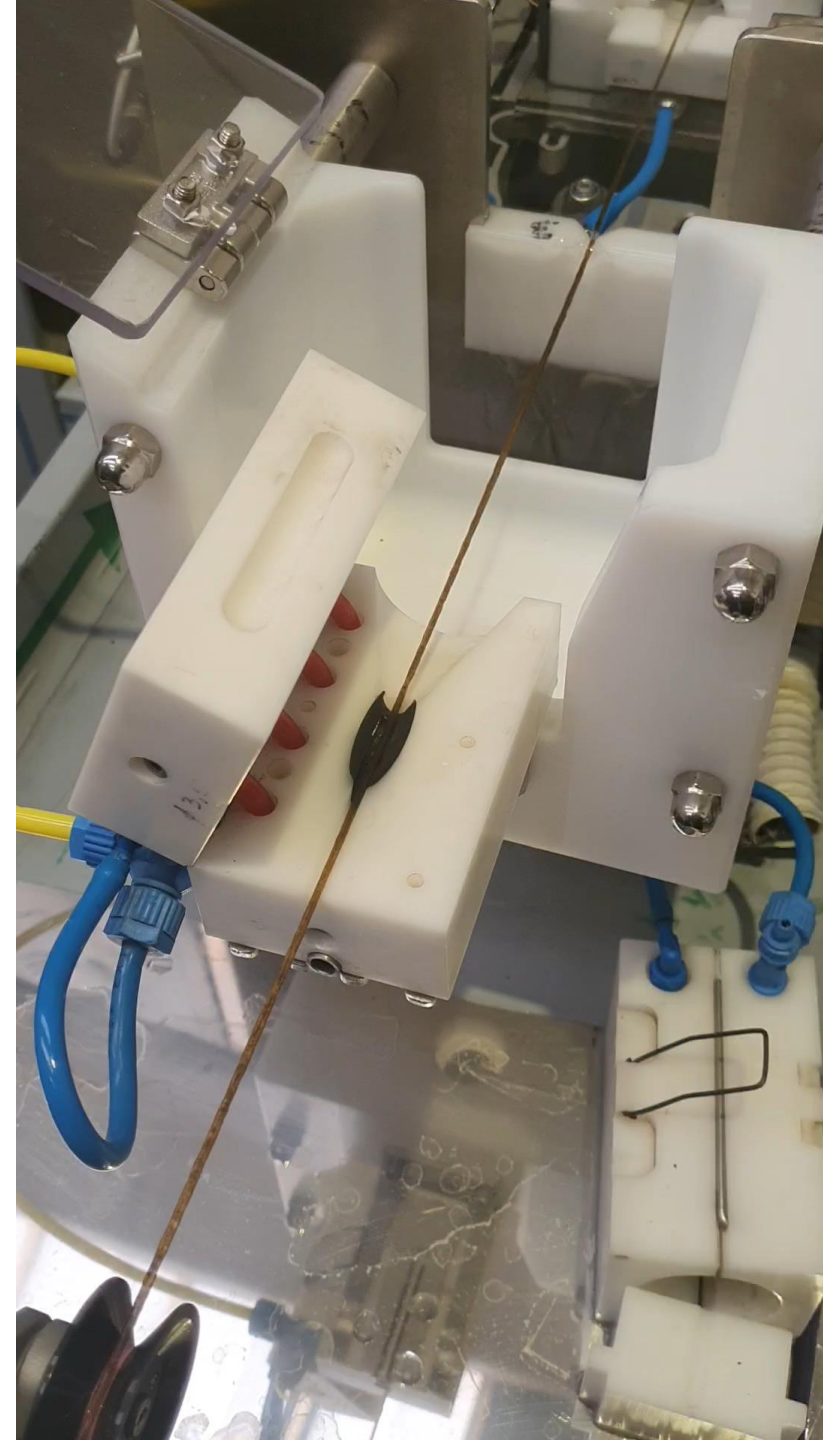
EXTRUDER



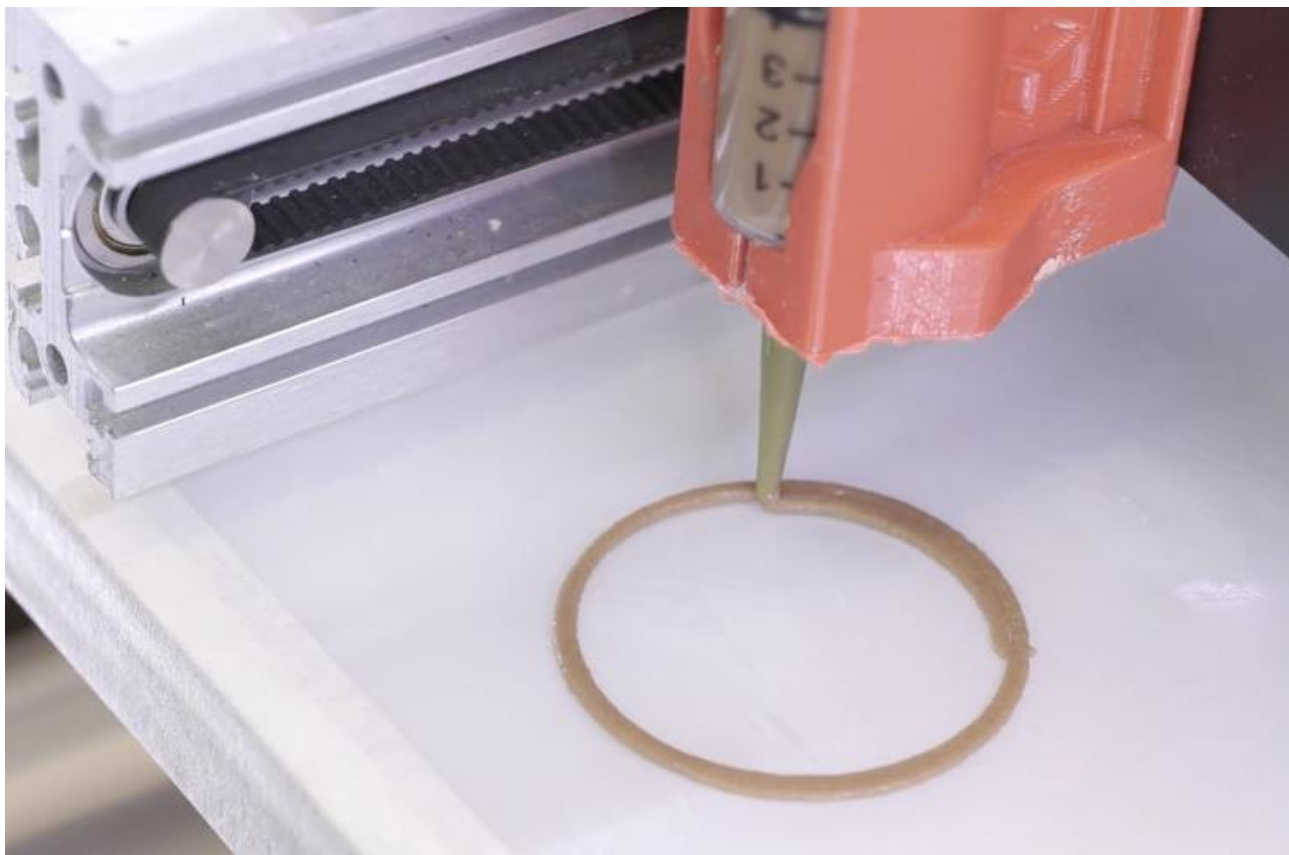
SPINNER



**EXTRUDER
&
SPINNER**



3d PRINTING



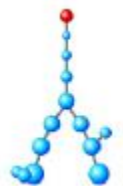
C'è canapa e ... canapa

La ricerca applicata quale elemento di congiunzione tra mondo agricolo e mondo industriale

GRAZIE !

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