



Universidade do Minho
Escola de Engenharia



CENTRO DE CIÊNCIA E
TECNOLOGIA TÊXTIL



AUTEX 2022
21st World Textile Conference

Sustainable and Multifunctional Natural Fibre- Based Electric Wire Sheats for Smart Textiles

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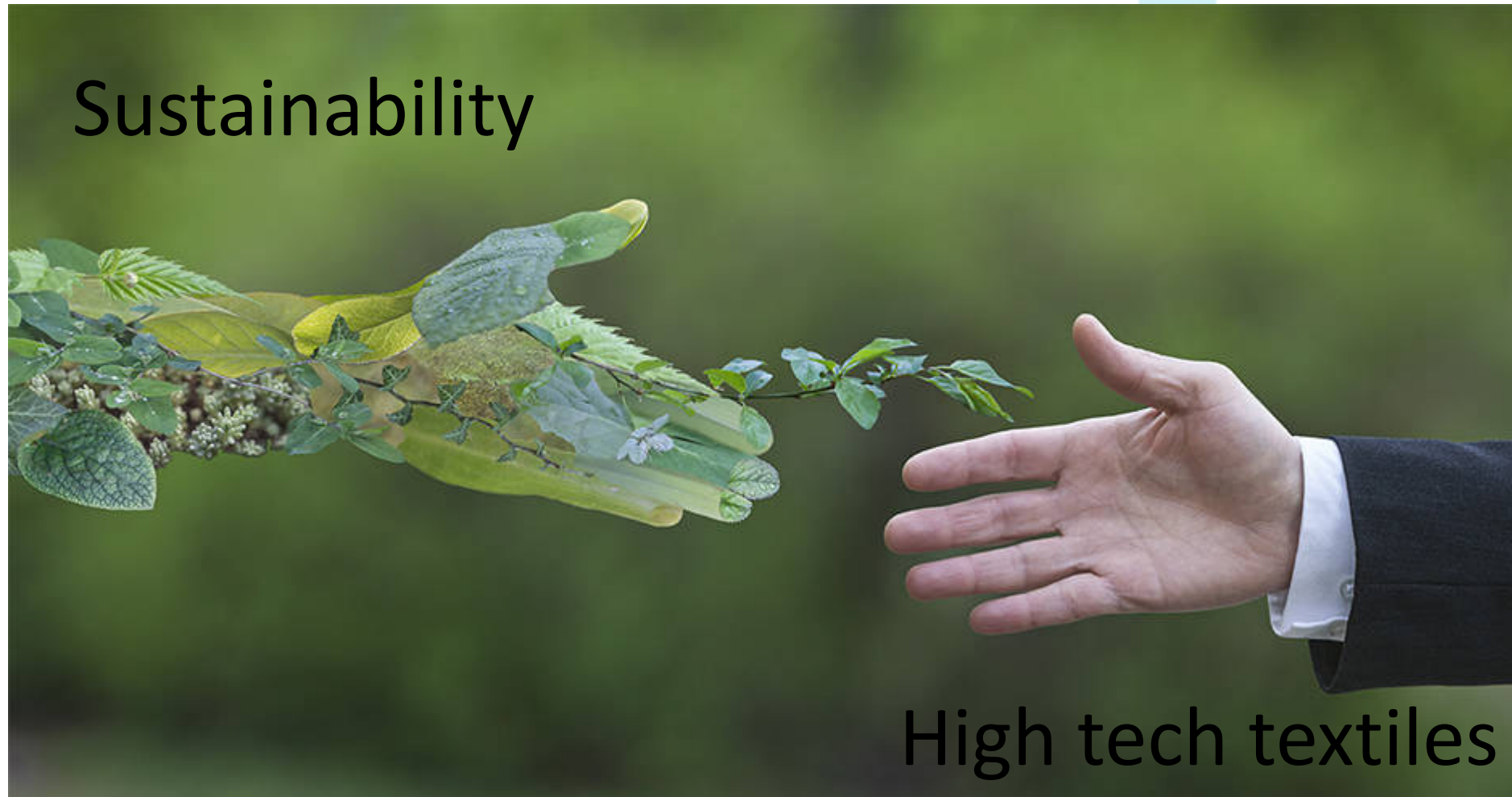
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Main objective

Exploiting advantages of “opposite worlds”



<https://www.hec.edu/en/news-room/why-does-sustainability-make-business-sense>

Environmental concerns

Sustainability



<https://www.cms.int/es/node/22718>



<https://www.waystofightplasticpollution.com/why-is-reducing-plastic-pollution-important/>

Environmental concerns

Sustainability



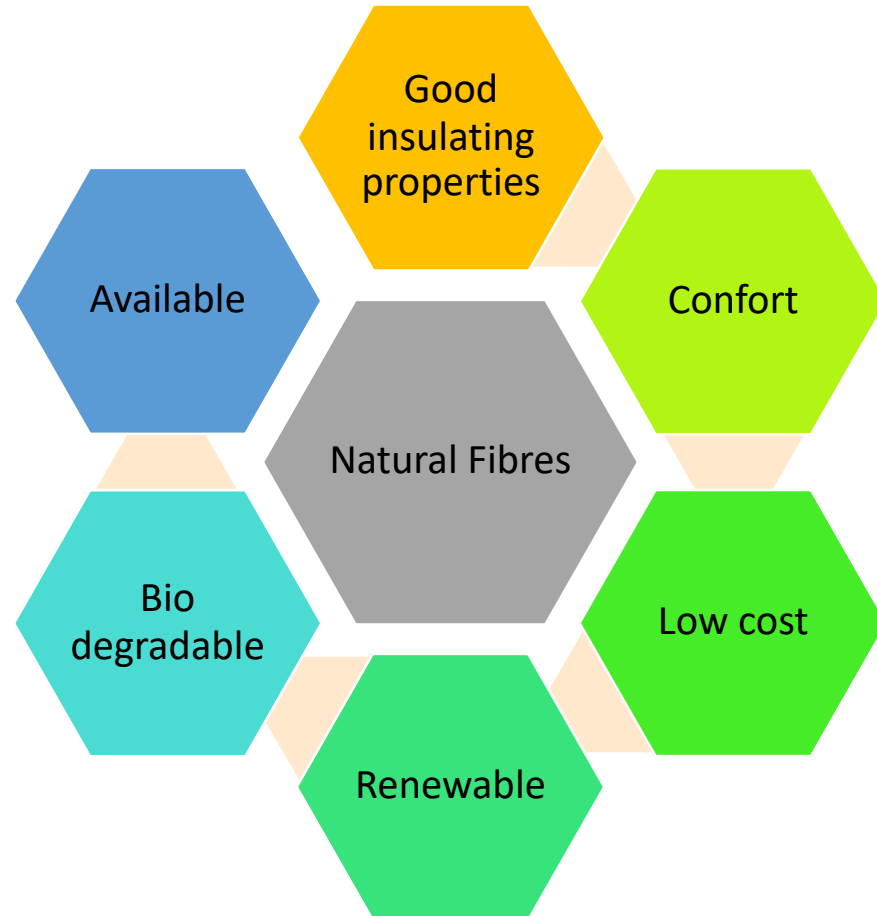
<https://textilelearner.net/environmental-impacts-of-textile-and-fashion-industry/>



<https://chinadialogue.net/en/pollution/5589-officials-failing-to-stop-textile-factories-dumping-waste-in-qiantang-river/>

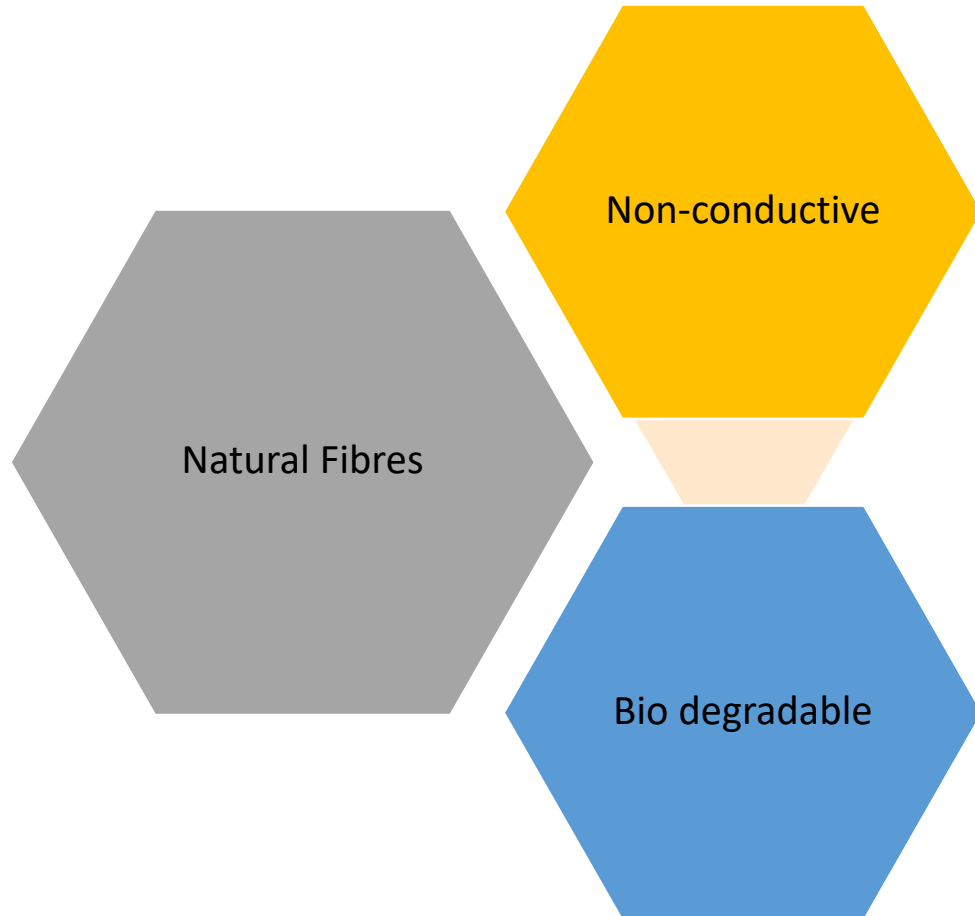
Natural fibrous materials

Advantages



Natural fibrous materials

Disadvantages



Smart textiles

Demands



Concept testing

Natural fiber-based composite sheath



- High conductivity
- High electrical insulation
- Natural fibers
- Natural antimicrobial (enhance textile longevity)
- Adequate mechanical properties

Concept testing

Natural fiber-based composite sheath



Plain hemp fabric



Main sheath component

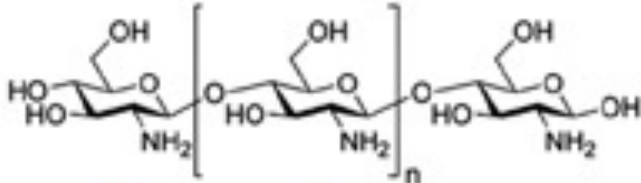
Raw jute fiber



Reinforce



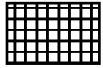
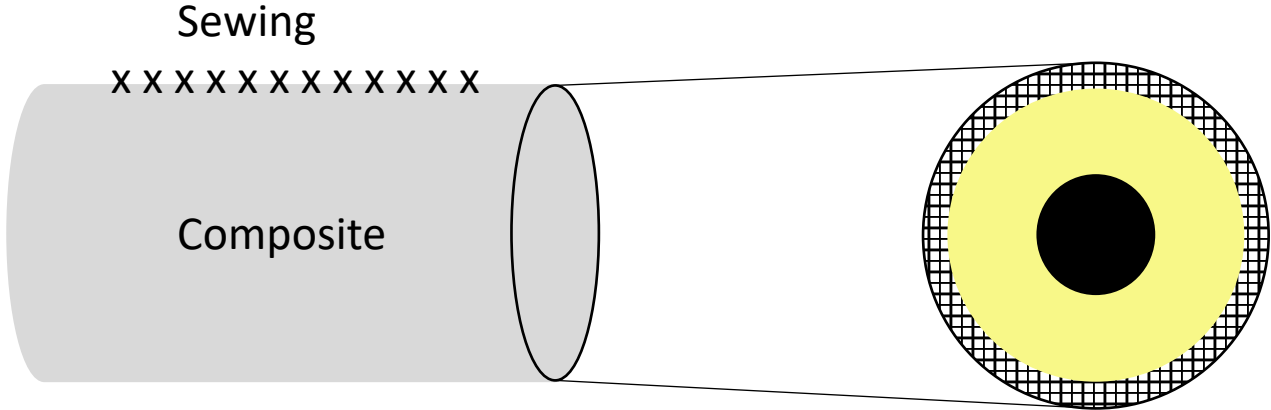
Bekinox® VN



Antimicrobial activity

Natural fiber-based composite sheath

Enclosing a stainless steel yarn



Chitosan coated hemp fabric



Jute fiber



Bekinox®VN yarn

Electrical resistance

EN 16812:2016 (E)



<https://www.sciencefocus.com/science/how-heavy-is-electricity/>



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Sample	Applied power (V)	Tension (mV)	Direct current (mA)	Resistance (Ω)
Bekinox [®] VN	14.00	48.20	3.00	16.01
Cable composite	14.00	55.50	3.00	18.45

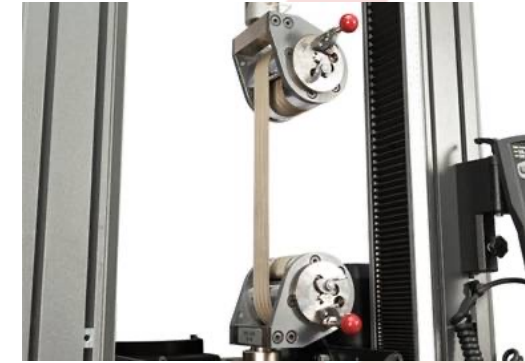
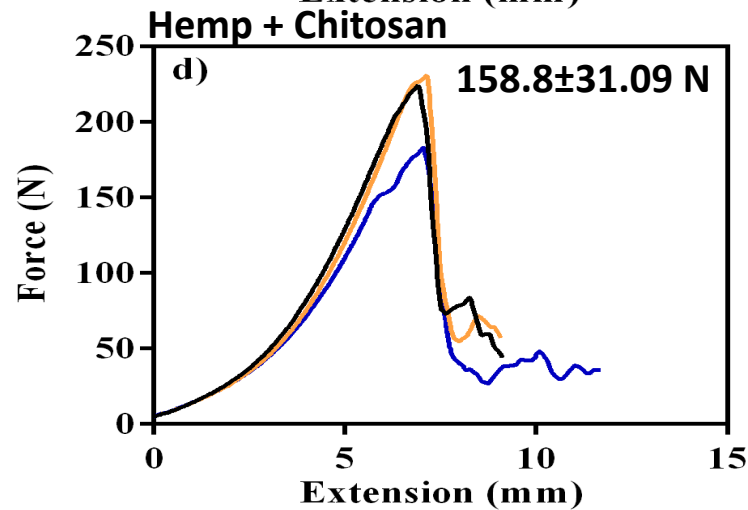
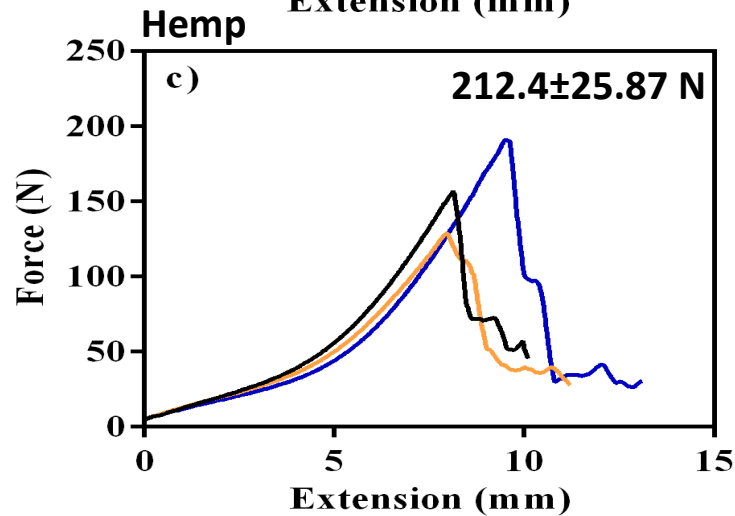
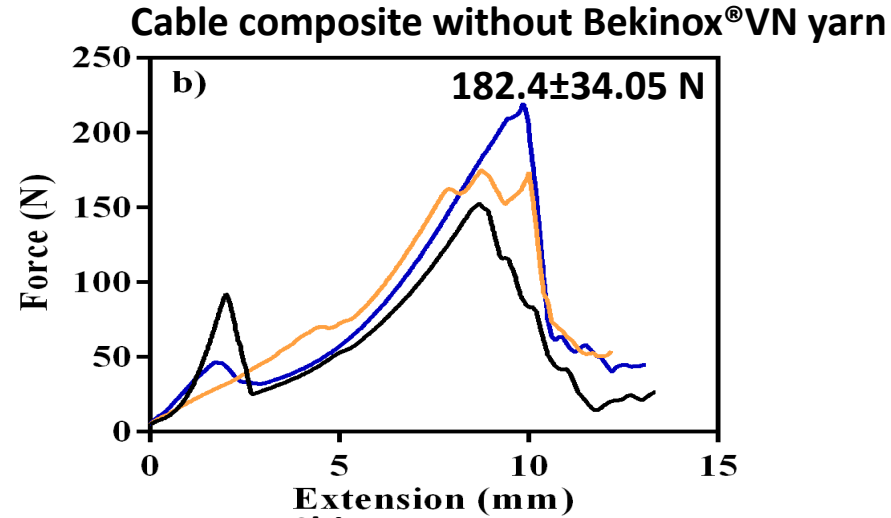
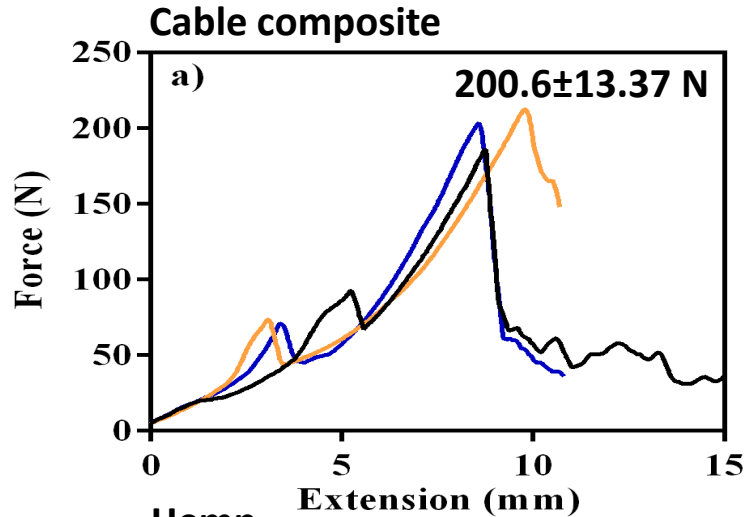
Mechanical properties

ASTM D5035-11 (2019)

Measurements (n=3)



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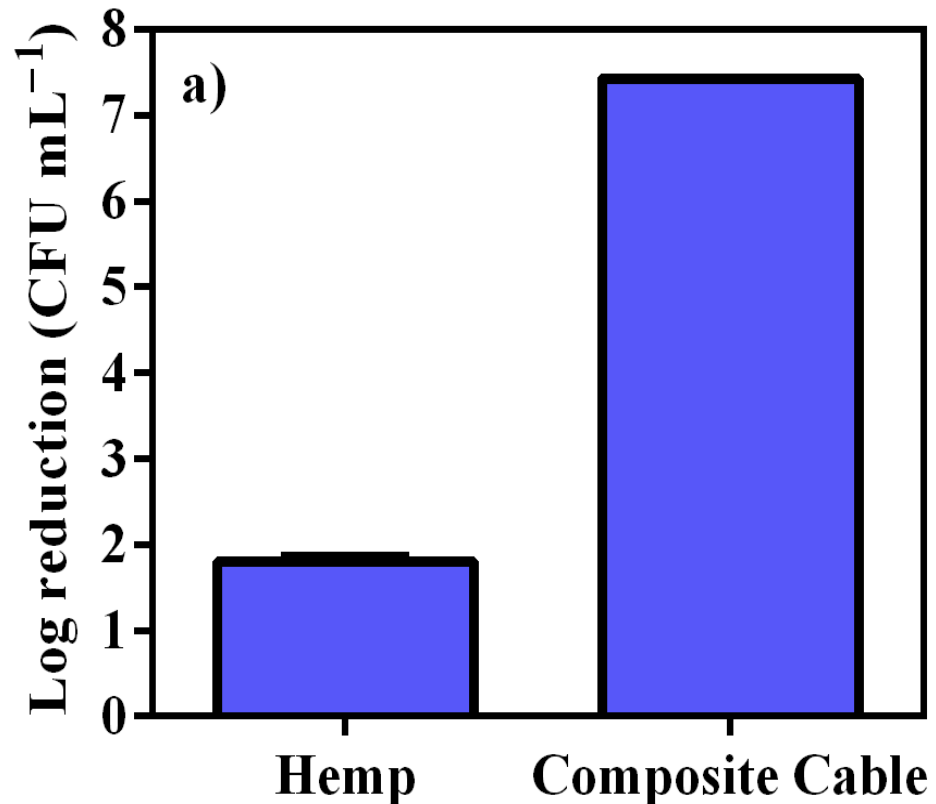
<https://www.instron.com/en/industry-solutions/automotive/interior/textiles-testing>

Antimicrobial properties

AATCC 100TM 100 (adapted)

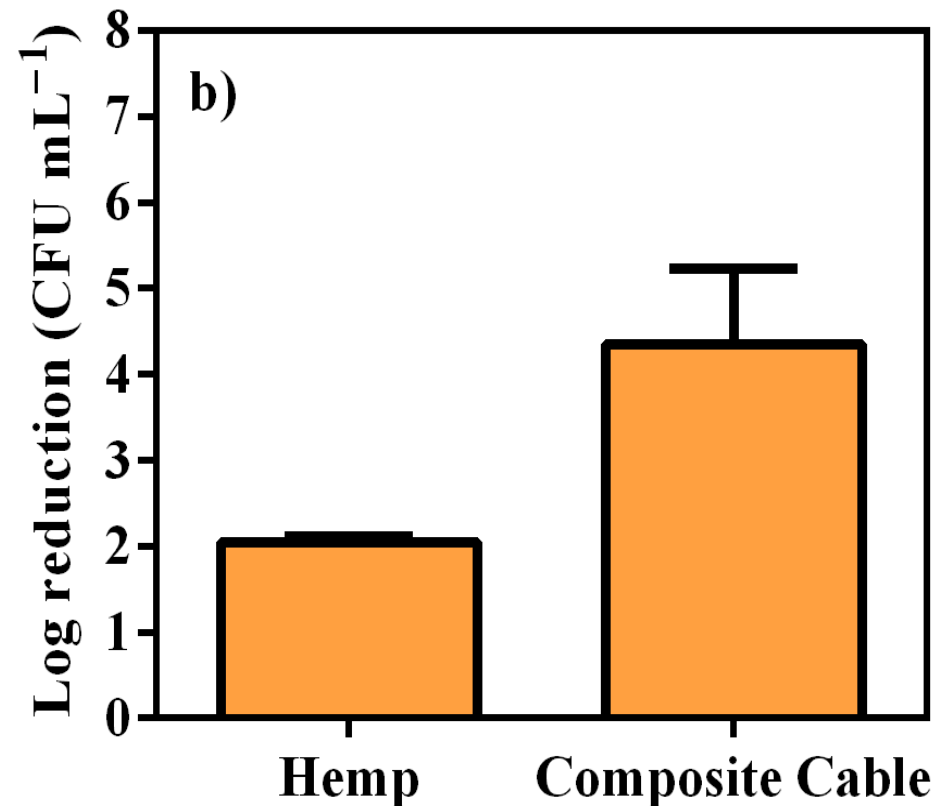
Staphylococcus aureus

ATCC 6538



Escherichia coli

ATCC 25922



Conclusions

- Conductivity was not considerably hindered
- Good electrical insulation
- Tensile strength not considerably hindered
- Notable antibacterial activity

Future perspectives

- Replace Bekinox[®] by a functionalized natural fiber
- Incorporate in a smart textile

Acknowledgments



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CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR



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