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NOVEL BIOBASED MATERIALS TO IMPROVE CIRCULARITY

Biobased carbon fibers from water-based lignosulfonate solutions - DITF

Circular Bio-based Europe Joint Undertaking

Bio-based Industries Consortium

Co-funded by the European Union

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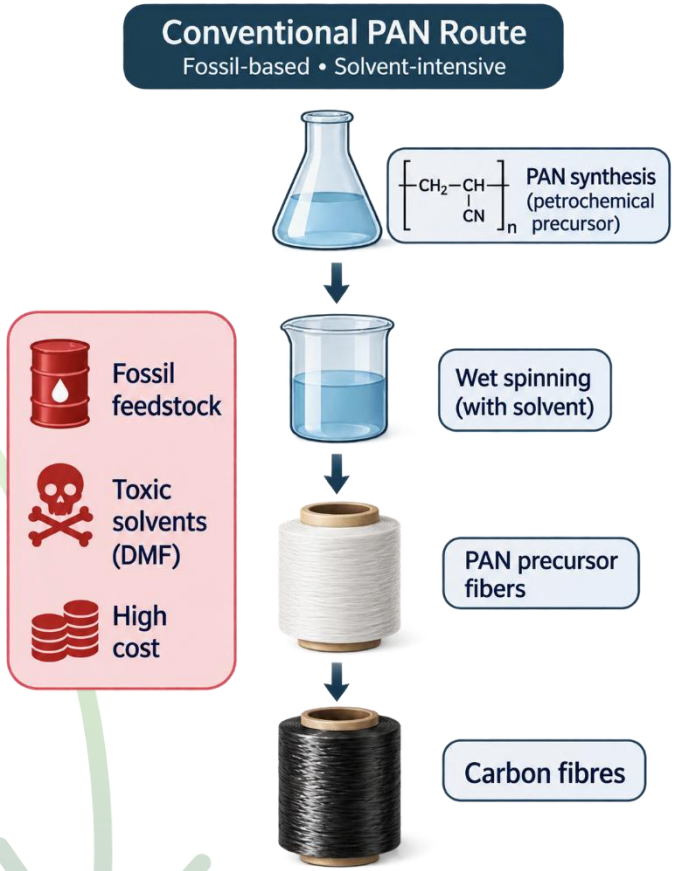
The problem that solves

Conventional carbon fibers produced from PAN:

- Fossil-based precursor - costly and not environmentally friendly synthesis.
- Solvent use: wet spinning with organic solvents such as DMF, requiring recycling and extra safety measures for workers.
- High production costs: precursor synthesis contributes to 50% of PAN based CF.



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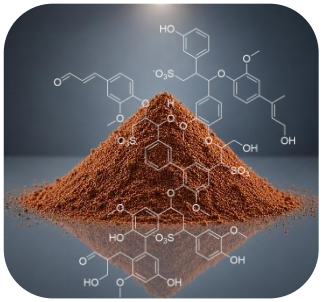
Unique properties and innovation

- Lignosulfonate-based carbon fibers.
  - High biobased carbon content of >74%
  - Renewable feedstock, available industrial scale
- Dry spinning from water, avoiding organic spinning solvents such as DMF.
- Stabilization and carbonization scaled-up using conventional processing lines.



Lignosulfonate



Dry-spinning from water



Stabilization



Carbonization

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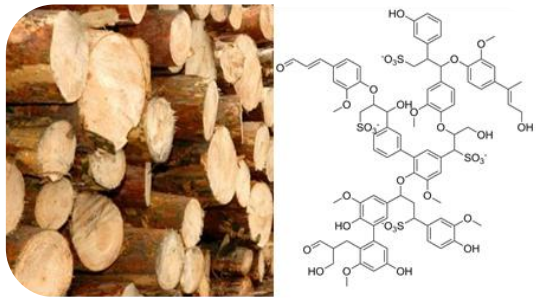
Main benefits

- Environmental benefits
  - Renewable, biobased precursor, side product of pulp and paper industry.
  - Water-based spinning dope - no organic solvents.
- Economic potential
  - Avoids PAN precursor synthesis.
  - Lower-cost of raw materials.
  - Lower cost carbon fibers.
- Industrial advantages
  - Compatible with conventional stabilization and carbonization equipment.
  - Potential for continuous, scalable process.





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Demonstrated impact

Carbon fibres with high biobased content:

- ≥60% lignin content in spinning dope
- ≥ 74% bio-based carbon in final carbon fibres
- Preliminary LCA data show lower environmental impact

Scale-up demonstrated

- Spinning 500 filaments, 12kg spinning dope
- Joining of tows up to 3K
- Continuous stabilization and carbonization
- 150 m carbonized fibres possible in 1 day
- Electrochemical surface treatment
- Sizing application
- Feasibility impregnation for tow-pregs demonstrated









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Unique selling points

- Carbon fibers with high biobased carbon content – unique on the market.
- Use of lignin as feedstock, side product of pulping industry.
- Water-based spinning – safe and environmentally friendly.
- Compatibility with existing carbon fiber processing infrastructure.
- Potential much lower carbon fiber cost.

Potential applications, industries

- Lightweight components, semi-structural (automotive, sport)
- Construction (see DACCUS-Pre project, lightweight panels)



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