**Spinifex nanocellulose as a potential carbon precursor for carbon fibre and anode material for rechargeable sodium-ion batteries**

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**Introduction**  
Nanocellulose, which is versatile and can be derived from lignocellulose biomass, has a potential to be utilised in plethora of advance engineering applications. Spinifex nanocellulose is unique in terms of cost-effective preparation of long and thin nanofibres, retaining toughness and residual lignocellulosic composition. This nanocellulose has resulted in highly ordered carbon structure formation upon carbonisation in the lower temperature regime than that is typically required, and exhibited a potential to be utilised carbon materials for various applications. This communication will demonstrate how spinifex nanocellulose can be utilised in carbon fibre manufacturing and as anode material for rechargeable sodium-ion batteries (NIBs).

**Results and Discussion**

Firstly, we have investigated spinifex grass and cotton based nanocelluloses in different morphologies for reinforcing the polyacrylonitrile precursor fibres with the aim of enhancing the carbonisation efficiency and improving mechanical properties of final carbon fibres. The carbon fibres from PAN fibre reinforced with only 0.1 wt.% of cotton low aspect ratio CNC (c-CNC), spinifex based medium-to-high aspect ratio CNC (s-CNC)1 and CNF (s-CNF), exhibited upto 4%, 87% and 170% improvements in tensile modulus, respectively, after carbonisation at 1200°C. as compared to a control PAN fibre. Similar trend were observed for the tensile strength improvements, which were related to the highly ordered (graphitic) carbon structure formation.

Secondly, we prepared carbon material from the freeze-dried spinifex nanocellulose through a fast, low temperature carbonisation protocol. This spinifex derived carbon material has exhibited superior performance as an anode for NIBs with a high specific capacity (386 mA h g−1 at 20 mA g−1) due to a large interlayer spacing (∼0.39 nm). It has also showed superior cycling stability and high rate tolerance (326 mA h g−1 at 50 mA g−1 and 300 mA h g−1 at 100 mA g−1).

**Conclusion**

This presentation will discuss in detail about carbonisation of spinifex fibre for anode material application2, then a screening through electro-spinning,3 scaling up through solution-spinning and carbonisation efficiency of the PAN/nanocellulose composite fibres4.

**References**  
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