**Spinifex Nanotechnology: A University – Indigenous Community Partnership for Nanomaterials Commercialisation**

*Céline Chaléat\*, Pratheep K. Annamalai, Alireza Hosseinmardi, Nasim Amiralian, Emilie Gauthier, Liam Pooley, Katarzyna Kępa, Darren Martin*

Australian Institute for Bioengineering & Nanotechnology, The University of Queensland, St Lucia, Queensland, Australia

In 2012, as part of a research partnership between the Indjalandji-Dhidhanu people of the Camooweal region and the Australian Institute of Bioengineering and Nanotechnology (AIBN, University of Queensland), we discovered that lignocellulose nanofibres and cellulose nanofibres (CNF) can be readily and cost-effectively produced from endemic Australian spinifex grasses from the Triodia genus.1-3  These fascinating extremophile grasses have been traditionally used for thousands of years and involve Aboriginal knowledge. Millions of years of arid evolution have presented us with quite a unique source for manufacturing nanocellulose. Our bio-industrial process converts Spinifex grass feedstock into novel, well-differentiated and high value CNF for multiple applications.4-6

Over the past 7 years, Traditional Owner business, Dugalunji Aboriginal Corporation (DAC), and AIBN have been partnering to commercialise the use of spinifex-derived CNF in a range of innovative industry applications. DAC has been responsible for the upstream harvesting and early stage processing of raw spinifex grass. In recent years, DAC has delivered training to Indigenous people in land management to support a workforce of 10 spinifex harvesting officers. Since its establishment in 2016, the UQ Long Pocket Spinifex Nanocellulose Downstream Pilot facility has produced hundreds of kg of CNF for customer and commercial trials for various applications and has developed scalable methods to convert spinifex feedstock into high-performance nanomaterials.7-8

Based on the very strong commercial interest in this unique technology, the initiative has the potential to create an entirely new industry in spinifex harvesting and CNF processing. The potential benefits include substantial employment and wealth creation for Indigenous people in remote areas, greater involvement of Indigenous people in materials science, and growth of Australian industry based on innovative new nanotechnology-enhanced products.

This presentation will give an overview of the upstream and downstream processing facilities. It will include an update of our team’s technology development and commercialisation activities related to spinifex CNF production. It will also discuss the techno-economics of this nanotechnology and its social impact. It will also introduce the landmark umbrella agreement and commercial partnership between The University of Queensland and The lndjalandji-Dhidhanu traditional owner group, which has provided a framework accommodating shared future commercial benefits and Indigenous economic development from the generated IP.

**References**

1. Amiralian, N., Annamalai, P. K., Memmott, P., Martin, D. J. *Cellulose* 2015, *22*, 2483.

2. Amiralian, N., Annamalai, P. K., Memmott, P., Taran, E., Schmidt, S., Martin, D. J. *Rsc Adv* 2015, *5*, 32124

3. Amiralian, N., Annamalai, P.K., Garvey, C.J., Jiang, E., Memmott, P. *Cellulose*, 2017, 24, 3753

4. Hosseinmardi, A., Annamalai, P.K., Martine, B., Pennells, J., Martin D., Amiralian, N. *ACS Omega*, 2018, 3, 15933

5. Hosseinmardi, A., Annamalai, P.K., Wang, L., Martin, D., Amiralian, N. *Nanoscale*, 2017, 9, 9510

6. Amin, K. N. M., Amiralian, N., Annamalai, P. K., Edwards, G., Chaleat, C., Martin, D. *Chem Eng J* 2016, 302, 406

7. Kępa, K., Chaléat, C., Amiralian, N., Batchelor, W. Grøndahl, L., *Cellulose*, 2019, 26, 6555

8. Pennells, J., Lin T.Y., Schmidt, S., Gamage, H., Godwin, I.D., Erickson, T.E., Hosseinmardi, H., Martin, D., Amiralian, N. *Industrial Crops and Products*, 2018, 126, 238