

NOMATEN Online Seminar

Time: 1 PM

Location: gotomeeting room - <https://meet.goto.com/NCBJmeetings/nomaten-seminar>

Seminar date: April 30th, 2024

Title: Future Opportunities of Lignin derived Advanced Materials

Speaker name: Dr. Maurice Collins

Speaker affiliation: University of Limerick, Ireland

Abstract: As we head towards 2030 and 55% carbon emission reduction targets with the ultimate goal of net zero carbon by 2050. It has become evident that materials and the source of such materials will play a key role for future generations of devices and products. This along with the depletion of petroleum resources and their associated environmental impact has driven increased interest in biobased materials as potential sustainable drop-in replacements for fossil-based equivalents. Lignocellulosic biomass, hard and soft wood, straw corncobs and other products from agriculture and forestry offers an abundant and renewable alternative to fossil-based materials. Taking a look at Lignin, it is amorphous and the only naturally occurring aromatic biopolymer, it is present in the cell wall of pith, roots, fruit, buds and bark. Currently, it is a non-valorised by product of the paper industry. The synthesis of lignin is carried out by the enzyme-initiated dehydrogenative random polymerisation of coniferyl alcohol, sinapyl alcohol and *p*-coumaryl alcohol and this leads to a cross-linked and highly heterogeneous aromatic polymer with chemical and physical properties largely determined by the syringyl (S), guaiacyl (G), and *p*-hydroxyphenyl content, molecular weight, the degree of branching, and purity with extraction method, *e.g.*, kraft/organosolv, also influencing its structure. This talk addresses structure/property/processing relationships of lignin and their influence on its ultimate function/ application. Tailoring of miscibility/ immiscibility of lignin-based blends is utilised to produce highly tuned fibres (nano and micron), hydrogels and porous materials for advanced applications in composites (automotive, construction), energy creation and storage, biomedical and sensing.

Bio: Professor Maurice N. Collins is a Materials Scientist and Principal Investigator (PI) in the School of Engineering at the University of Limerick. He is a member of the Bernal Institute, the Health Research Institute, FI/PI at SFI AMBER (based at TCD) and challenge lead at SFI BiOrbic (based at UCD). His expertise is in biopolymer science which includes: Tissue Engineering/Regenerative medicine, hydrogels and biobased carbon precursor materials as well as the development of 3D printable (bio)polymers. He works on the cascading principle - whereby higher value applications are preferentially derived from biological resources, through the utilisation of waste bioresources from forestry to produce advanced engineering materials for automotive, biomedical and energy applications (batteries and wind turbine blades). He has successfully led the H2020 funded LIBRE consortium (lignin for carbon fiber), the largest consortium in biobased carbon fibre research in Europe as well as being PI on multiple national funded projects. He is currently active in national projects (TRACELESS, NXTGENWOOD, Valid) and WP leader in 5 international Horizon Europe consortia (LIBRE, VIBES, CUBIC, BIOUPTAKE, BLADES2CIRC, BIONEER); two Spanish Government funded collaborations (Coversus and Encarna); two industrial collaborations (Pepsi, and J&J); supervising several fellowships (IRC, Marie Curie Individual); and has won a recent composites infrastructure award over €2.6 million to underpin the future output as well as international collaborators both

in Industry and academia. His work has led to 4 licensing agreements and 9 patent filings. Coupled to this, he has authored >200 publications and his research has featured in various national and international media outlets. His research has been recognised through multiple awards. He is a reviewer for > 40 international Journals. He served as editor of the Elsevier published International Journal of Biological Macromolecules (2019-2023) and sits on the editorial board of International Journal of Bioprinting, Carbohydrate Polymers, Heliyon, soldering and surface mount tech. He is proposal assessor for the European Research Council (ERC consolidator), the Polish Academy of Science, Israeli Ministry of Science, EPSRC (UK), National Research and Development Agency (Chile), A*STAR MTC Investigator Research Grant/Young Investigator Research Grant (Singapore), Austrian Research Promotion Agency (FFG), and Horizon Europe. He has chaired sessions at the Tissue Engineering and Regenerative Medicine International Society (TERMIS), European Society for Biomaterials and World Biomaterials Congress whilst delivering research presentations throughout the world. He lectures polymer therapeutics to postgraduate students and Tissue Engineering to undergraduates. He is a renowned mentor (IRC ally Award, SFI Mentor of the year nominee) with many of his team transitioning to academia and Industry. Currently, he supervises 10 PhD candidates, 6 postdocs and is Course Director for the MSc in Biomedical Device Materials. He was recently elected Fellow of the Royal Society of Chemistry and Fellow IOM3 for sustained leadership and impact in materials science. His work to date has led to >9k citations with a h-index > 50. Professor Collins is ranked in top 2% of scientists globally by Stanford University for both for career and yearly impact.