Books

1 Vidhura Mahendra, Dora Sousa and Geoffrey Mitchell "Rosin – an untapped green resource for the future for Portugal" – Vol 4 CDRSP knowledge series – Series Editors Geoffrey Mitchell and Paula Faria Institute Polytechnic of Leiria 2017 ISBN 978-989-96501-1-4 (print) and ISBN 978-972-8793-55-5 (e-book).

2 Geoffrey Mitchell, Florindo Gaspar, Vidhura Mahendra, Dora Santos "Advanced Materials from the Forests" in Handbook of Ecomaterials edited by Boris I Kharisov Oxana, Oxana Kharissova, Leticia M. Torres-Martínez Springer-Nature 2018 ISBN 9783319682549

Papers International Refereed Journals

1 G.R.Mitchell Climate Change and Manufacturing Procedia Manufacturing 12 298- 2017

doi: 10.1016/j.promfg.2017.08.033

Abstract

In 1966, the World Meteorological Organization proposed the term climatic change to encompass all forms of varations in the climate variability on time-scales of greater than 10 years, whether the cause was natural or anthropogenic. When it was realized that human activities had a potential to drastically alter the climate, the term climate change replaced climatic change as the dominant term to reflect an anthropogenic cause. Climate change was incorporated in the title of the Intergovernmental Panel on Climate Change (IPCC) and the UN Framework Convention on Climate Change (UNFCCC). Since 1988, the IPCC has produced 5 multivolume reports which collate the consensus of all leading scientists across the globe on all aspects of the science of climate change.

At the Paris climate conference in December 2015, 195 countries agreed to the world's first universal action plan to tackle climate change by limiting global warming to 'well below 2 °C'. This historic achievement was just the beginning – now every country must turn their promises into action. We must give serious attention to adapting our processes to mitigate the effects of global warming. This paper reviews the current state of expectations and agreements and explores how manufacturing technology can contribute toward these programmes.

2 Vidhura Mahendra, Mahadevappa Y. Kariduraganavar, Nandini A. Pattanashetti,

Geoffrey R. Mitchell The Coconut Tree – a source of sustainable polymeric materials United Journal of Biochemistry and Biotechnology in press 2018 preprint available

Coconut is a versatile tree belonging to the palm family (Botanic term Arecaceae, coconut palms, Cocos nucifera) in which each part is used for numerous applications. It is grown in the tropic and subtropic regions of the world. There is a tradition and culture associated with the coconut tree due to its enormous value as a food commodity, the use of its branches and wood for daily needs. Coconut is typically cultivated in the coastal regions of the countries due to its preferred moistened soil and salty nature. As well as a source of food, coconut fibres are widely used due to its high strength material properties for many domestic applications. It is clear that the coconut tree can contribute materials without compromising on the supply of food in contrast to other sources of sustainable materials.

3 Sousa, D., Biscaia, S., Viana, T., Gaspar, M., Mahendra, V., Mohan, S.D., Mateus, A., Mitchell, G.R., 2019. Rosin Based Composites for Additive Manufacturing. Applied Mechanics and Materials 890, 70–76. https://doi.org/10.4028/www.scientific.net/amm.890.70

Rosins are the non-volatile exudates of pine resins with hydrophobic characteristics that are widely used as a precursor for many industrial applications. In this paper we discuss the nature, process and its applications as a matrix for a composite material for additive manufacturing. The composite material has been tailored to chemical and mechanical properties with respect to their applications.

4. Mahendra, V., 2019. Rosin Product Review. Applied Mechanics and Materials 890, 77–91. https://doi.org/10.4028/www.scientific.net/amm.890.77

Rosin is the non-volatile exudate of pine resin with hydrophobic characteristics that are widely used and modified as a precursor for many industrial applications such as paints, inks and adhesives. The review paper discusses the rosin, its nature, processing, production material development for green science. The composite materials have been designed and tailored with respect to desired applications to offer a potential replacement of petrochemical use. Rosin consists of different resin acids that can undergo isomerisation at elevated temperatures and interchange its form, which, can be used as a rigid building block to manipulate their mechanical properties and crystallisation behaviours. Modified rosin epoxy binders have been recognised as materials with resistance to a wide variety of chemical conditions that can be used to fabricate a variety of reinforced constructions. Rosin has been employed in foam making in addition to composite material, depicting its ability as a crosslinker.

5. Properties of Rosin Vinyl Imidazolium Based Compounds as Potential Advanced Biocompatible Materials. Waste Biomass Valor 11, 3723–3730 (2020). https://doi.org/10.1007/s12649-019-00691-0

Rosin is a natural material extracted from the pine tree that is vastly used as an adhesive in the construction industry. It chemically consists of cyclic carboxylic structure that is known as rosin acids or abietic acid and other isomers. The abietic acid or/and its isomers can structurally be altered to design for different applications. Herein we envisage the potentials of altering the rosin structure to investigate its thermal and physicochemical properties for advanced material applications. In this regard we have utilised the potassium rosinate (rosin soap) also known as the saponified rosin. Saponified rosin is reacted through an anion exchange metathesis process promoted by ultrasound, with either an ionic liquid or a poly(ionic liquid), namely the 3-octyl-1-vinylimidazolium bromide and the poly (3-octyl-1-vinylimidazolium bromide) as a scope to improve thermal and mechanical applications. The structures of these new compounds were determined using fourier transform infrared spectroscopy (FTIR) and Nuclear Magnetic Resonance spectroscopy (NMR). The rosin/ionic liquid based compound found to be a better fitting candidate for advanced material applications, due to significant improvement in the thermal stability compared to the crude rosin (up to 70 °C raise in the thermal degradation) and promising mechanical characters such as elasticity and malleability.

Patent

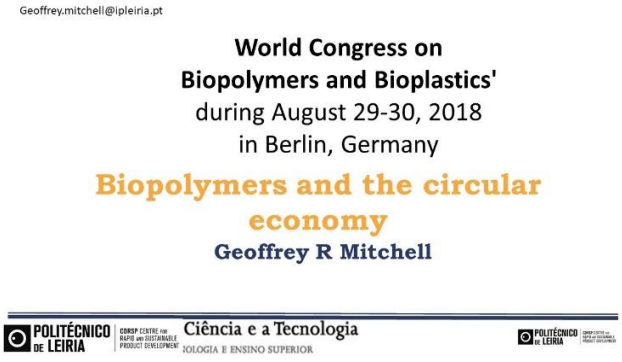
Vidhura Mahendra, Artur Mateus and G.R.Mitchell 2018 Eco Foams Portuguese patent nº 108659

Presentations at International Conferences

EUPOC2017 Polymers and Additive Manufacturing

25th International conference on composites/nanoengineering (ICCE-25) Rome 2017

Biopolymer Congress 2018 Berlin Keynote



9th World Congress on Biopolymers & Bioplastics 2019 | London, UK Plenary

2019 Algiers Ecole Thematics

Nanocomposites – Geoffrey Mitchell

MANUFACTURING A BETTER FUTURE

CDRSP Speakers at the Ecole Thematique Cooperation Algero-Portugaise

Poster Presentations at International Conferences

Polymer Connect Lisbon 2020 (Poster)

Green Nanocomposites Prepared with Rosin-Limonene copolymer and Algerian Clay (Maghnite-CTAB)

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The aim of this work is to prepare green thermosets using two natural sustainable and cheap materials (Rosin and Maghnite). The rosin is a solid form of resins obtained from pines and similar types of plants belonging to the conifer family, produced by heating fresh liquid resin to vaporize the volatile liquid terpene (large group of unsaturated hydrocarbons). The Maghnite is natural clay from the montmorillonite family that comes from the region of Maghnia (Telemcen-Algeria). The propos of those modifications is on one hand to enhance the thermal and the mechanical properties of the rosin and on the other hand to make both the rosin and the Maghnite suitable for the preparation of nanocomposites. The synthesis of green nanocomposites using Rosin-Limonene as a copolymer and Maghnite as a nanorenfort was done by two steps; first we polymerize limonene by cationic polymerization using Maghnite-H+ as a catalyst. The FT-IR and H-NMR have confirmed the

polymerization of limonene. The obtained polymer is intercalated in the clay sheets. Afterwards, the Rosin is added to the reaction mixture in order to synthesize copolymers- nanocomposites/ clay and to extract a green material from a green raw material (limonene, Rosin and clay). Following the same procedure we use Maghnite-CTAB for the synthesis of nanocomposites limonene-rosin/clay by in situ polymerization. The obtained nanocomposites were characterized by FT-IR, TGA, XRD and SEM analysis.

RESIM 2018 (Virtual Conference)

Rosin the ultimate green material

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