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Plastic to elastic: Fungi-derived composite nanopapers with tunable tensile properties (Article) (Open Access)

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Abstract

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Fungal chitin is attracting commercial and academic interest as a cheap, renewable, easily isolated and abundant alternative to crustacean chitin. Being covalently decorated with β-glucan, fungal chitin exhibits a native nanocomposite architecture that varies in fibre diameter and chitin to β-glucan ratio from species to species, resulting in mechanical properties ranging from brittle, high tensile strength, plastic -like properties to very tough and elastomeric rubber-like tensile properties if processed into paper form. This study utilised a mild alkaline process to extract chitin-β-glucan complexes from tree bracket fungi (D. confragosa) and common mushrooms (A. bisporus), which were then combined in varying ratios and hot pressed to form engineered composite nanopapers with tunable tensile properties . Fruiting bodies of common mushrooms, with almost proportional contents of chitin and β-glucan, exhibited a nanofibrous architecture resulting in very high tensile strengths, far outperforming crustacean-derived chitin. These nanopapers could then be plasticised in a controlled fashion through addition of extract from tree bracket fungi, which contains large quantities of β-glucan, to produce composite nanopapers . The fungal chitin extracts were significantly more hydrophobic than crustacean chitin, suggesting potential as a coating agent for hydrophilic materials, such as cellulose. These remarkable and controllable characteristics make fungi-derived materials versatile for a wide range of applications, including coatings, membranes, packaging and paper.

SciVal Topic Prominence

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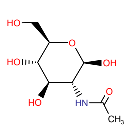
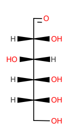
Chemistry database information

Substances





β-glucan

crab shell chitin

chitin

Author keywords

A. Fibres | A. Hybrid composites | B. Mechanical properties | Fungal chitin-β-glucan

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