Green Flow Nitration of Bacterial Cellulose

Introduction

Nitrocellulose is a key component of many energetic compositions. Traditional cellulose sourcing from the wood industry is labour intensive and leads to vegetal cellulose (VC) containing difficult to remove impurities [1].

Bacterial Cellulose

BC is a 3D nanoporous, paracrystalline fibre network and an important component of bacterial biofilms [2]. BC shows a high crystallinity and is free of VC associated impurities [3].

Comparative Nitration

To evaluate differences in NC based on starting material, a range of cellulose sources are being taken a through standardised nitration protocol.

Methodology

NC was produced through use of a mixed acid nitrating mix, quenches and boils. Samples were analysed by differential scanning calorimetry (DSC) and ferrous ion titration to determine thermal stability and Nitrogen percentage.

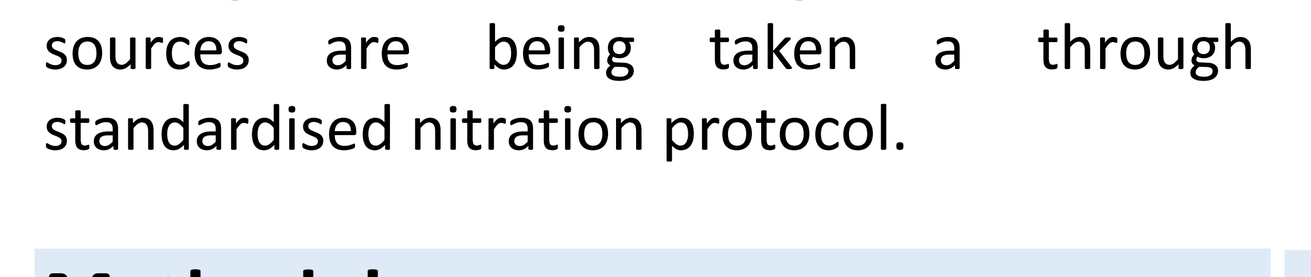

Fig 2 – Laboratory scale production of NC

Objectives

Growth, modification, and nitration of bacterial cellulose (BC) is being investigated to provide a consistent, high purity cellulose. Eliminating dependency on traditional cellulose.

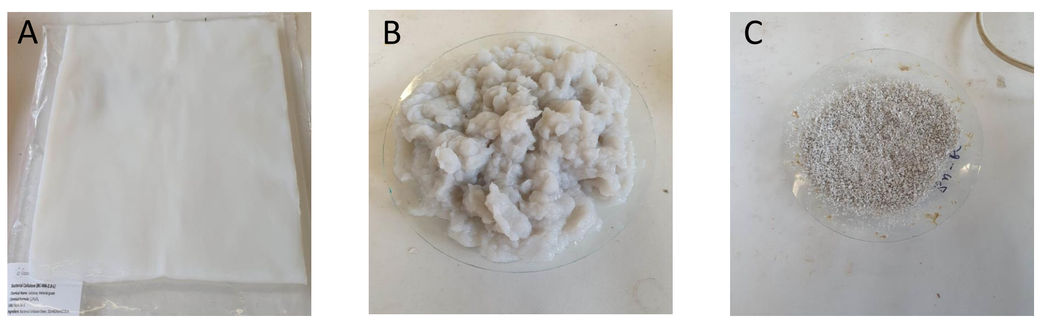

Fig 1– Stages of BC Sheet Processing. A, Native BC sheet. B, Blended sheet. C, dried blended sheet

Preliminary Results

A nitrogen percentage of 12.73% ± 0.10% was achieved in VC derived NC. Compared to 8.70% ± 0.03% achieved in BC derived NC. All Thermal profiles displayed a concise single peak.

Conclusion & Outlook

NC produced using BC as a starting material displayed significantly lower nitrogen percentage than VC derived NC when nitrated using traditional methods.

Further work includes molecular weight and crystallinity quantification of BC and VC & modification of *In vivo* BC synthesis to better suits traditional and flow manufacturing.

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[1] - Keegstra, K. (2010). Plant Cell Walls. *Plant Physiology*, *154*(2), 483–486. https://doi.org/10.1104/pp.110.161240
[2] - Flemming, H.-C., Wingender, J., Szewzyk, U., Steinberg, P., Rice, S. A., & Kjelleberg, S. (2016). Biofilms: an emergent form of bacterial life. Nature Reviews Microbiology, 14(9), 563–575. https://doi.org/10.1038/nrmicro.2016.94
[3] - Pogorelova, N., Rogachev, E., Digel, I., Chernigova, S., & Nardin, D. (2020). Bacterial Cellulose Nanocomposites: Morphology and Mechanical Properties. *Materials*, *13*(12), 2849. https://doi.org/10.3390/ma13122849