

Technical Brief

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High yield production of bacterial nanocellulose from a novel bacterial strain

Technology Summary

A high-yielding bacterial nanocellulose (BNC) strain of *Komagataeibacter rhaeticus* from rotten pomegranate that utilizes glycerol as a low cost carbon source.

Background

Bacterial nanocellulose (BNC), the nanofibrillar form of cellulose, has been exploited as a material for diverse applications due to its unique characteristics. Although BNC is structurally similar to plant cellulose, its unique physicochemical characteristics, such as high tensile strength, a pure form (without having hemi-cellulose and lignin components), greater crystallinity and moldability make it superior to plant cellulose. BNC is most commonly obtained from *Komagataeibacter xylinus*. However, low yields and high production costs are the two major hurdles for industry in using this versatile polymer material for wider applications.

Technology Description

For the first time, a potential BNC producing strain, *K. rhaeticus* PG2, was isolated from a rotten pomegranate fruit sample. The production of bacterial cellulose was assessed using different sugars and sugar alcohols as the carbon source. Glycerol was found to be the most efficient carbon source. Hestrin-Schramm (HS) liquid media containing glycerol as a carbon source resulted in the highest BC production (6.9 g/L). A further increased yield of BC (8.7 g/L) was obtained by using 3% (w/v) glycerol concentration, and this BNC yield is the highest reported among any of the known *Komagataeibacter rhaeticus* strains reported. The physicochemical characteristics of the cellulose membranes obtained from different culture media were characterized using many techniques.

Market Potential

The Microbial and Bacterial Cellulose market will register a 14.8% CAGR in terms of revenue; the global market size will reach US\$ 570 million by 2024, from US\$ 250 million in 2019. Price realization is roughly USD 10/gm for bacterial cellulose sheet, USD 11/gm for bacterial cellulose slurry and USD 50/gm for bacterial cellulose freeze dried powder

Value Proposition

- Novel indigenous bacterial strain
- Highest ever reported BNC-yielding organism (dry weight 8.7 g/L)
- High yielding process
- Utilizes very low cost carbon source as feedstock
- Affordable and low cost BNC
- Static fermentation process
- Enhanced water absorption ability (around 800%-1000%)
- Enhanced crystallinity index of resulting BNC
- Easy to harvest and Purest form of nanocellulose
- Produced in different shapes, gels, and foams

Applications

Bacterial Nanocellulose finds use as (i) Cosmetics like creams, lotions (ii) Textile Industry (Sports clothing, tents etc) (iii) Biomed application (Wound dressing, implants, drug delivery) (iv) Waste treatment (recycling of minerals and oils) (v) Mining (sponges to collect leaking oil, materials for absorbing toxins) (vi) Food industry (edible cellulose) (vii) Paper industry (special papers)

Technology Status

- Demonstrated at 50 L static fermentative conditions scale (samples available)
- Patent protected
- Seeking interested industry partners

References

<https://medium.com/@anshulpa1994/microbial-and-bacterial-cellulose-market-growth-2019-2024-b149bfa3bab>
High yield production of cellulose by a *Komagataeibacter rhaeticus* PG2 strain isolated from pomegranate as a new host. Meghana N. Thorat and Syed G. Dastager. RSC Adv., 2018, 8, 29797-29805

