Exploring SCOBY Bacterial Cellulose Interactions with Graphene Oxide in Kombucha Fermentation

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SCOBY bacterial cellulose (BC) is a biological macromolecule, deemed a by-product, that forms at the liquid-air interface during kombucha tea fermentation [1]. Given the extensive investigation on graphene hybrids and nanocomposite and biopolymer-based materials such as BC [2], this study explores the intricate interaction between the kombucha culture and graphene oxide (GO). The primary objective was to optimize the in-situ production of BC/GO hybrids during Kombucha cultivation, by monitoring the impact of GO on cellulose structure, mechanical properties as well as on consortium metabolism. Metagenomic analysis was performed to unveil the dynamic microbial consortium responsible for cellulose production of kombucha when grown in the presence of GO. Moreover, utilizing isolation techniques, specific cellulose-producing bacteria were identified and genomically characterized to gain insight into cellulose synthesis pathways and understand how GO-BC interactions shape the final material properties.

Preliminary findings indicate that the proposed approach, after the thermal reduction of the GO phase to reduced GO (rGO), is able to produce porous BC/rGO hybrids with high electrical conductivity, with interesting applications in materials science. This comprehensive approach, combining metagenomic/genomic insights and BC/rGO production, provides new perspectives for developing innovative, sustainable materials with enhanced properties and multifunctional capabilities, thereby advancing biomaterials and applications across diverse scientific and industrial domains.

References:

[1] Laavanya D, Shirkole S and Balasubramanian P. "Current challenges, applications and future perspectives of SCOBY cellulose of Kombucha fermentation." Journal of Cleaner Production 295 (2021): 126454.

[2] Kiangkitiwan N and Srikulkit K. "Preparation and properties of bacterial cellulose/graphene oxide composite films using dyeing method." Polymer Engineering & Science61.6 (2021): 1854-1863.