Junior Science Communications
Faculty of Applied Sciences, UiTM Shah Alam
https://journal.uitm.edu.my/ojs/index.php/JSC

E-ISSN 2637-0689
Vol 31 2024

Colloquium on Applied Sciences-CAS 2023
17-18 July 2023, Faculty of Applied Sciences, UiTM Shah Alam, Malaysia

Effect of Alkalisation Treatment on Bacterial Cellulose Dissolution at Different Temperature

Nur Anis Qistina Mohammad[a], Mohd Iqbal Misnon[ac*], Mohd Fakharul Zaman Raja Yahya[b]

Structured Abstract

Background: Bacterial cellulose (BC) is solely constituted of cellulose, with no additional polymers such as hemicellulose, lignin, or pectin. BC is known to be difficult to dissolve in alkali solutions due to its high polymerisation. For various reasons, including lower temperature, Sodium Hydroxide (NaOH) is known to be the most efficient solvent for cellulose dissolving. The objective of this study is to investigate the most effective concentration of NaOH and the optimal temperature for dissolving bacterial cellulose, with or without the presence of urea in order to regenerate BC fibre.

Methods: The BCs were dissolved in 6 different concentrations of NaOH with and without adding Urea and left at ambient and -20°C for 24 hours. The solubility percentage was calculated to identify the optimum condition for the dissolution process. The regeneration process of BC was then conducted by neutralising the dissolved solution of BC with Hydrochloric Acid (HCl). The regenerated BC fibre was then analysed and characterised using Scanning Electron Microscopy (SEM), Fourier Transform Infrared (FTIR), and X-ray Diffraction (XRD) and compared with the pure BC fibre.

Results: The results showed that the solubility percentage of BC in ambient temperature increased with the increase of NaOH concentration (44%) and decreased with the addition of urea (5%). While a lower solubility percentage was obtained in the -20oC dissolution (-3%). However, the high gelation properties of the BC in the dissolution process are shown in the -20oC condition, and these properties are still highly researched. Still, some studies indicate the properties result from the dissolved BC. The favourable condition of dissolution is to be at 25% of NaOH concentration at ambient temperature. The analysation and characterisation of regenerated BC fibre with the pure BC fibre showed cellulose I to cellulose II shifting in XRD, while similar results and peaks showed in FTIR.

Conclusion: Understanding these characteristics can aid in optimising BC's dissolving process in a variety of commercial applications like as medications, tissue engineering, and food science, hence improving society's overall quality of life through the development of improved goods.

Keywords: Bacterial Cellulose, Cellulose Regeneration, Alkalisation, Neutralisation

*Correspondence: texiqbal@uitm.edu.my

[a]School of Industrial Technology, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia

[b]School of Biology, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia

[c]Textile Research Group, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia