Covalent modifiCation of miCroCrystalline Cellulose to induCe inherent antibaCterial activity

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INTRODUCTION

Microcrystalline Cellulose, a semicrystalline water insoluble polymer having D-anhydroglucopyranose ring as the repeating unit was allowed to react with an epoxide followed by with a primary aliphatic amine. This aminated cellulose molecule showed antibacterial activity by gaining a positive charge and neutralizing gram-positive bacteria. The structure of the modified molecule was confirmed via FTIR and NMR. This modified molecule was subjected to Scanning Electron Microscopy and X-ray Diffraction method which showed no change in the crystalline nature and morphology. Hence, it was found to be stable antibacterial compound.

RATIONALE

To chemically modify microcrystalline cellulose (MCC) via introduction of an aliphatic amine and indicate it for antimicrobial activity which can be advantageous for wound healing.

Microcrystalline cellulose (No antibacterial activity)

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Introduction of amine group into cellulose molecule

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Aminated Microcrystalline cellulose (exhibits antibacterial activity) → **Wound Healing purpose for infection prevention**

OBJECTIVES

1) **To perform the epoxy modification of MCC**

2) **To perform amination of epoxy modified MCC**

3) **To perform FTIR, SEM, NMR of epoxy-MCC and Aminated epoxy-MCC**

4) **To perform the in-vitro antibacterial assay of aminated epoxy-MCC**

OBJECTIVES

EXPERIMENTAL WORK

Preparation of epichlorohydrin modified MCC (EPH-MCC)

1g of MCC added to 4g in 80mL NaOH and stirred till 60^{0}C was reached

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At 60^{0}C, 10mL Epichlorohydrin added

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Stirred at 60^{0}C for 2 hours

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Filtration of the mixture

↓

Residue washed with Millipore water till the pH turns from basic to neutral

↓

Product analysed for acid-base titrimetric analysis, FTIR, NMR, XRD and SEM

Preparation of amine modified EPH-MCC

1g of EPH-MCC added to 10 mL of n-butylamine

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Stirred at 60^{0}C for 2 hours

↓

Filtration of the mixture

↓

Residue washed with Millipore water till the pH turns from basic to neutral

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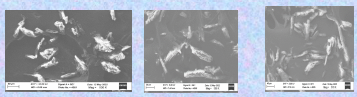
Product analysed for FTIR, NMR, XRD and SEM

RESULTS AND DISCUSSION

SEM characterization

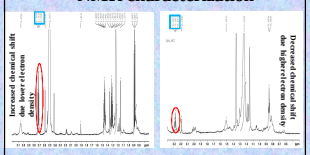


SEM Image of MCC | SEM Image of EPH-MCC | SEM Image of aminated EPH-MCC

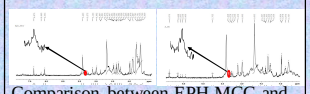
FTIR characterization

Microcrystalline Cellulose (MCC) | *Epichlorohydrin modified Microcrystalline Cellulose (EPH-MCC)* | *Aminated EPH-MCC*

NMR characterization



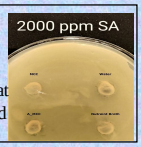
Comparison between MCC and EPH-MCC



Comparison between EPH-MCC and aminated EPH-MCC

Antibacterial activity testing →

The aminated EPH-MCC was found to have a slight antibacterial activity at 2000ppm as compared to that of MCC.



CONCLUSION

The aminated epoxy MCC was synthesized successfully and its structure was established by characterization techniques like IR, NMR and SEM. It showed an intrinsic antimicrobial activity against *Staphylococcus aureus* at 2000 ppm. Such an epoxy modified cellulose molecule can be used in wound healing to prevent infections. In addition, it can be used in food packing to prevent the spoilage of food and extent its shelf life.