

Development of Film-Forming Wound Dressing Gel from SCOBY Kombucha Combined with Green Tea Extract for Antimicrobial Applications

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ABSTRACT

SCOBY kombucha is a cellulose-based biomaterial derived from bacterial and yeast fermentation, often regarded as a byproduct in kombucha beverage production. This study aimed to develop a wound dressing that incorporates SCOBY kombucha and green tea extract to prevent bacterial skin infections. In this study, fresh SCOBY kombucha was first prepared by neutralization and washed with water several times. The SCOBY was blended and sterilized by autoclaving before being formulated into a film-forming wound dressing gel with green tea extract. The antimicrobial efficacy of green tea extract was assessed by determining its minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) against bacteria causing skin diseases, including *Pseudomonas aeruginosa*, *Staphylococcus aureus*, Methicillin-resistant *Staphylococcus aureus* (MRSA), *Staphylococcus epidermidis*, *Clostridium perfringens* and *Cutibacterium acnes*. The results revealed that green tea extract exhibited the lowest MIC and MBC values 0.98 mg/ml against MRSA. Moreover, green tea extract at 125 mg/ml had the ability to inhibit all tested skin pathogenic bacteria. Following this, the extract (125 mg/ml) was incorporated into SCOBY kombucha, polyvinyl alcohol, glycerol, propylene glycol, and water, which were then developed into a functional film-forming wound dressing gel. These findings highlight the potential of SCOBY kombucha based wound dressings infused with green tea extract as a promising biomaterial for infection prevention. This study provides insights into the development of sustainable, bioactive wound dressings with applications in biomedical and clinical settings.

INTRODUCTION

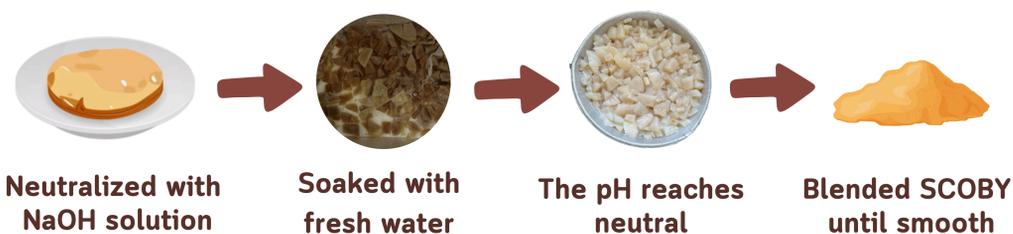
The fermentation of kombucha produces a byproduct known as the symbiotic culture of bacteria and yeast (SCOBY), which is often discarded as waste. However, due to its high cellulose content, SCOBY holds potential for various applications, particularly in the development of sustainable biomaterials. This study investigates the valorization of discarded SCOBY as a raw material, aiming to reduce waste while contributing to the advancement of eco-friendly bioproducts.

OBJECTIVE

To develop of film-forming wound dressing gel from SCOBY kombucha combined with green tea extract for antibacterial treatment of skin infections.

METHODOLOGY

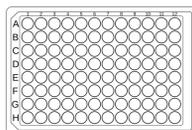
• Preparation of SCOBY



• Antibacterial Activity of Green Tea Extract

Minimal inhibitory concentration (MIC)

Minimal bactericidal concentration (MBC)



Pseudomonas aeruginosa

Staphylococcus epidermidis

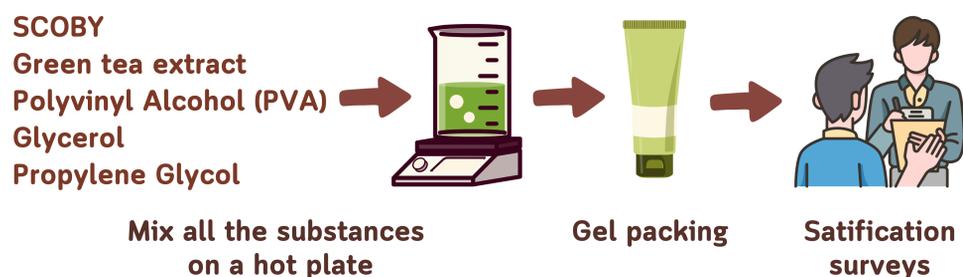
Staphylococcus aureus

Clostridium perfringens

Methicillin resistant *S. aureus* (MRSA)

Cutibacterium acnes

• Film-forming Wound Dressing Gel Development



RESULTS

• Antibacterial Activity of Green Tea Extract

Table 1 MIC and MBC values of green tea extract against skin pathogenic bacteria

Samples	Concentration (mg/mL)											
	<i>P. aeruginosa</i>		<i>S. aureus</i>		MRSA		<i>S. epidermidis</i>		<i>C. perfringens</i>		<i>C. acnes</i>	
	MIC	MBC	MIC	MBC	MIC	MBC	MIC	MBC	MIC	MBC	MIC	MBC
Green Tea Extract	62.5	125	1.96	3.91	0.49	0.98	0.98	1.95	31.25	62.50	62.50	125
Gentamicin	0.02	0.05	0.01	0.02	>25.00	>25.00	<0.01	0.01	0.05	0.09	<0.01	0.01

• Film-Forming Wound Dressing Gel Development

Table 2 Description of ingredients in each tested formulation

Ingredients	Formula (%)			
	1	2	3	4
SCOBY	60-65	40-45	15-20	15-20
Glycerol	4-6	4-6	6-7	4-6
Propylene Glycol	2-3	2-3	2-3	2-3
Carbomer	0.1-1	0.1-1	-	-
Gelatin	5-10	1-5	-	-
Polyvinyl Alcohol (PVA)	-	-	5-7	8-10
Green Tea Extract	125 mg/mL			

Fig 1 Formula 4 the gel will dry into film within 5-10 minutes

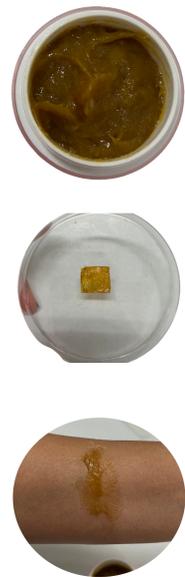
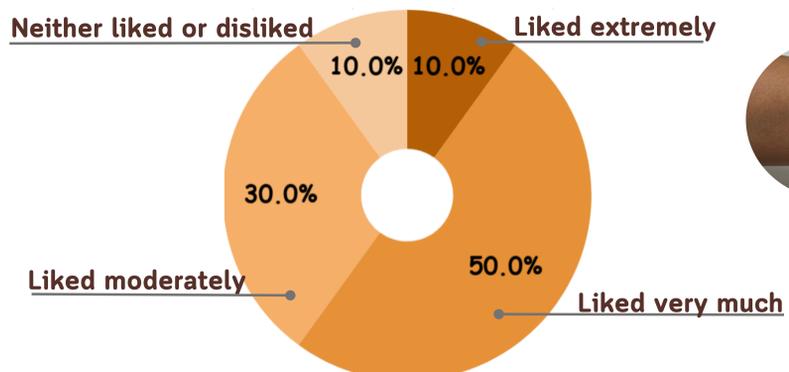


Fig 2 Illustrates the volunteer satisfaction surveys for the product



CONCLUSION

- The green tea extract exhibited antibacterial activity against all tested bacteria, with MRSA showing the highest susceptibility (MIC = 0.49 mg/mL, MBC = 0.98 mg/mL), indicating potent antibacterial properties.
- Formula 4 demonstrated the highest effectiveness in film-forming wound dressing gel development, ensuring optimal gel formation and structural integrity.

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