Biosynthesis and Characterization of Microbial Exopolysaccharide for Cosmeceutical Application

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Certification

This is to certify that **Sakirat Yetunde ABODERIN** with matriculation number LCU/PG/005434, carried out this research work titled "**Biosynthesis and Characterization of Microbial Exopolysaccharide for Cosmeceutical Application**." in the Department of Biological Sciences, Faculty of Natural and Applied Sciences, Lead City University, Ibadan, Oyo state, for the award of Master Degree (M.Sc.) in Industrial Microbiology and that this has not been previously submitted**.**

Dr. O.A Aiyelabola **Date**
(Promoter)

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(Head of Department)

Dedication

This research is dedicated to the Almighty God for making its completion possible**.**

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Abstract

Exopolysaccharides (EPS) are high-molecular-weight biopolymers secreted by microorganisms into their extracellular environment. Among the most well-known producers of EPS are species of yeast, bacteria, and fungi. The aim of this study is to isolate, optimize, and evaluate application of microbial exopolysaccharides (EPS) in formulation of a clarifying skin gel from microbial strains obtained from naturally fermented grape samples, soursop, maize gruel, locust beans and palm wine. Grape samples were obtained from three major markets in Ibadan: Oje, Challenge, Molete, Locust beans samples were obtained from Challenge, Felele, Orita Challenge, while maize gruel samples were collected from Soka, Challenge, and Orita challenge areas and soursop samples were obtained from Oje, Palm wine samples were obtained from Tollgate. Samples were fermented for 24 hours and cultured on Nutrient broth, Yeast Extract Potatoes Dextrose broth to reduce microbiological load and allow the growth of the discrete colonies. Isolates that exhibited mucoid colonies were incubated for 15 days at room temperature. After incubation, the culture was centrifuged at 4000 rpm for 30 minutes, and the supernatant was carefully decanted into a sterile tube. Macroscopic observation was done on selected EPS producers and microscopic examination was conducted along with molecular identification using FTIR. Quantitative analysis revealed significant variability in EPS yield across samples. Isolates G1, G2, H2, from soursop and grape showed higher yields (e.g., G1 = 9.1 and G2 = 7.1), highlighting their superior production capacity. Additionally, palmwine samples (YEG PW1) showed moderate EPS production, which aligns with reports on EPS-producing microbes isolated from fermented foods. Optimization experiments identified **G1** as the most promising isolate. Under different sugar sources (fructose, sucrose, glucose, galactose) and temperature ranges (25–35 °C), EPS production varied significantly. The highest yield was recorded at **8.9 g/L** under 6 % glucose at 30 °C, demonstrating that substrate type and concentration, along with environmental factors, critically influence EPS synthesis.

Word Count: 300

Key Words: Exopolysaccharides, microbial, optimization experiments, fermented foods

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List of Acronyms

Abbreviation	Meaning
ANOVA	Analysis of Variance
AOAC	Association of Official Analytical Chemists
C/N ratio	Carbon to Nitrogen Ratio
CFU	Colony Forming Unit
CMC	Carboxymethyl Cellulose
DNA	Deoxyribonucleic Acid
EPS	Exopolysaccharides
EtOH	Ethanol
FTIR	Fourier Transform Infrared Spectroscopy
GC	Gas Chromatography
GRAS	Generally Recognized As Safe
HPLC	High Performance Liquid Chromatography
ICP-OES	Inductively Coupled Plasma Optical Emission Spectroscopy
MIC	Minimum Inhibitory Concentration
MTCC	Microbial Type Culture Collection
NaCl	Sodium Chloride
OD	Optical Density
PBS	Phosphate Buffered Saline
PCR	Polymerase Chain Reaction
pH	Potential of Hydrogen
rpm	Revolutions per Minute

SEM	Scanning Electron Microscopy
SDS-PAGE	Sodium Dodecyl Sulfate Polyacrylamide Gel Electrophoresis
SPSS	Statistical Package for Social Sciences
TLC	Thin Layer Chromatography
UV	Ultraviolet
v/v	Volume per Volume
w/v	Weight per Volume
YEPD	Yeast Extract Peptone Dextrose (medium)
YEGA	Yeast Extract Glucose Agar
NA	Nutrient Agar
MRS	De-man Rogosa Sharpe Agar