

Genetics • Genomics • Genetic engineering • Biotechnology • Bioinformatics

eISSN 2566-431X

# Genetics & Applications

An Aspiring Interdisciplinary Journal of Genetic Research

*special edition*



## ABMBBIH

CONFERENCE 2023

International Conference of  
Biochemists and Molecular  
Biologists in Bosnia and  
Herzegovina



The Official Publication of the  
Institute for Genetic Engineering and Biotechnology  
University of Sarajevo



## STRENGTHENING THE POTENTIAL OF R-PHYCOCYANIN FROM *PORPHYRA SP.* FOR SUSTAINABLE COLORATION IN THE FOOD INDUSTRIES

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*Porphyra sp.* (Nori), red algae, is a highly nutritious superfood due to its abundance of vitamins, minerals, antioxidants, and proteins, including R-phycoerythrin (R-PE), a purple-coloured phycobiliprotein. However, the limited stability of R-PE poses a challenge to its application in the food industry. This study aimed to purify, characterize, and stabilize R-PE for use as a natural colourant in the food, cosmetic, and pharmaceutical industries. Highly pure R-PE was obtained from Nori flakes, and its trimeric (( $\alpha\beta$ )<sub>3</sub>) structure was determined using SAXS measurements. Far-UV CD spectroscopy revealed the dominant secondary structure to be  $\alpha$ -helix, and R-PE was stable in the pH range of 4 to 8. However, thermal treatment at 60 °C had detrimental and irreversible effects on the R-PE's colour and antioxidant capacity (22% residual capacity). Encapsulation within the calcium alginate beads preserved its purple colour and retained its antioxidant capacity (78% residual capacity). Our findings demonstrate the potential of R-PE as a replacement for toxic synthetic dyes and highlight the importance of stabilizing R-PE through encapsulation for its bioactivity and colour preservation.

**Keywords:** R-phycoerythrin, purification, stability, SAXS, CD spectroscopy, calcium-alginate, antioxidant capacity

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