

## **Growth rate analysis and protein identification of *Kappaphycus alvarezii* (Rhodophyta, Gigartinales) under pH induced stress culture**

### **Abstract**

Environmental pH is one of the factors contributing to abiotic stress which in turn influences the growth and development of macroalgae. This study was conducted in order to assess the growth and physiological changes in *Kappaphycus alvarezii* under different pH conditions: pHs 6, ~8.4 (control) and 9. *K. alvarezii* explants exhibited a difference in the daily growth rate (DGR) among the different pH treatments ( $p < 0.05$ ). The highest DGR was observed in control culture with pH ~8.4 followed by alkaline (pH 9) and acidic (pH 6) induced stress cultures. Protein expression profile was generated from different pH induced *K. alvarezii* cultures using sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE) followed by protein identification and analysis using matrix-assisted laser desorption/ionization time-of-flight mass spectrometer (MALDI-TOF-MS) and Mascot software. Ribulose biphosphate carboxylase (Rubisco) large chain was identified to be up-regulated under acidic (pH 6) condition during the second and fourth week of culture. The findings indicated that Rubisco can be employed as a biomarker for pH induced abiotic stress. Further study on the association between the expression levels of Rubisco large chain and their underlying mechanisms under pH stress conditions is recommended.