Investigation of Growth Rate and Phycocolloid Content from Kappaphycus alvarezii (Rhodophyta, Solieriaceae) under Different Light Conditions Using Vibrational Spectroscopy

Abstract

Kappa-carrageenan (K-carrageenan) is an important phycocolloid which is a major constituent of the cell wall of Kappaphycus alvarezii. The chemical structure of K-carrageenan comprises a linear backbone of D-galactose residues linked with alternating α-(1,3) and β-(1,4) linkages which are substituted by one ester-sulphonic group per di-galactose repeating unit. The spectral qualities of light as well as the ambient carbon dioxide concentration, both play an important role in the photosynthetic pathway in plants and this investigation set forth to establish the effect of different wavelengths of light and carbon dioxide supplementation on the chemical structure of K-carrageenan obtained from K. alvarezii. Specimens were cultivated under a range of monochromatic light spectra and assessed for chemical composition using Fourier Transform Infrared (FTIR) spectroscopy.The K. alvarezii control was irradiated with full light spectrum, treatments were carried out using blue (492-455 nm), green (577-492 nm) and red (780-622 nm)light. One experiment was carried out by supplementation with carbon dioxide. Samples were collected after 14 days. The effect of different wavelengths of light on the growth rates of experimental samples was determined. Red light had the most significant impact on the growth rate of K. alvarezii as compared to those treated with blue light. The FTIR fingerprint of the ground seaweed was found to be identical to that of commercial K-carrageenan (Sigma). Special emphasis was given to the 800-1300 cm-1 region, which presents several vibrational modes. All the samples produced similar FTIR spectral profiles, suggesting that genes related to the carrageenan biosynthesis are not affected by different wavelengths of light or CO2. The results obtained from FTIR spectroscopy demonstrated that different wavelengths of light and supplementation with CO2 have no influence to the chemical structure of K-carrageenan in K. alvarezii.