Abstract

The global demand for omega-3 polyunsaturated fatty acids (PUFA) has been increasing owing to their various health benefits necessitating the search for additional sources. The microalgae could be an excellent source as they accumulate high content of PUFA rich lipids, have higher photosynthetic efficiency and surface area productivity compared to crop plants, have simple nutritional requirements and do not require agricultural land. The present study focused on the screening and selection of indigenous microalga accumulating omega-3 alpha-linolenic acid (ALA) rich lipids, enhancement of lipid accumulation in the selected microalga *Desmodesmus* sp., understanding the biochemical mechanisms involved in lipid accumulation and developing the cultivation strategies for the production of the microalgal biomass with ALA-rich lipids. Different stresses were studied for inducing lipid accumulation in the microalga. The lipid enhancing stress conditions led to reduced photosynthetic efficiency indicating physiological stress. The ROS and the MDA levels also increased, suggesting that the cells experienced oxidative stress. The differential expression pattern of key genes involved in lipid biosynthetic and CO2 fixation pathways was studied. The expression pattern of genes encoding acetyl CoA carboxylase and malic enzyme observed to be increased under various stress conditions. The stress-induced enhancement in lipid content is characterized by reduced growth and biomass production. Different cultivation strategies were developed to overcome this limitation.