World Academy of Science, Engineering and Technology
International Journal of Marine and Environmental Sciences
Vol:15, No:12, 2021

A Microcosm Study on the Response of Phytoplankton and Bacterial Community of the Subarctic Northeast Atlantic Ocean to Oil Pollution under Projected Atmospheric CO_2 Conditions

Authors : Afiq Mohd Fahmi, Tony Gutierrez, Sebastian Hennige

Abstract : Increasing amounts of CO_2 entering the marine environment, also known as ocean acidification, is documented as having harmful impacts on a variety of marine organisms. When considering the future risk of hydrocarbon pollution, which is generally detrimental to marine life as well, this needs to consider how OA-induced changes to microbial communities will compound this since hydrocarbon degradation is influenced by the community-level microbial response. This study aims to evaluate the effects of increased atmospheric CO_2 conditions and oil enrichment on the phytoplankton-associated bacterial communities. Faroe Shetland Channel (FSC) is a subarctic region in the northeast Atlantic where crude oil extraction has recently been expanded. In the event of a major oil spill in this region, it is vital that we understand the response of the bacterial community and its consequence on primary production within this region—some phytoplankton communities found in the ocean harbor hydrocarbon-degrading bacteria that are associated with its psychosphere. Surface water containing phytoplankton and bacteria from FSC were cultured in ambient and elevated atmospheric CO_2 conditions for 4 days of acclimation in microcosms before introducing 1% (v/v) of crude oil into the microcosms to simulate oil spill conditions at sea. It was found that elevated CO_2 conditions do not significantly affect the chl a concentration, and exposure to crude oil detrimentally affected chl a concentration up to 10 days after exposure to crude oil. The diversity and richness of the bacterial community were not significantly affected by both CO_2 treatment and oil enrichment. The increase in the relative abundance of known hydrocarbon degraders such as Oleispira, Marinobacter and Halomonas indicates potential for biodegradation of crude oil, while the resilience of dominant taxa Colwellia, unclassified Gammaproteobacteria, unclassified Rnodobacteria and unclassified Halomonadaceae could be associated with the recovery of microalgal community 13 days after oil exposure. Therefore, the microbial community from the subsurface of FSC has the potential to recover from crude oil pollution even under elevated CO_2 (750 ppm) conditions.

Keywords : phytoplankton, bacteria, crude oil, ocean acidification
Conference Title : ICOAMO 2021 : International Conference on Ocean Acidification and Marine Organisms
Conference Location : Sydney, Australia
Conference Dates : December 02-03, 2021