北台灣紅樹林土壤產甲烷古菌活性與族群結構

Activities and compositions of Methanogens in Mangrove soil in Northern Taiwan

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摘要

近年來氣候變遷日益加劇，不僅造成天然災害(如:極端氣候)更使人類生活受到影響，而引起氣候變遷的主要原因為溫室氣體的排放。溫室氣體指的是二氧化碳、甲烷及氧化亞氮,這些氣體會吸收紅外光,當太陽輻射經地表反射後在大氣層被溫室氣體阻擋，因此使得地球表面升溫,造成全球暖化的現象。其中,甲烷作為第二大的溫室氣體在100年的全球變暖潛能為二氧化碳的25倍，可知其影響不容忽視；甲烷的排放源可以分自然排放與人為排放,自然排放源像是濕地、湖泊等,而人為排放源則是化石燃料的使用、畜牧業及水稻田。目前全球約1/3的甲烷排放是來自天然濕地的產甲烷古菌，在厭氧的條件下，有機物被降解為小分子再由產甲烷古菌進一步代謝轉化為甲烷。紅樹林作為天然的海岸型濕地會受到潮汐的影響，長時間處於厭氧狀態為產甲烷古菌提供了絕佳的環境，影響到其原本具有高潛力的固碳功用。

紅樹林不僅是吸收二氧化碳能力極佳的自然碳匯，且為產甲烷旺盛的厭氧場所，甲烷排放的多寡會影響紅樹林生態系統作為碳匯的價值。本研究主要目標為探討北台灣紅樹林的產甲烷活性與族群組成，且針對碳源、現地營養鹽的不同，討論其甲烷生成的速率與族群差異。期望藉由本研究得知紅樹林生態系的產甲烷潛力及產甲烷古菌活性跟環境因子之間的相關性，並期望以此作為基礎，在未來降低紅樹林濕地可能的甲烷排放之問題，增進其藍碳儲存。

關鍵詞:氣候變遷(溫室氣體排放)，海岸濕地，藍碳，產甲烷古菌，紅樹林

Abstract

Climate change has been intensifying in recent years. It not only causes natural disasters

(such as: Extreme climate) but also affects human life. One of the driver for climate change is greenhouse gas emission. Greenhouse gases, such as CO_2, CH_4,and N_2O, have high ability in converting solar radiation into heat, and increase the global temperature. Methane, which is the second largest greenhouse gas, is very important to global warming. The global warming potential of CH_4 is 25 times greater than that of CO_2 with a 100 year time horizon. Major CH_4 sources include natural environments, such as wetlands and lakes, and anthropogenic activities, such as fossil fuel combustion, animal husbandry and paddy farming. At present, about one-third of global CH_4 emission is from methanogens in natural wetlands. Under anoxic conditions, organic matter is degraded into small molecules and then further metabolized into methane by methanogens. Mangrove forest, as one type of natural wetlands, is under tidal influences and characterized by absence of oxygen. Thus, it provides a great environment for methanogenesis.

Mangroves not only have high potential in sequestrating carbon from the atmosphere, but also ideal places for methane production. The amount of methane emitted will affect the value of carbon sinks for mangrove ecosystems. Thus, the objective of this study is to investigate the activities and compositions of methanogens in mangrove soils in northern Taiwan. We also evaluate the relation among methane production, different carbon sources and nutrient concentrations, with the hope to provide a better understanding in how methane emission can be potentially affected and regulated. By having such knowledge, we hope to reduce the net CH_4 emission from mangrove forests and maximize the “blue carbon” storage of mangroves with proper managements in future.

Keyword: Climate change (Greenhouse gas emission)，Coastal wetland，Blue carbon，Methanogens，Mangrove