Effect of Culture Media on Growth and Chemical Composition of *Nostoc* sp.

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Abstract

Cyanobacteria are photosynthetic bacteria with high potential for applications in medicine, food industry, and agriculture due to their capacity to synthesize a wide range of valuable biomolecules. This study aimed to investigate the growth performance and chemical composition of *Nostoc* sp. cultivated in five culture media containing different NaCl concentrations: BG-11_0 (without NaCl supplementation), and BG-11_0 supplemented with 0.5%, 1.0%, 1.5%, and 2.0% (w/v) NaCl over a 14-day cultivation period. The results indicated that *Nostoc* sp. grown in BG-11_0 supplemented with 1.0% NaCl achieved the highest dry biomass (0.2053 g/L). On the other hand, the lowest biomass (0.0708 g/L) was observed in the BG-11_0 supplemented with 2.0% NaCl, indicating that increasing NaCl concentration inhibited the growth of *Nostoc* sp. Regarding chemical composition, cells cultivated in BG-11_0 supplemented with 2.0% NaCl exhibited the highest total lipid content (26.86 ± 0.27%) and total carbohydrate content (41.85 ± 1.14%) on a dry weight basis. In contrast, the highest total fatty acid content (3.39% dry weight) and total phenolic content (6.52 ± 0.20 mg GAE/g) were detected in BG-11_0 supplemented with 0.5% NaCl. These findings demonstrate that varying NaCl concentrations in the culture medium significantly influence both growth and chemical composition of *Nostoc* sp., and provide a practical basis for selecting appropriate culture conditions to enhance biomass production and the yield of valuable biomolecules for commercial applications.

Introduction

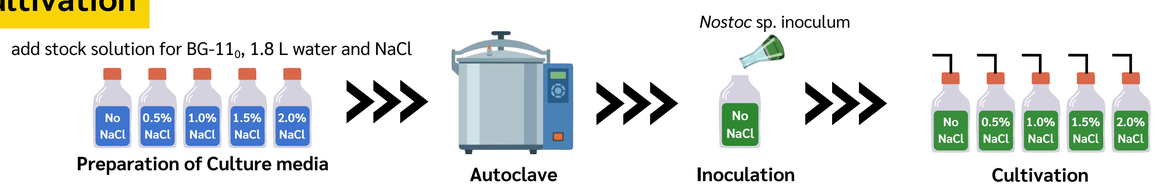
Cyanobacteria are photosynthetic microorganisms with significant potential for producing various important metabolites, leading to increasing interest in their commercial applications. One of the promising species that has been utilized in various fields is *Nostoc* sp. However, cultivation conditions and the composition of culture media can influence the growth and chemical composition of *Nostoc* sp. Although some studies have investigated these factors, information regarding the effects of different culture media on *Nostoc* sp. remains limited. Therefore, this study aims to evaluate the effects of different culture media formulations on the growth and chemical composition of *Nostoc* sp., providing fundamental information for improving cultivation efficiency in future applications.

Objective

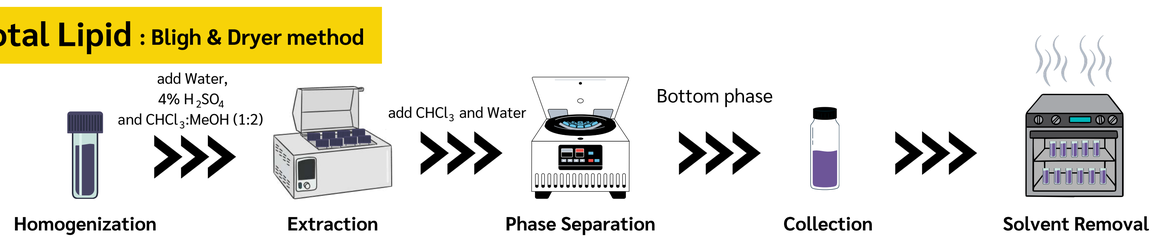
To study the effects of NaCl on the growth and chemical composition of *Nostoc* sp. (total lipid, total carbohydrate, total fatty acid, and total phenolic).

Methodology

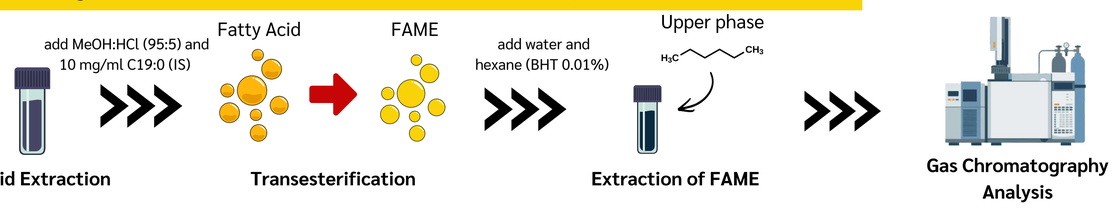
Cultivation



Total Lipid : Bligh & Dryer method



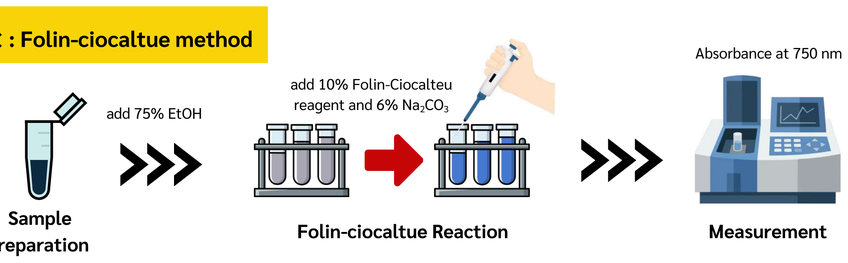
Total Fatty Acid : FAME (Fatty Acid Methyl Ester) technique by Gas Chromatography



Total Carbohydrate : Phenol-Sulfuric acid method



Total Phenolic : Folin-ciocaltue method



Results & Discussion

Cell structure

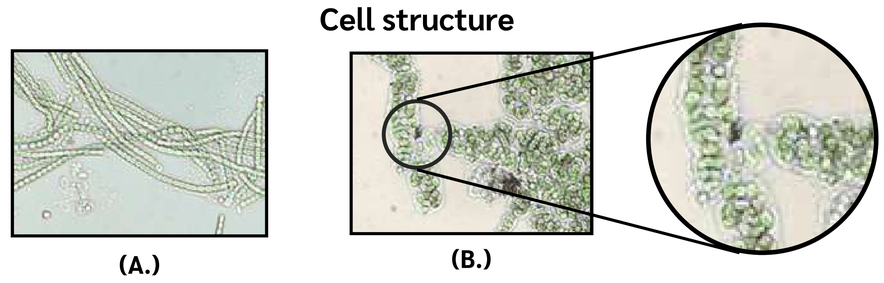


Figure 1. Cell structure of *Nostoc* sp. observed under a fluorescence microscope at 10× magnification. (A.) Cell structure of *Nostoc* sp. in BG-11_0. (B.) Cell structure of *Nostoc* sp. in BG-11_0 + 1.5% NaCl

The cell structure of *Nostoc* sp. in BG-11_0 + 1.5% NaCl produced abundant exopolysaccharide (encapsulate) surrounding the cells, which helped them survive under salt stress conditions.

Growth

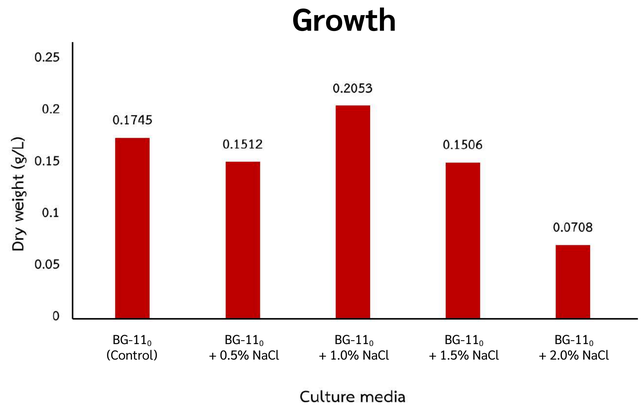


Figure 2. Dry weight of *Nostoc* sp. in each culture medium after 14 days of cultivation.

- The culture medium that yielded the highest biomass was BG-11_0 + 1.0% NaCl (0.2053 g/L).
- An optimal NaCl concentration increased biomass production, whereas excessively high salt concentrations inhibited the growth.

Chemical compositions

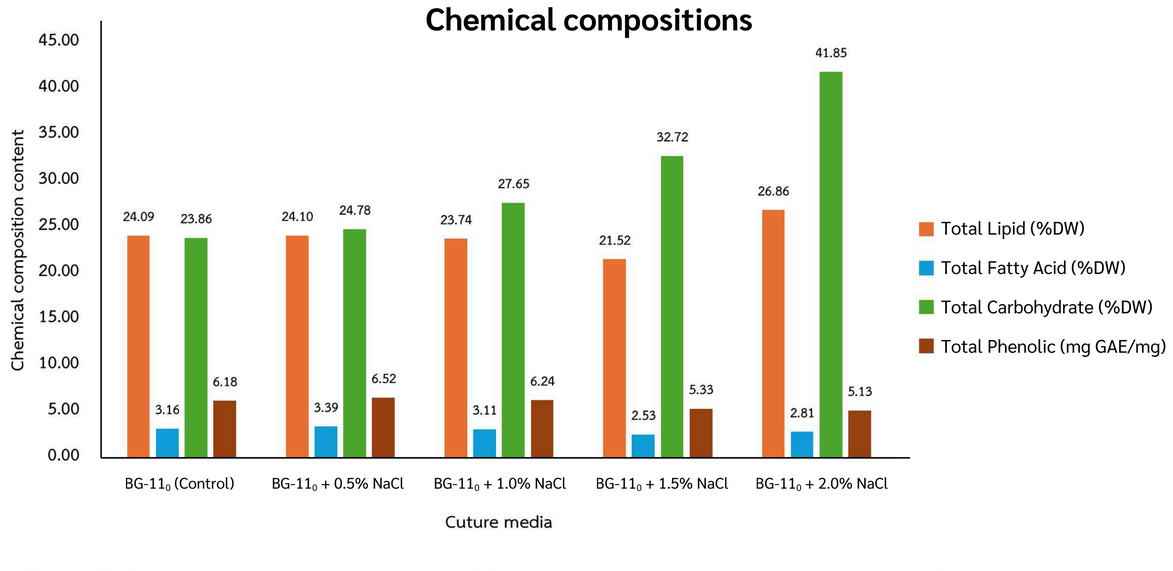


Figure 3. Chemical compositions content of *Nostoc* sp. in each culture medium after 14 days of cultivation.

- The NaCl concentration in the culture medium influenced the changes in chemical composition.
- Total carbohydrate content significantly increased ($p < 0.05$) in BG-11_0 + 1.0, 1.5 and 2.0% NaCl.
- BG-11_0 + 0.5% NaCl showed the highest total fatty acid and total phenolic content.
- BG-11_0 + 2.0% NaCl showed the highest total lipid and total carbohydrate content.

Conclusions

Biomass

BG-11_0 + 1.0% NaCl



Lipid & Carbohydrate

BG-11_0 + 2.0% NaCl



Phenolic

BG-11_0 + 0.5% NaCl



Acknowlegments

- Assist. Prof. Dr. Worraanong Leewattanapasuk (Cooperative Advisor)
- Ms. Nuanjun Jaisai (Researcher at TISTR)
- Division of Biochemistry and Biochemical Innovation, Department of Chemistry, Faculty of Science, Chiangmai Mai University
- Algal Excellent Center (ALEC), Thailand Institute of Scientific and Technological Research

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