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Research Article

STUDY OF CHARACTERISTICS OF SEA BIOMASS FOR BIOMETHANATION

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Abstract: Biogas from sea biomass would be a promising source of energy for replacing fossil-based fuels. Sea biomasses such as seaweeds and sea grasses can be used as an alternate feedstock for biomethanation as they have high carbohydrates and water content and low lignin. In this study, sea grasses such as *Cymodocea serrulata* and *Syringodium isoetifoliuma* and sea weed *viz*., *Gracilaria salicornia* found in Manalmekudi coast, Pudukottai district were collected and their characteristics were studied to assess its suitability for biogas production. Physico-chemical characteristics such as Total Solids, Volatile Solids, Total Organic Carbon and Nitrogen were determined. The C/N ratio of *Cymodocea serrulata,Syringodium isoetifoliuma* and *Gracilaria salicornia* were found to be 26.93, 29.19 and 22.81 respectively and hence all the three sea biomasses have very good biomethanation potential.

Keywords: *Biomethanation, Marine biomass, Seagrasses, Seaweeds, C/N ratio*

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Introduction

Biomethanation is a proven technology with huge potential to influence the energy outlook. The non-availability of adequate quantity of cattle dung is the major constraint of the technology and as a result majority of the biogas plants are underfed. To overcome this problem, emphasis has been laid on the utilization of biomass other than cattle dung for biogas production. Sea biomasses such as seaweeds and sea grasses found to contain less lignin percentage than terrestrial biomass which makes them suitable for biogas production. Recently, the interests in marine biomass utilization for biofuel production remerged due to mitigation of climate change by lowering CO_2 emissions and energy security by decreasing the reliance on petroleum fuels, and its erratic price fluctuation [1].

Green seaweeds and brown seaweeds were reported as a good feedstock for biomethanation because of high methane yields [2]. Seaweed species have the potential to be an aquatic energy crop for the production of biogas due to their low concentration of cellulose, lack of lignin and easily biodegradable sugars such as mannitol, alginate and laminarin [3]. Seaweeds have significant quantity of polysaccharides which are mostly five carbons in structure when hydrolysed, makes seaweeds a potential source of feedstock for methanogens to convert phycocolloids to biogas [4-6]. The objective of this study is to assess the suitability of seaweeds and sea grasses found in Manalmekudi coast, Pudukottai district for biomethanation.

Materials and Methods

Collection and identification of sea biomass

Sea biomass from Manalmekudi coast, Pudukottai district were collected and identified at the Botanical Survey of India, Coimbatore as *Cymodocea serrulata* (sea grass), *Syringodium isoetifoliuma* (sea grass) and *Gracilaria salicornia* (sea weed).

Physico-chemical characteristics of sea biomass

The physico-chemical characteristics such as Total solids, Volatile solids, Carbon content and Nitrogen content were determined.

Total solids and Volatile solids

Total solid and volatile solid content were determined by the procedure outlined by APHA.

Total Organic Carbon and Nitrogen

The Total Organic Carbon was estimated following the wet digestion method of Walkley and Black and the available Nitrogen was estimated in the samples by micro Kjeldhal method.

Fig-1 *Cymodocea serrulata*

Fig-2 *Syringodium isoetifolium*

Fig-3 *Gracilaria salicornia*

Results and Discussion

The findings were presented in the [Table-1]. Total solid content of *Cymodocea serrulata* was found to be 19.81% which needs to be diluted with equal amount of water for efficient biomethanation. The result also shows that the total solid content of *Syringodium isoetifoliuma* and *Gracilaria salicornia* was 12.25 % and 10.52 % respectively and it is suggested that they can be subjected to biomethanation without dilution with water. C/N ratio of *Cymodocea serrulata, Syringodium isoetifoliuma* and *Gracilaria salicornia* were found to be 26.93, 29.19 and 22.81 respectively which shows that the C/N ratio of all the three species of sea biomasses were very close to the optimal C/N ratio of 20 to 30:1.

Table-1 *Physico-chemical characteristics of seaweeds*

SN	Name	TS, %	VS, %	C, %	N, %	C:N
1	*Cymodocea serrulata*	19.81	65.50	33.13	1.23	26.93
2	*Syringodium isoetifolium*	12.25	57.60	27.44	0.94	29.19
3	*Gracilaria salicornia*	10.52	62.24	27.83	1.22	22.81

Conclusion

The identified samples were characterized to analyse their suitability for biomethanation. As the C/N ratio of *Cymodocea serrulata, Syringodium isoetifoliuma* and *Gracilaria salicornia* were found to be very close to the optimal C/N ratio of 20 to 30:1, it is concluded that all three sea biomasses have very good biomethanation potential and they can be used as an alternate feedstock for production of biogas, an alternate fuel for fossil fuels.

Application of research: Study of characteristics of sea biomass

Research Category: Renewable Energy Engineering

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Study area / Sample Collection: Manalmekudi coast, Pudukottai district

Cultivar / Variety / Breed name: Nil

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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