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Note

Artificial seawater for seaweed culture

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ABSTRACT

Artificial seawater prepared with simplified recipes was found suitable for maintaining seaweeds of commercial importance under laboratory conditions. The suitability of this artificial seawater formulation studied by gain or loss of wet weight of seaweeds incubated, showed 15.5% increase in specific growth rate in the case of *Gracilaria corticata* and 18% increase in the case of *Ulva lactuca.* However, *Gracilaria edulis* showed 14% decrease over the control. Physico-chemical characteristics of artificial seawater were compared with these of natural seawater.

The role of mariculture in the context of dwindling opportunities in the capture fisheries is becoming increasingly clearer to the scientific community and the industries. Onshore mariculture is an alternative for most of the hardships likely to occur in open sea mariculture caused by turbulance, waves, herbivory, pests and by intensive labour. Availability of seawater in areas away from the coast and the transportation of seawater from the coast to distant inland tanks/ponds are the serious constraints affecting onshore mariculture involving financial and labour problems. Hence artificial seawater can act handy to make the small scale culture of seaweeds feasible for marine aquaria or for edible purposes.

There are published recipes for the preparation of artificial seawater (Bidwell and Spotte, 1985). These have been developed and used in specialised applications involving single species and for only parts of the life cycle. Research on artificial seawater has neglected the needs of marine plants (Spotte, 1979). Artificial seawater medium formulated by Natarajan *et al.* (1997) was successfully tried for the culture of the microalga *Chlorella* sp. Here an attempt is made to culture macroalgae *Ulva lactuca, Gracilaria edulis* and *G. corticata* in artificial seawater and to compare their growth in natural seawater.

Artificial seawater of 33 ppt was prepared by dissolving 3.5 kg of seasalt crystals in 100 1 of fresh water along with 100 g of calcium chloride and 10 g of sodium bicarbonate. The next day the solution was filtered and the pH was adjusted to that of natural seawater with 0.1 N NaOH. Artificial seawater thus prepared and the natural seawater were enriched with 1.0 ml/1 of Walne's medium (Walne, 1970) stock solution A', 0.5 ml/1 of solution 'B' and 0.1 ml/1 each of vitamin Bl and B12 and mixed thoroughly. Salinity, total dissolved solids (TDS), dissolved nutrients, photosynthesis, respiration and chlorophyll content in seaweeds were determined according to the standard methods (APHA, 1981).

Five grams of clean and fresh seaweed samples (G. *edulis, G. corticata, U. lactuca)* were weighed and introduced in glass conical flasks separately containing 200 ml of artificial seawater medium and incubated for a photoperiod of 10 hr light and 14 hr dark. Similarly seaweed samples were incubated with natural seawater (control). Each species had 10 replicates of experimental as well as control sets. Every tenth day the medium was changed and the growth was compared by determining the gain/loss of wet weight of samples incubated and observed for a period for 30 days.

Results in terms of change in average wet weight of seaweed samples maintained in artificial seawater and in the control are presented in Table 1. Specific growth rate of seaweeds incubated both in artificial seawater and natural seawater was quite comparable to each other and in *Gracilaria corticata* and *Ulva lactuca* the growth rate recorded 15.5 and 18% respectively more than the control when incubated in artificial seawater (Table 1). However, *G. edulis* registered 14% decreasae in the growth rate over the control. The characteristics of artificial seawater as well as natural seawater used to culture seaweeds such as pH, salinity, TDS, dissolved nutrients and also chlorophyll pigments, photosynthesis and respiration of seaweeds at the end of culture period are given in Table 2 for comparison. Except for the levels of dissolved nutrients and phytosynthetic potential no major variations could be observed in the characteristics between the artificial and natural seawater media (Table 2).

Artificial seawater is used mostly for small aquarium research projects that need a highly repeatable and predictable seawater source or inland systems where there is little choice. The advantage of artificial seawater is that it has a defined composition with reduced risk of chemical and biological contamination. Artificial seawater systems often work quite well, especially if operated very conservatively. However, for some specialised applications such as the hatchery phases of delicate organisms, there may be some problems due to complex interactions of seawater and organisms which are presently poorly understood (Huguenin and Colt, 1989). Artificial seawater formulations that are useable with animals may not be suitable for plants. Even for only marine animals a particular formulation may not be suitable to certain species or life stages. It is evident from

TABLE 1. *Growth rate of seaweeds maintained in artificial seawater medium and in natural seawater medium*

Seaweed species	Growth rate (mg wet wt/day)		Increase/ decrease over control (%)
	Artificial seawater	Natural (control) seawater	
Gracilaria corticata	34.02 ±7.14	29.45 ±9.26	115.52
Gracilaria edulis	29.23 ± 11.32	34.06 ±12.40	085.82
Ulva lactuca	29.59 ± 8.57	25.06 ±8.0	118.07

TABLE 2. *Characteristics of artificial seawater medium and the natural seawater medium used to culture seaweeds*

Characteristics	Artificial seawater	Natural (control) seawater
Salinity ppt	33.0	33.0
pH	7.30 ±0.09	7.26 ± 0.08
TDS %	4.18 ±0.09	4.14 ± 1.13
Phosphate ug at/1	37.82 ± 1.87	36.62 ±2.25
Nitrate ug at/1	66.39 ± 2.94	52.71 ±1.42
Nitrate ug at/1	0.18 ±0.008	0.26 ±0.007
Photosynthesis mlOj/g wet wt^hr		
U. lactuca	2.94 ± 0.06	3.07 ± 0.09
G. edulis	1.21 ±0.004	1.54 ±0.01
G. corticata	1.13 ±0.09	1.22 ±0.17
Respiration mlOj/g wet wt/hr		
U. lactuca	0.85 ± 0.008	0.81 ±0.017
G. edulis	0.52 ±0.008	0.64 ±0.005
G. corticata	0.74 ± 0.006	0.71 ±0.011
Chlorophill content mg/g wet wt		
U. lactuca	1.30 ±0.16	1.32 ±0.09
G. edulis	0.13 ±0.02	0.14 ± 0.03
G. corticata	0.08 ±0.01	0.08 ± 0.02

the present study that the present formulation is suitable for *Ulua lactuca* and *Gracilaria corticata* but not for *Gracilaria edulis.*

The results obtained especially on *G. corticata* and *U. lactuca* are reasonable to conclude the possibility of using artificial seawater prepared with simplified recipes at the cost of approximately Rs. 50/1000 1 can support the growth of seaweeds and can be employed for onshore culture of seaweeds at places away from the sea.

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