Algal Cell Culture - Algal Culture and Seaweed Mariculture:

Algal Culture

In a world increasingly focused on sustainability and eco-friendly solutions, algal culture emerges as a key player in addressing environmental concerns. This article will delve into the fascinating realm of algal culture, exploring its significance, methods, and potential applications.

What is Algal Culture?

Algal culture, also known as microalgae cultivation, involves the controlled growth of microalgae for various purposes. These microscopic photosynthetic organisms come in diverse forms, including green, brown, and red algae, and play a crucial role in ecosystems worldwide. Algal culture harnesses their potential for a multitude of applications.

One of the remarkable aspects of algal culture is its sustainability. Microalgae are incredibly efficient at converting carbon dioxide into oxygen and biomass through photosynthesis. This green technology has garnered attention as a potential solution for reducing carbon emissions and mitigating climate change.

It is necessary to culture algae because it is difficult to get pure growth of particular algae. Algae are cultured for different purposes like for morphological study, study of life history, cytological study, genetical study, define algal species, physiological study, ecological study. Various types of cultures are used for this purpose.

Preparatory Cultures - It refers to the initial cultivation of microorganisms or cells before they are used in specific experiments, tests, or applications.

Enrichment cultures - This technique used to selectively encourage the growth of specific microorganisms from a complex or mixed sample. Algae are collected from natural habitats and grown in laboratory in a medium containing phosphates, nitrates and vitamin B12.

Maintenance cultures- algae are cultured which are collected from algae maintained in artificial light.

Pure cultures- Only one species is present in culture vessel, and it is free from living organism. These cultures are also known as bacteria free cultures.

Clonal or monocell cultures- All the populations in culture vessels are derived from a single cell.

Unialgal cultures- Only one species of algae is cultured.

Batch cultures - A constant volume of culture is maintained within a vessel or there is no replacement of culture medium.

Continuous cultures- Cultures are maintained at its highest growth curve by regular addition of fresh medium.

Dialysis cultures- These are having characteristics of batch cultures and continuous cultures. Two chambers are separated by semipermeable membrane are present. The alga is kept in one chamber and fresh medium is kept in another chamber.

Synchronous cultures- These cultures are continuous cultures, here all or most of the cells are at same developmental stage.

Mass cultures- These are on very large scale when algae are utilized for food purpose.

Crude cultures- Algae are grown in big vessels or tins without caring for contamination.

Agnotobiotic cultures- In these type of cultures, unknown microbial flora or fauna is present.

Hanging drop cultures-These are used for study of a single cell or a filament or a colony directly under the microscope.

Nature of culture

There are 3 types of cultures

Liquid cultures- Containing only liquid means substrate is in the form of liquid.

Biphasic cultures-Containing solid and liquid means substrate is solid and liquid in

case of soil and water.

Solid cultures- Containing solid substrates like agar and gelatin.

Culture media

Most algae are phototrophic and photoautotrophic and are able to grow on inorganic media. But some algae require B12 organic material to grow under laboratory condition which are called as photo auxotrophic. Colourless algae also require organic substrate and called as heterotrophic.

Examples of culture media used for culturing algae are Knop's modified medium, Pringsheim's medium, Czurda's solution, Chu 10 medium, Bold's basal medium, Beijerinck solution, ASM-1 medium, Pringsheim's biphasic medium, Ott's artificial seawater. Fresh water algae grow well in soil water culture, tap water or filtered water collected

from pond.

When unicellular algae were grown on a definite volume of culture medium containing adequate nutrients and when they are inoculated in small number and exposed to suitable light, temperature and aeration they show definite pattern of growth.

Isolation of algae

For the first time algae are collected from nature and kept in preparatory cultures, from these cultures they are transferred to enrichment culture. They are kept in diffuse light of moderate intensity and this results in highest growth of algae. Disadvantage of this method is that there may be complete loss of delicate forms.

Growth of algae may be increased or decreased during adjustment of pH. Blue green algae grow well at 30 to 350C. The growth of green algae may be reduced by the addition of 0.02 to 0.04% Sodium sulphide. In the cultures which are free of nitrogen, the growth of all algae is eliminated except nitrogen fixing algae. Growth of flagellate algae and blue green algae is increased by the addition of 0.1% Sodium acetate.

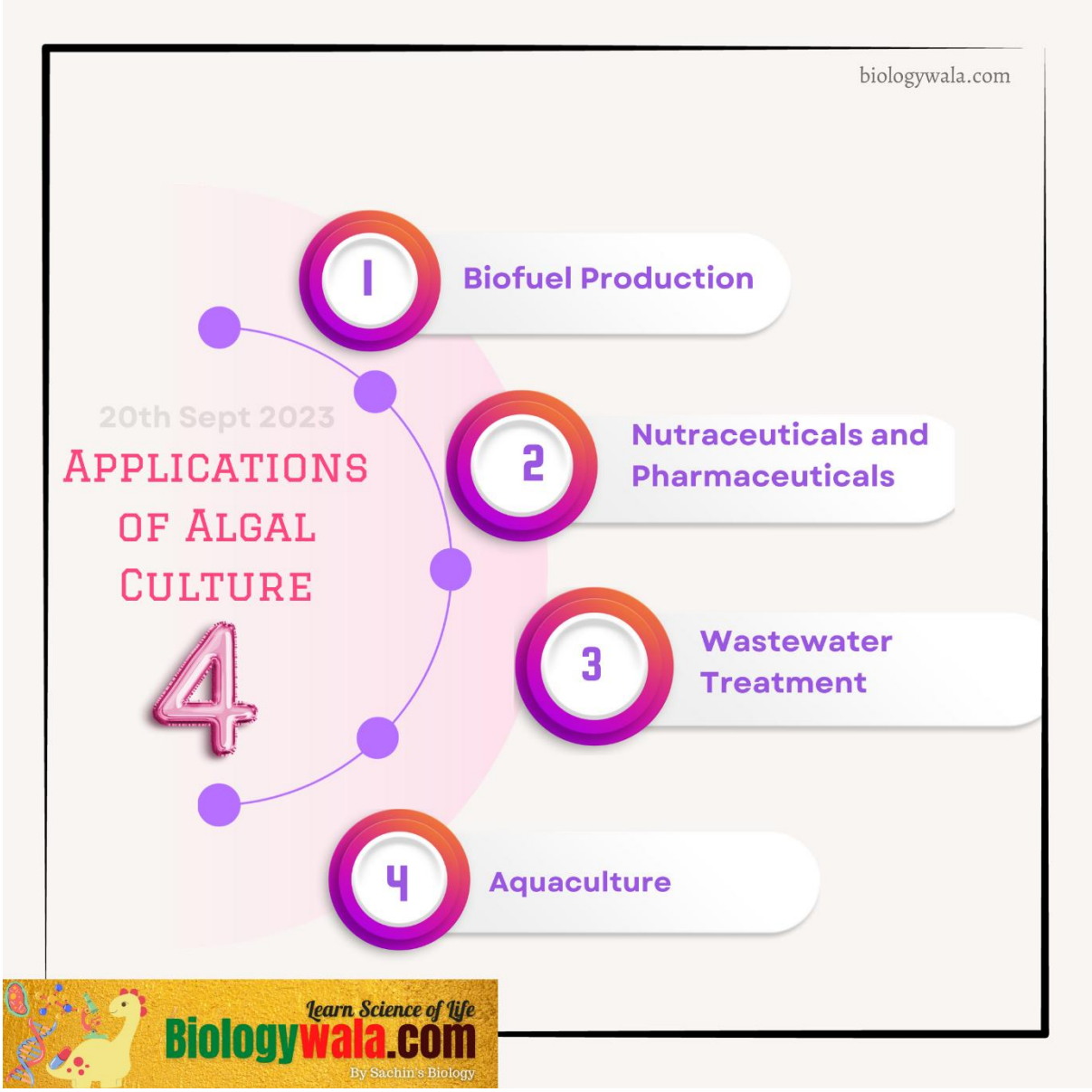
Filamentous and colonial forms of algae which are microscopic forms are separated by fine brushes, pipettes, needles. Microscopic forms are also picked up and transferred by small, narrow mouthed, pointed pipettes or micropipettes- microscope or micromanipulator.

Washing technique is used for getting unialgal cultures of desired algae. Here algae are transferred through a number of watch glasses containing sterilized culture media. Different species of algae can be picked up by pipettes and separated from mixed growth of algae.

Dilution technique is also used for separation of microscopic forms. Here double distilled water or sterilized medium is added to the culture and is divided into 2 parts. Medium is again added to the part in which desired algae is present and the procedure is repeated till desired algae is separated.

By using Streak cultures on agar algae can be isolated. Dumbbel tipped bent glass rod is dipped into algal suspension and streaked onto agar for example, Diatoms, Desmids, Chlamydomonas, Oscillatoria.

Applications of Algal Culture:



Biofuel Production

Microalgae are rich in lipids, making them an excellent source for biofuel production. Their rapid growth and high lipid content offer a sustainable alternative to fossil fuels.

Nutraceuticals and Pharmaceuticals

Algal culture is instrumental in the production of nutraceuticals and pharmaceuticals. Microalgae are a source of essential nutrients and bioactive compounds, contributing to the development of health-promoting supplements and medicines.

Wastewater Treatment

Microalgae play a crucial role in wastewater treatment. They can remove contaminants from wastewater while producing biomass that can be used for various purposes, promoting a circular economy.

Aquaculture

Algal culture supports the aquaculture industry by providing a natural and nutritious food source for fish and shellfish. This sustainable practice reduces the reliance on wild-caught feed.

Seeweed Mariculture

Seaweed mariculture involves the cultivation of various species of seaweed in controlled marine environments. These underwater farms harness the rapid growth and incredible nutritional value of seaweed for a wide range of purposes. Often referred to as "marine vegetables," seaweeds come in diverse forms, colors, and flavors, offering a unique and sustainable food source.

Seaweed Mariculture of Ulva armoricana

Methods of Seaweed Mariculture

Offshore Rope Cultivation

One of the most common methods of seaweed mariculture involves suspending ropes or lines in the open ocean. Seaweed spores attach themselves to these lines, where they grow and develop into mature plants. This method is particularly popular for species like kelp and dulse.

Floating Rafts

Floating rafts or platforms are another method used for seaweed cultivation. Seaweed is attached to floating structures on the water's surface, allowing for easy access and management. This approach is often employed for species such as nori, commonly used in sushi.

Submerged Net

Submerged nets are utilized in areas with strong currents or where other methods may not be suitable. Seaweed is grown within mesh nets submerged in the ocean, providing protection from environmental factors and herbivorous marine life.

Seaweed Mariculture

Applications of Seaweed Mariculture

Nutritional Powerhouse

Seaweeds are incredibly nutritious, packed with vitamins, minerals, and antioxidants. They are a rich source of iodine, which is essential for thyroid health, and they also provide essential fatty acids, making them a valuable addition to a healthy diet.

Eco-friendly Farming

Seaweed mariculture is an eco-friendly farming practice. Seaweeds absorb excess nutrients from the water, helping mitigate harmful algae blooms and improving water quality. Additionally, they absorb carbon dioxide from the atmosphere, contributing to carbon sequestration.

Culinary Delights

Seaweeds have been a staple in Asian cuisines for centuries, but their popularity is growing worldwide. They are used in various dishes, from salads and soups to sushi rolls and snacks. Seaweed's umami flavor and nutritional benefits make it a sought-after ingredient in modern cuisine.

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