The Peerian Journal
Open Access | Peer Reviewed
Volume 27, February, 2024
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

The Ecological Role of Algae in Confronting Global Warming / A review Article

Siham N.Lefta[1] ,Baraah Hussein Abdulhadi[2], Estabraq Mohammed Ati[3], Omer Abdul Kareem Aswad [4]
[1,3,4] Department of Biology Science, Mustansiriyah University, POX 46079, Iraq-Baghdad.
[2] Department of Biology Science, Diyala University, Iraq-Baghdad
Corresponding Email: dr.baraahussein@uodiyala.edu.iq , istabraqmohammed@gmail.com

Abstract: The problem of climate change has become a threat to the entire world, and threatens the melting of ice blocks in many regions of the world. Therefore, an alga is an environmental solution to purify the air from gases emitted and harmful to the environment. The diverse development in employing algae to overcome environmental obstacles has stimulated ensuring sustainability. The word sustainability refers to comprehensive constructive improvements to the environment that include abundant dynamism and its systems. Rapid population growth and rapid civilization have led humanity to comprehensively exploit nature and its vibrant resources. However, today humans have realized the disasters they have caused due to their past mistakes and are already facing future challenges related to livelihood. Today, it has been shown that the discovery and development of eco-friendly, cost-effective and cutting-edge strategies to address current sustainability shortcomings such as sustainable agriculture solutions, raw material crisis, pollution, carbon neutrality, industrial effluent and wastewater treatment, energy crisis have led to polluting the natural ecosystem. Advances in mycology research and allied fields have shown positive promise on the path to green transformation and maintaining sustainable environments. Algae can be an obvious factor to be employed in developmental activities, as it can replace various domestic needs and actions of humans. This review discusses the broad opportunities for using algae for basic sustainability.
Keywords: Environmental Pollution, Algae , Global Warming

Introduction: Climate change poses a threat to the future of life on our blue planet. It has become necessary to take preventive measures to limit the spread of this problem, which causes icebergs to melt in cold regions, which causes a decline in the arctic (Hallmann, 2007). This problem threatens the environmental balance on planet Earth. In order to confront these risks, scientists are trying hard to find a solution to this dilemma and to avoid what might be worse conducted scientific studies on marine algae and ultimately concluded that it was possible to find a solution to this problem (Spolaore, *et al.* 2006). The solution lies in establishing environmental reactors that will undertake the task of purifying the air from carbon dioxide. The idea is to convert carbon

The Peerian Journal
Open Access | Peer Reviewed
Volume 27, February, 2024
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

dioxide into environmental fuel with the help of algae, it is necessary to build huge environmental reactors whose mission is to convert carbon dioxide gas emitted from the chimneys of power generation plants, which is absorbed by algae, into environmental fuel that can be used(Rindi, 2007). Thompson believes that "within ten years it will be possible to convert lands of 20 to 30 square kilometers on the shores of the Mediterranean into reactors that can clearly reduce the percentage of carbon dioxide emitted into the atmosphere. The increasing emission of toxic carbon dioxide threatens life on planet earth .The role of algae will not be limited to purifying the air from carbon dioxide, but at the same time it will form an environmental material that can be used to extract oil and natural ethanol, which can later be converted into car fuel. However, Thompson is counting on more than that, as he wants to convert only half of the environmental material into fuel. As for the other half, it is expected to be used in the future as a material used in construction, as it can be used as an insulating material in building foundations. Bremen Power Station Generators is following this project with great interest. It is worth noting that the currently available possibilities are to discharge carbon dioxide gas underground, if the research on this project is completed, we will have to cooperate with those responsible for it. The only problem that she sees as being absent is the space that will be allocated to this project, which was definitely not lost on Professor Thompson's mind. Because algae absolutely needs the sun, he wants to exploit lands not used for agriculture, such as those found, for example, in southern Spain. However, it is necessary for the environmental reactors to be close to the sea or agricultural land, because the water mixed with algae will be transported through pipes (Radmer and Parker, 1994). A new German study has confirmed that brown algae absorb large amounts of carbon dioxide from the air and greatly help in combating global warming. Researchers at the Max Planck Institute for Biology have indicated that brown algae can remove 550 million tons of carbon dioxide annually. This number represents a fifth of the emissions generated by industrial activities in Germany in 2020, according to estimates by the Federal Environment Agency. These algae absorb carbon dioxide from the atmosphere, use the carbon to grow, and then release about a third of it into the seawater. Algae vary in size and in the benefits they provide, pointing out that they can be described as plants suspended in water. Studies on the environmental benefits of algae began in 2002 before they actually began to benefit from them today. He points out that these algae are not cultivated, but are used in the waters in which they are originally found, such as the Atlantic and Pacific oceans (Radmer, 1996).

Brown algae absorb large amounts of carbon dioxide from the air and release parts of the carbon contained in them back into the environment in the form of mucus(Liang, *et al.* 2004). This mucus is difficult to decompose for other ocean inhabitants, and thus carbon is removed from the atmosphere for a long time. Brown algae are beneficial plants when it comes to absorbing carbon dioxide from the air(Hutchings, 1996). They even outperform forests on Earth at this, and thus play a crucial role in the atmosphere. Brown algae can remove significant amounts of carbon dioxide from the global cycle in the long term and can thus counteract global warming, researchers at the Max Planck

The Peerian Journal
Open Access | Peer Reviewed
Volume 27, February, 2024
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

Institute for Marine Microbiology reported in the Proceedings of the National Academy of Sciences (PNAS)(Radakovits, *et al.* 2010). An algal mucus called fucoidan is particularly responsible for removing carbon. They estimate that brown algae can, therefore, remove up to 550 million tons of carbon dioxide from the air each year – roughly the amount of Germany's annual greenhouse gas emissions. Brown algae can bind all CO2 emissions in a country like Germany are approx(Kodo, *et al.* 2010).

Algae absorb carbon dioxide from the atmosphere and use the carbon to grow. They release up to a third of the carbon they absorb back into seawater, for example in the form of sugary secretions. Depending on the structure of these secretions, they are either quickly used by other organisms Or it sinks to the bottom of the sea. The secretions of brown algae, or what is called fucoidan, are so complex that it is very difficult for other organisms to use them. As a result, the carbon from fucoidan does not return to the atmosphere quickly, his makes brown algae particularly helpful in removing carbon dioxide from the atmosphere over the long term hundreds to thousands of years(Goudie, 2018).

Benefits of algae: Algae are used as food for humans in many countries of the world, and most of these free-living algae belong to some species belonging to the ranks of red, green, brown, and blue-green algae. These species are characterized by being rich in proteins, salts, vitamins, fats, and others, such as algae. Algae are important in maintaining the gaseous balance between oxygen and carbon dioxide between the atmosphere and water, noting that about 90% of the total process of photosynthesis in nature takes place in marine algae, especially plankton, and algae carry out the process of self-purification in some bodies of water, which supports the amount of oxygen dissolved in them. This is done by supporting decomposing microorganisms with oxygen during the process of converting organic materials from the remains of living organisms or after their death and converting them into raw materials(Hutchings, 1996; D'amato, *et al.* 2001). Some types of algae have also been used in the production of medical drugs, such as the red algae Digenia simplex, which is known for its use as a repellent for intestinal worms and to treat appendicitis. Some types are also used to treat coughs and treat kidney diseases. Some types of red algae are also known for their use in treating scurvy, such as Palmaria palmate and *Porphyra sp. Ulva* algae is used to treat burns and in many biological experiments and research, such as those related to photosynthesis, reproduction, heredity, and genetic engineering, for the sake of shortening the disease. Its life cycle and ease of growth, such as *Scendesmus, Clamydomonas*(Matsuzaki, *et al.* 2004).

The presence of some types of algae in water indicates pollution of that water or its cleanliness. Some types of diatoms are considered evidence of organic pollution of water, such as *Navicula and Nitzischia* algae. Algae have an important role in the production of various types of biofuels because they contain a high percentage of oils and fatty acids, as well as the production of various hydrocarbons, and among the types of fuel from which *bioethanol, biomethanol*, oil, kerosene, and biodiesel are produced, such as the algae *Botryococcus braunii*(Steinbrenner and Sandmann, 2006). Some types of blue-green

The Peerian Journal
Open Access | Peer Reviewed
Volume 27, February, 2024
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

algae are also used in rice farms, as these algae fix atmospheric nitrogen in the form of nitrates that rice plants can absorb, such as Nostoc algae, and some red algae are used as fertilizer for agricultural soils, such as ithothamnio algae(Rasala, *et al.* 2010). It is used in the manufacture of Agar. This substance is extracted from some types of red algae. It is a complex carbohydrate substance that is involved in the formation of cell walls. It is used to harden the culture media used in studying microorganisms such as algae, fungi, and bacteria. It is also used in canned food such as Gelidium algae. Algae is also used in the manufacture of polishes and cosmetics and toothpastes are used in the plastic and rubber industry, and glue is extracted from red algae(Jiang, *et al.* 2014).

Harmful of Algae: Some types of algae produce toxic substances that lead to the death of aquatic organisms, especially fish, as in the phenomenon of red tide caused by Gymnodinium algae, a rotating algae. Microcystis algae produces a toxic compound known as Microcystin, in addition to other toxic compounds produced by other types of algae that cause the death of aquatic organisms (Rehnstam and Godhe, 2003; Dahlin and Guarnieri, 2016). When present in high concentrations. The phenomenon of nutrient enrichment occurs as a result of the rapid growth of some types of algae, accompanied by rapid division of the cells of those algae, thus forming a large mass of algae covering the surface of the water, which has a harmful effect on the organisms present in those environments, meaning it prevents light from reaching the organisms located at different depths, and thus may lead to These organisms stop growing or die(McHugh, 2003). Some types of algae cause harm to humans when eating fish that have previously fed on these harmful algae, such as those that secrete toxins that affect the human digestive system. Also, the presence of small amounts of blue-green algae in drinking water causes diarrhea, and causes injury to the skin of swimmers. It causes major damage and swelling of the mucous membranes surrounding the eyes and nose, redness and congestion of the skin (Sivakumar, *et al.* 2005). The abundant growth of marine algae in bays, ports and some rivers sometimes hinders navigational operations. Some types of benthic algae grow on the outer surfaces of boats, ships and ships, which leads to damage to the paint and impedes their speed(Rezaei, *et al.* 2013).

4. Conclusion

The world has begun to use many means of transportation, such as cars, planes, ships, and trains, which depend when operating on fuel extracted from petroleum, as well as power stations that supply electricity to citizens. Petroleum is considered the black gold of the current century. It has become difficult for people to live without its products, including fuel. Fuel is considered expensive, but the need for it prompted people to use it. In addition, cars, although they use fossil fuels, work on... Increased emission of carbon dioxide, which is harmful to the environment another fear lies in the reduction of petroleum yields in the future. This reason may be considered an obstacle to obtaining fuel to benefit from, so the world began to look for another source of fuel, which is considered to have a low cost compared to petroleum and gives many times the yield of petroleum. So biofuel is the solution then turned to biofuels and searched for a source for this fuel. Researchers introduced algae as a source of biofuel after ethanol-producing

The Peerian Journal
Open Access | Peer Reviewed
Volume 27, February, 2024
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

corn, as it is considered less expensive than fossil fuels, as algae is characterized by its use of carbon dioxide gas in addition to water, sunlight, and some nutrients, which makes carbon dioxide gas go through a circle, as it is emitted from factories and cars and returns to be absorbed by algae, turning it into biofuel that is extracted from algae again. This process is considered inexpensive, in addition to the fact that the fuel produced from algae is considered it has a high yield and is also characterized by reducing carbon dioxide emissions, in addition to being considered a sustainable and renewable source of fuel. Algae is distinguished by its high growth rate, which contributes to increasing the rate of biofuel production, and algae does not need fertile soil for its growth. Different types of algae do not provide the same yield. Some algae give a high yield of biofuel with little consumption of the nutrients used in the manufacture of biofuel within the algae. Biofuel is extracted from algae by dissolving the fats from the algae in a solvent, then separation is done by filtration and obtaining pure fats from water and proteins. Then the fats are mixed with methanol and drops of sodium hydroxide, then the biofuel is obtained after forming two layers. The upper layer biofuel and the bottom layer is glycerin. The biofuel is purified for use. There is an additional technology in extracting biofuel from algae, which is ultrasound to enhance the mixing between the solvent and fat and reduce the extraction time.

Acknowledgment

The authors would like to thanks Mustansiriyah University (www.uomustansiriyah.edu.iq) Baghdad–Iraq for it support in the present work and extremely grateful to all the people help us to get our data.

References

1. D'amato G, Liccardi, G., D'amato, M., and Cazzola, M. (2001). The role of outdoor air pollution and climaticchanges on the rising trends in respiratory allergy. Respiratory medicine, 95(7), pp 606-611.
2. Dahlin, L., r,. and T Guarnieri, M. (2016). Recent advances in algal genetic tool development. CurrentBiotechnology, 5(3), 192-197.
3. Goudie A. (2018) Human impact on the natural environment. John Wiley & Sons.
4. Hallmann, A. (2007). Algal transgenics and biotechnology. Transgenic Plant J, 1(1), 81-98.
5. Hutchings, K. (1996) Globalisation, an examination of the effects of its economic emphasis on individuallivelihood. Social Alternatives, 15(1) pp 34.
6. Jiang, W., Brueggeman, A. J., Horken, K. M., Plucinak, T. M., and Weeks, D. P. (2014). Successful transientexpression of Cas9 and single guide RNA genes in Chlamydomonas reinhardtii. Eukaryotic cell, 13(11) pp 1465-1469.
7. Kodo, K., Kodo, Y., and Tsuruoka, M. (2000). U.S. Patent No. 6,083,740. Washington, DC: U.S. Patent andTrademark Office.
8. Liang, S., Liu, X., Chen, F., and Chen, Z. (2004). Current microalgal health food R & D activities in China. InAsian Pacific Phycology in the 21st Century: Prospects and Challenges (pp. 45-48). Springer, Dordrecht.

The Peerian Journal
Open Access | Peer Reviewed
Volume 27, February, 2024
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

9. Matsuzaki, M., Misumi, O., Shin-i, T., Maruyama, S., Takahara, M., Miyagishima, S. Y., and Yoshida, Y. (2004).Genome sequence of the ultrasmall unicellular red alga Cyanidioschyzon merolae 10D. Nature, 428(6983), 653.
10. McHugh, D. J. (2003). A guide to the seaweed industry FAO Fisheries Technical Paper 441. Food andAgriculture Organization of the United Nations, Rome.
11. Radmer, R. J., and Parker, B. C. (1994). Commercial applications of algae: opportunities and constraints. Journalof Applied Phycology, 6(2), 93-98.
12. Radmer, R. J. (1996). Algal diversity and commercial algal products. Bioscience, 46(4), 263-270.
13. Rindi, F. (2007). Diversity, distribution and ecology of green algae and cyanobacteria in urban habitats. In Algaeand cyanobacteria in extreme environments (pp. 619-638). Springer, Dordrecht.
14. Radakovits R., Jinkerson E, Darzins, A., and Posewitz, M. C. (2010). Genetic engineering of algae for enhancedbiofuel production. Eukaryotic cell, 9(4), pp 486-501.
15. Rasala, B. A., Muto, M., Lee, P. A., Jager, M., Cardoso, R. M., Behnke, C. A., ... and Mayfield, S. P. (2010).Production of therapeutic proteins in algae, analysis of expression of seven human proteins in the chloroplast ofChlamydomonas reinhardtii. Plant biotechnology journal, 8(6), 719-733.
16. Rehnstam-Holm, A. S., and Godhe, A. (2003). Genetic engineering of algal species. Eolss Publishers, Oxford,UK.
17. Rezaei, R., Wang, W., Wu, Z., Dai, Z., Wang, J., and Wu, G. (2013). Biochemical and physiological bases forutilization of dietary amino acids by young pigs. Journal of animal science and biotechnology, 4(1),
18. Spolaore, P., Joannis-Cassan, C., Duran, E., and Isambert, A. (2006). Commercial applications ofmicroalgae. Journal of bioscience and bioengineering, 101(2), 87-96.
19. Steinbrenner, J., and Sandmann, G. (2006). Transformation of the green alga Haematococcus pluvialis with aphytoene desaturase for accelerated astaxanthin biosynthesis. Appl. Environ. Microbiol., 72(12), 7477-7484.
20. Sivakumar, M. V. K., Das, H. P., and Brunini, O. (2005). Impacts of present and future climate variability andchange on agriculture and forestry in the arid and semi-arid tropics. In increasing climate variability andchange (pp. 31-72). Springer, Dordrecht.