iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VI **Month of publication:** June 2022

DOI: https://doi.org/10.22214/ijraset.2022.44886

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VI June 2022- Available at www.ijraset.com

Ethnobotanical and Pharmacological Activity of Arthrospira Platensis

Mugaonkar Bajirao
Aditya Pharmacy College, Beed

Abstract: ***Spirulina is also known as Arthrospira platensis is algae that belong to cyanobabcteria having lots of bioactivities. Cyanobacteria (blue-green algae) are among the most primordial life forms on the planet. It contains proteins, vitamins, carbohydrates, and lipids. It has been established that Arthrospira platensis has strong antioxidant activity, inhibits the colonisation of wounds by multi-resistant bacteria, and stops viruses from entering target cells. Anti-cancer action was also seen in mouth cancer, melanoma, and UV-induced non-melanoma skin cancer animals. Arthrospira platensis has an immunostimulating impact on humans, animals, chickens, and fish by increasing their resistance to infections, altering hemopoiesis, and stimulating the synthesis of antibodies and cytokines. Here we discussed about some pharmacological activities of Arthrospira platensis.***

I. INTRODUCTION

Spirulina (Arthrospira platensis) is a microscopic, filamentous cyanobacterium considered a sustainable and environmentally favourable microalga for bioremediation, nitrification, and CO2 fixation. Spirulina is a potential for the elimination of toxic elements such as heavy metals (1,2,3,4) and phenol (5) in the context of bioremediation. Cyanobacteria also include unicellular organisms, which are not always spiral-shaped (Spirulina is spiral-shaped). They are primarily planted in ponds and small lakes, where they grow naturally in warm climates' water. Microalgae (Spirulina) is a type of microalgae that does not require organic, inorganic, nutritional, or other carbon sources for growth and can survive at higher alkaline pHs and higher bicarbonate and carbonate concentrations than other living organisms(6).

Cyanobacteria have been used by African and Mexican people as a traditional food source since the sixteenth century. The most extensively cultivated microalgae species include Spirulina maxima (Arthrospira maxima), Spirulina platensis (Arthrospira platensis), and Spirulina fusiformis (Arthrospirafusiformis) (7). More than 3,000 tonnes of Spirulina are grown each year for human nutrition and the manufacturing of excellent commercial chemicals around the world (8).

People have been interested in taking Spirulina in tablet and powder form in recent years due to its relatively high protein (58%) content, carbohydrates (30%), fat (8%), dietary fibres (3%), sugars (3%), vitamins (1%), and phytochemicals (1%) (9,10).Linoleic acid, docosahexaenoic acid, eicosapentaenoic acid, arachidonic acid, and stearidonic acid are among the fatty acids found in spirulina. Spirulina also ha s moderate amounts of vitamins like vitamin A, vitamin C, vitamin E, vitamin B12, thiamine, nicotinamide, pyridoxine, riboflavin, and folic acid, as well as beneficial pigments like chlorophyll-a, zeaxanthin, diatoxanthin, 3′-hydroxyechinenone, echinenone, beta-carotene, xanthophyll, canthaxanthin, phycobiliprotiens(10,11).

Apart from the high (up to 70%) content of protein, it also contains vitamins, especially B12 and provitamin A (β-carotenes), and minerals, especially iron. It is also rich in phenolic acids, tocopherols and γ-linolenicacid (12) . Spirulina lacks cellulose cell walls and therefore it can be easily digested (12). Microalgae chemical analysis Spirulina has been shown to be a good source of several macro and micronutrients. This high prot ein, vitamin, and mineral content necessary amino acids, dietary minerals and critical vitamins are all important.

Spirulina contains fatty acids, which have a variety of health benefits properties. The following are some of the possible health consequences: anticancer, antioxidant, antiviral, and immunomodulation antibacterial properties, as well as antiviral properties nutrient deficiency, hyperlipidemia, obesity, diabetes, and heavy metal/ Toxicity caused by chemicals, inflammatory allergic responses, anemia and radiation damage(13,14).

A. Geographical Source

Found in freshwater lakes and ponds.
Mostly found in Mexico, Africa, and Asian society.
In Japan popularly used as a nutritional food supplement (15).

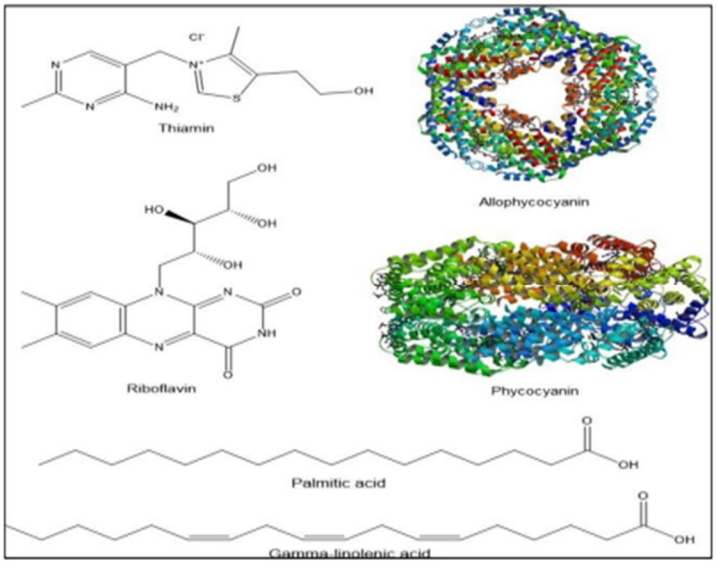
Table 1. Scientific classification of spirulina (15)

Domain	Bacteria
Phylum	Cyanobacteria
Class	Cyanophyceae
Division	Cyanophyta
Order	Spiruinales
Family	Spirulinaceae
Genus	Spirulina
Species	Plantesis

Table 2. Chemical constituents of spirulina (16)

Protein	Threonine, Alanine, Arginine , Histidine, Tryptophan, Cystine , Lysine etc.
Carbohydrate	Sugars , Dietary Fibres.
Fat	Saturated, Monosaturated, Polysaturated.
Vitamins	Thiamine, Niacin, Ascorbic acid, Beta carotene, Riboflavin etc.
Minerals	Iron, Calcium, Magnesium, Manganese, Potassium, Sodium etc.

Some of the chemical structures are present in the spirulina are added below.



The nutritional components and other phytochemicals in Spirulina primarily exhibit anti-inflammatory, antioxidant, antidiabetic, neuroprotective, hepatoprotective, and anticancer activities (16).

Because to its low cost and excellent nutritional value Spirulina has been recommended as a sustainable way to prevent Protein Energy Malnutrition (PEM) and Protein Energy Wasting (PEW) in humans (17)and has been utilised as a protein-rich animal feed for increasing meat production and quality (18).

Spirulina, on the other hand, has hypolipidemic (19), hypoglycaemic (20) and antihypertensive (21) characteristics. Spirulina has been shown in rats to boost lipoprotein lipase activity (22)and insulin production from the pancreas (23). The latter effect was also shown in mice treated with Spirulina derived phycocyanin, which was followed by a decrease in cholesterol, triglycerides, and malondialdehyde (MDA), as well as an increase in blood total antioxidant capacity (24).

As a result, the biomass of this rich source of components is used as feed and food additives in a variety of industries (agricultural, perfumery, pharmaceutics, and food). The same microalgal category can be classified differently depending on the source. Even the culture condition, harvest timing, and extraction procedure are all factors to consider. if they have a similar appearance composition, in general, can be the following is a summary (in percentages of dry weight): 50-70 per cent protein; Carbohydrates account for 15–25%, lipids for 6–13%, and nucleic acids for 4.2–6%.2.2-4.8 per cent minerals (25,26).

B. Bioactivity

Bauer et al. introduced the Disc diffusion method to determine the antifungal activity of Spirulina platensis preparations (27).Bauer et al. proposed the Disc diffusion method for determining the antibacterial activity of Spirulina platensis preparations 27). Spirulina presents hypolipidemic, hypoglycaemic, and antihypertensive properties (28).Spirulina contains phenolic acids, tocopherols and ß-carotene which are known to exhibit antioxidant properties (29)**.** The methanol extract showed more potent antimicrobial activity than dichloromethane, petroleum ether, ethyl acetate extracts and volatile components (30). Spirulina (Arthrospira) shows antitumor, anticancer and antimicrobial (antibacterial, antifungal, and antiviral) activities via the production of valuable products, phycobiliproteins including c-phycocyanin (C-PC), phycocyanobilin, allophycocyanin (APC)(30).

C. Anticancer Effect Of Spirulina

The potential cancer chemopreventive effect of Spirulina has been reported (8,9). Carcinogenic steps can be inhibited or reversed by some specific agents (natural or synthetic) before the onset of cancer (31). Grawish reported a tumour suppressive effect in hamster cheek pouch mucosa by Spirulina extract due to repair of the damaged DNA. Repair of DNA damage is due to endonuclease activity, which can be stimulated by the unique polysaccharide contents of Spirulina (32). Cox-1 (as a constitutive enzyme) is in charge of maintaining proper physiologic function, and the PGs it produces are protective. (as an inducible form) Cox-2 Mitogens, oncogenes, and tumour stimulators are some of the stimulators. The promoters and growth factors) are in charge of the PGs are produced at inflammatory sites (33). It was demonstrated. that the activity of Cox-2 (rather than Cox-1) increases in cancer colorectal cancer tissues, as well as human stomach and intestinal tissues breast cancer (34). C-phycocyanin is a pigment produced by A. platensis. Cox-2 inhibitor with high selectivity. This owes to the fact that Phycocyanin conformation and large structure; this makes it easier to bind to the active site of Cox-2 (35).

D. Antiviral Activity

In S. platensis, the main polymer is a branched polysaccharide with a structure similar to glycogen. High anionic polysaccharides of low molecular weight extracted from Spirulina (36) have antiviral and immunomodulatory properties. activities. Antiviral sulphated polysaccharide fraction activity (calcium spirulan) has been thoroughly purified. 3-O-methylrhamnose has been found to be a component of rhamnose. 3-O-methylxylose, 2,3-di-O methylrhamnose, acofriose Sulphate and uronic acids (37) a polysaccharide that is acidic. It has also been reported that a fraction of S. platensis has been isolated. Tumour Necrosis Factor-alpha is produced as a result of this (36).

E. Antibacterial Activity

The antimicrobial activity of Spirulina extracts prepared with various solvents has been investigated. Demule and colleagues (38) reported that methanolic acid has antibacterial activity. The presence of -linolenic acid in S. platensis extract is due to the presence of -linolenic acid, an antibiotic active fatty acid found in high concentrations(39).

F. Heavy-Metal Poisoning Activity

Different metals cause damage to different organs by creating oxidative stress. the effects oxidative stress Aerobic organisms can be protected from a variety of threats. Antioxidants, which are produced naturally, neutralize free radicals. reduced glutathione, for example, is a manufactured molecule (GSH), Nitric oxide (NO) and superoxide dismutase (SOD) (40)

G. Antioxidant Activity

In vitro and in vivo investigations have shown that spirulina possesses antioxidant capabilities (38). Protective properties Spirulina's protective effects against CCl4-induced liver damage are related to scavenging of free radicals It is credited with this observation. high protein, fat, and mineral content (zinc, manganese, etc.) Some vitamins (beta carotene, magnesium, and selenium) as well as minerals (magnesium and selenium) alfa-tocopherol, carotene, riboflavin, cyanocobalamin, and lipoic acid (alpha-lipoic acid) (41,42)

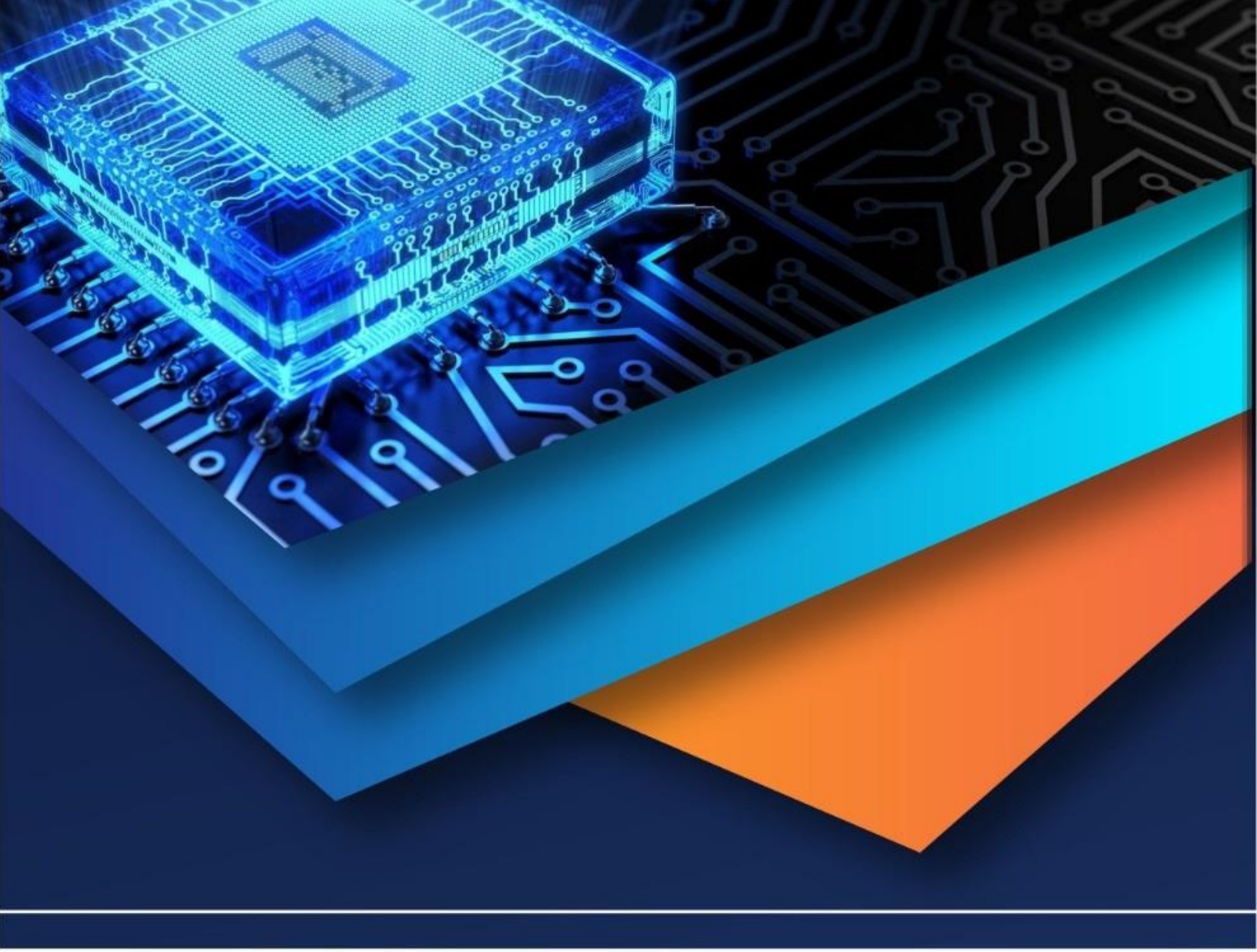
II. CONCLUSION

Arthrospira platensis is a high source of protein that's why it can be used as a protein supplement and taken as dietary food material. It is also used as feed and food additives. Arthrospira platensis have activities like antitumor, anticancer and antimicrobial (antibacterial, antifungal, and antiviral) activities. It also possesses hypolipidemic, hypoglycaemic, and antihypertensive properties. Arthrospira platensis contains phenolic acids, tocopherols and ß-carotene which are known to exhibit antioxidant properties. It gives anticancer activity by acting on cox-2.

REFERENCES

[1] Al-Homaidan, J. A. Alabdullatif, A. A. Al-Hazzani, A. A. Al-Ghanayem, and A. F. Alabbad, "Adsorptive removal of cadmium ions by Spirulina platensis dry biomass," Saudi Journal of Biological Sciences, vol. 22, no. 6, pp. 795–800, 2015.
[2] Çelekli, M. Yavuzatmaca, and H. Bozkurt, "An eco-friendly process: predictive modelling of copper adsorption from aqueous solution on Spirulina platensis," Journal of Hazardous Materials, vol. 173, no. 1-3, pp. 123–129, 2010.
[3] Cain, R. Vannela, and L. K. Woo, "Cyanobacteria as a biosorbent for mercuric ion," Bioresource Technology, vol. 99, no. 14, pp. 6578–6586, 2008.
[4] L. Fang, C. Zhou, P. Cai et al., "Binding characteristics of copper and cadmium by cyanobacterium Spirulina platensis," Journal of Hazardous Materials, vol. 190, no. 1–3, pp. 810–815, 2011.
[5] G. L. Dotto, J. O. Gonçalves, T. R. S. Cadaval, and L. A. A. Pinto, "Biosorption of phenol onto bionanoparticles from Spirulinasp. LEB 18," Journal of Colloid and Interface Science, vol. 407, pp. 450–456, 2013
[6] Nicoletti, M., 2016. Microalgae nutraceuticals. Foods, 5(3), p.54
[7] Jiménez, B. R. Cossío, and F. X. Niell, "Relationship between physicochemical variables and productivity in open ponds for the production of Spirulina: a predictive model of algal yield," Aquaculture, vol. 221, no. 1–4, pp. 331–345, 2003.
[8] L. Brennan and P. Owende, "Biofuels from microalgae—a review of technologies for production, processing, and extractions of biofuels and co-products," Renewable and Sustainable Energy Reviews, vol. 14, no. 2, pp. 557–577, 2010.
[9] K. Chopra and B. Mahendra, "Antioxidant profile of Spirulina: a blue-green microalga," in Spirulina in Human Nutrition and Health, M. E. Gershwin and A. Belay, Eds., pp. 101–119, CRC Press, London, UK, 2008.
[10] Ö. Tokuşoglu and M. K. Ünal, "Biomass nutrient profiles of three microalgae: Spirulina platensis, Chlorella vulgaris, and Isochrisisgalbana," Journal of Food Science, vol. 68, no. 4, pp. 1144–1148, 2003.
[11] S. Babadzhanov, N. Abdusamatova, F. M. Yusupova, N. Faizullaeva, L. G. Mezhlumyan, and M. K. Malikova, "Chemical composition of Spirulina platensis cultivated in Uzbekistan," Chemistry of Natural Compounds, vol. 40, no. 3, pp. 276–279, 2004
[12] J. C. Dillon, A. P. Phuc, and J. P. Dubacq, "Nutritional value of the alga Spirulina," World Review of Nutrition and Dietetics, vol. 77, pp. 32–46, 1995.
[13] Henrikson, R. Earth Food Spirulina, 6rd ed.; Ronore Enterprises, Inc: Hana, Maui, Hawaii, 200
[14] Falquet, J. The Nutritional Aspects of Spirulina, Antenna Technologies
[15] Pawan K. Dadheech, Andreas Ballot, Peter Casper, KiplagatKotut, EbertoNovelo, Brook Lemma, Thomas Pröschold&LotharKrienitz (2010) Phylogenetic relationship and divergence among planktonic strains of Arthrospira (Oscillatoriales, Cyanobacteria) of African, Asian and American origin deduced by 16S–23S ITS and phycocyanin operon sequences, Phycologia, 49:4, 361-372, DOI: 10.2216/09-71.1
[16] Lafarga, T., Fernández-Sevilla, J.M., González-López, C. and Acién-Fernández, F.G., 2020. Spirulina for the food and functional food industries. Food Research International, 137, p.109356
[17] R. R. Siva Kiran, G. M. Madhu, and S. V. Satyanarayana, "Spirulina in combating Protein Energy Malnutrition (PEM) and Protein Energy Wasting (PEW)—a review," Journal of Nutrition Research, vol. 3, no. 1, pp. 62–79, 2015
[18] W. B. Holman and A. E. O. Malau-Aduli, "Spirulina as a livestock supplement and animal feed," Journal of Animal Physiology and Animal Nutrition, vol. 97, no. 4, pp. 615–623, 2013.
[19] M.-C. Serban, A. Sahebkar, S. Dragan et al., "A systematic review and meta-analysis of the impact of Spirulina supplementation on plasma lipid concentrations," Clinical Nutrition, vol. 35, no. 4, pp. 842–851, 2016.
[20] M. Iyer Uma, A. Sophia, and V. Mani Uliyar, "Glycemic and lipemic responses of selected Spirulina supplemented rice-based recipes in normal subjects," International Journal of Diabetes in Developing Countries, vol. 19, pp. 17–22, 1999

[21] P. V. Torres-Duran, A. Ferreira-Hermosillo, and M. A. Juarez-Oropeza, "Antihyperlipemic and antihypertensive effects of Spirulina maxima in an open sample of mexican population: a preliminary report," Lipids in Health and Disease, vol. 6, article no. 33, 2007.
[22] K. Iwata, T. Inayama, and T. Kato, "Effects of spirulina platensis on plasma lipoprotein lipase activity in fructose-induced hyperlipidemic rats," Journal of Nutritional Science and Vitaminology, vol. 36, no. 2, pp. 165–171, 1990.
[23] P. Muthuraman, R. Senthilkumar, and K. Srikumar, "Alterations in beta-islets of Langerhans in alloxan-induced diabetic rats by marine Spirulina platensis," Journal of Enzyme Inhibition and Medicinal Chemistry, vol. 24, no. 6, pp. 1253–1256, 2009
[24] Y. Ou, L. Lin, X. Yang, Q. Pan, and X. Cheng, "Antidiabetic potential of phycocyanin: effects on KKAy mice," Pharmaceutical Biology, vol. 51, no. 5, pp. 539–544, 2013.
[25] Habib, M.A.B., Parvin, M., Huntington, T.C., Hasan, M.R. A Review on Culture, Production and Use of Spirulina as Food for Humans and Feeds for Domestic Animals and Fish. FAO Fisheries and Aquaculture Circular No. 1034, 2008.
[26] Cohen, Z. Spirulina platensis (Arthrospira): Physiology, Cellbiology, and Biotechnology, Taylor and Francis: London., 1997,pp. 175-204
[27] Bauer, A.W., W.M.M. Kirby, J.C. SherrisM.Turck, 1966. Antibiotic susceptibility testing by a standardized single disk method. Amer. J. Clin Pathol., 45(4): 493-496
[28] Alberto Finamore, Maura Palmery, SarraBensehaila, IlariaPeluso, "Antioxidant, Immunomodulating, and Microbial-Modulating Activities of the Sustainable and Ecofriendly Spirulina", Oxidative Medicine and Cellular Longevity, vol. 2017, Article ID 3247528, 14 pages, 2017. https://doi.org/10.1155/2017/3247528
[29] R. Hu, C. L.-L. Saw, R. Yu, and A.-N. T. Kong, "Regulation of NF-E2-related factor 2 signaling for cancer chemoprevention: antioxidant coupled with antiinflammatory," Antioxidants and Redox Signaling, vol. 13, no. 11, pp. 1679–1698, 2010.
[30] RANJANI RAMAKRISHNAN, International Journal of Medicine and Pharmaceutical Sciences (IJMPS) ISSN 2250-0049 Vol. 3, Issue 4, Oct 2013, 159-168.
[31] O'Shaughnessy, J.A., Kelloff, G.J., Gordon, G.B., Dannenberg, A.J., Hong, W.K., Fabian, C.J.,Sigman, C.C., Bertagnolli, M.M., Stratton, S.P., Lam, S., Nelson, W.G., Meyskens, F.L., Alberts, D.S., Follen, M., Rustgi, A.K., Papadimitrakopoulou, V., Scardino, P.T., Gazdar, A.F., Wattenberg, L.W., Sporn, M.B., Sakr, W.A., Lippman, S.M., Von Hoff D. Treatment and prevention of intraepithelial neoplasia: an important target for accelerate new agent development. Clin Cancer Res., 2002, 8, 314-46.
[32] Grawish, M.E. Effects of Spirulina platensis extract on Syrian hamster cheek pouch mucosa painted with 7,12-dimethylbenz[a]anthracene. Oral. Oncol., 2008, 44, 956-62.
[33] Fournier, D. B., Gordon, G. B. COX-2 and colon cancer: Potential targets for chemoprevention. J. Cell. Biochem. Suppl., 2000, 34, 97-10
[34] Vane, J. R., Bakhle, Y. S., Botting, R. M. Cyclooxygenase 1 and 2. Annu. Rev. Pharmacol. Toxicol., 1998, 38, 97-120.
[35] Reddy, C.M., Bhat, V.B., Kiranmai, G., Reddy, M.N., Reddanna, P., Madyastha, K.M. Selective Inhibition of Cyclooxygenase-2 by C Phycocyanin, a Biliprotein from Spirulina platensis. Biochem. Bioph. Res. Co., 2000, 277, 599-603.
[36] Prasanna, R., Sood, A., Jaiswal, P., Nayak, S., Gupta, V., haudhary, V., Joshi, M., Natarajan, C. Rediscovering cyanobacteria as valuable sources of bioactive compounds. Appl.Biochem. Microbiol., 2010, 46(2), 133-47
[37] Scotter, M.J. Emerging and persistent issues with artificial food colours: natural colour additives as alternatives to synthetic colours in food and drink, Qual.Assur.Saf.Crop, 2011, 3, 28-39.
[38] Demule, M.C.Z., Decaire, G.Z., Decano, M.S. Bioactive substances from Spirulina platensis (cianobacteria). Int. J. Exp. Bot., 1996, 58, 93-96.
[39] Mendiola, J.A., Jaime, L., Santoyo, S., Reglero, G., Cifuentes, A., Ibanez, E., Senorans, F.J. Screening of functional compounds in supercritical fluid extracts from Spirulina platensis. Food chem., 2007, 102, 1357-67
[40] Simsek, N., Karadeniz, A., Kalkan, Y., Keles, O.N., Unal, B. Spirulina platensis feeding inhibited the anemia - and leucopeniainduced lead and cadmium in rats. J. Hazard. Mater., 2009, 164, 1304-1039.
[41] Bermejo-Bescós, P., Piñero-Estrada, Villar, A.M. Iron-chelating ability and antioxidant properties of phycocyanin isolated from a protein extract of Spirulina platensis. Food. Chem., 2008, 110, 436-45.
[42] Gad, A., Khadrawy, Y.A., El-Nekeety, A.A., Mohamad, Sh. R., Hassan, N.S., Abdel-Wahhab, M.A. Antioxidant activity and hepatoprotective effects of whey protein and Spirulina in rats. Nutrition., 2010, 1-8.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY