Cyanobacteria As A Bioresource For Pharmaceutical Compounds

Karisma Dash
Dept of Botany
Utkal University, BBSR, Odisha

Abstract- *New bioactive secondary metabolites are being produced by cyanobacteria, which is becoming a significant source. Recently, it has also been noted to be a plentiful source of bioactive compounds such lynbyabellin, curacin A, and apratoxins. Some substances have shown some extremely intriguing outcomes and successfully completed clinical studies in Phase II and Phase III. Additionally, cyanobacterial substances have a bright and promising future in scientific study and offer a big chance for the identification of novel drugs. 2005 saw the creation of new miniaturised screens based on cell cultures, enzyme activity, and ligand receptor binding thanks to a number of innovative technologies. This strategy has effects on the creation of new compounds for structure-based medication design. This review paper therefore primarily focuses on baseline data for encouraging the use of cyanobacterial bioactive chemicals as medications for many terrible human diseases, using the computational technique.*

Keywords- Cyanobacteria, Lyngbyabelin, curacin A, apratoxins, pharmaceutical

I. INTRODUCTION

New medication for all major disease is largely derived from natural sources.However, in many disease categories, natural products continue to be a significant source of structures, mostly contributing to semi- or synthetic medications. Therefore, antimicrobial therapy, cancer, and immunoregulation are the main therapeutic areas where natural product-derived medications are effective (Hoelder *et al.,* 2012). Researchers have recently concentrated mostly on creating novel medications using marine cyanobacteria. The majority of the metabolites have been isolated from cyanobacteria, which has been regarded as a rich source of secondary metabolites with potential biotechnical applications in the pharmacological field. Studies of biomedical natural products have focused solely on Cyanophyta (blue-green algae) and Pyrrophyta (dinoflagellates). Interest in studying these organisms has recently increased due to the production of bioactive compounds with practical and therapeutic uses (Newman *et al.,* 2002). In fact, in addition to producing powerful toxins, cyanobacteria also produce numerous substances with intriguing antifungal, antibiotic, and anti-cancerogenic properties. Additionally, cyanobacterial metabolites exhibit fascinating and exciting biological activities, such as antimicrobial, immune-suppressant, and anti-cancerogenic properties. Since cyanobacteria produce a variety of bioactive compounds with intriguing antifungal, antibiotic, and anti-cancerogenic properties, interest in studying these organisms has recently increased (Mayer *et al.*, 2009) Additionally, cyanobacterial metabolites exhibit fascinating and exciting biological activities, such as antimicrobial, immune-suppressant, and anti-cancerogenic properties.

Research on bioactive compounds producing cyanobacteria

With fossil records reaching back almost 3.5 billion years, photosynthetic prokaryotes known as cyanobacteria, formerly known as blue-green algae, are among the oldest living things on Earth. These organisms have been discovered to provide a fresh and abundant source of bioactive substances (Simmons *et al.,* 2005). According to reports, bioactive substances differ from manufactured medications in terms of their radical and atom arrangements and chemical makeup. They are far more effective at preventing protein-protein interactions, which enhances immunological response, signal transduction, mitosis, and ultimately apoptosis without doing much damage to living things (Kobayashi *et al.,* 1997; Gupta *et al.,*2012). Few substances, such as hassallidin, hapalindole, and Y-lactone, were isolated from *Nostoc* species. *Fischerella* sp., and *Nostoccalcicula* including *Scytonema* species (Liang *et al.,* 2005) have achievd prominence in the field of biotechnology for their antibacterial activity. For the benefit of society, further research must be done to isolate from cyanobacteria bioactive substances with antibacterial properties. Such substances that may have a hemolytic or anti-haemolytic effect on human erythrocytes may come from cyanobacteria. To be classified as a secure treatment for illnesses, various cyanobacteria species must thus be tested for their potential haemolytic activity. The biosynthesis of bioactive substances in cyanobacteria can be roughly divided into terpenes, alkaloids, fatty acids, UV-absorbing substances, peptides, and polyketides, among other categories.

Condition required for cyanobacteril production of bioactive compounds

Factors to consider while producing and extracting bioactive compounds from cyanobacteria Sub-aerial cyanobacteria grow on exposed surfaces of building facades, monuments, and temples (Keshari and Adhikary, 2014). Due to their resilience to challenging environmental conditions including high light intensity, high temperature, and drought conditions, they are more common in tropical climates than in temperate climates. When they are under stress, they create bioactive substances to have a favourable growth. The production of bioactive chemicals is greatly influenced by environmental parameters such as culture age, temperature, salinity, pH, macro and micronutrients, and light (Noaman *et al.,* 2004). The entire process of bioactive compound extraction can be cost effective by increasing physiological and environmental factors through optimization of extraction protocol with respect to culture media, pH, temperature and cell disruption technique etc.favouring bioactive compounds production (Chisti,2007; Paul *et al.,* 2010). There are two types of photobioreactor: open bioreactors and closed photobioreactor. But for bioactive substances having pharmacological utility, mostly closed bioreactors are preferred to avoid contamination (Singh *et al.,* 2005). Depending on the species and substratum, the environmental conditions may change. The blue green eleven (BG-11) media (Rippka*et al.,* 1979) was thought to be the best artificial medium for maximising production. Strategies for sub-aerial cyanobacteria biomass production on a wide scale and bioactive compounds with pharmacological utility Science is constantly looking for methods to apply its findings for the benefit of people. Any research into its application must therefore focus on two things. The first is its safety for people or the intended host, and the second is its cost-effectiveness. Academicians and researchers around the world have long strived to develop high-quality items at a low cost using a variety of unique strategies.

Table 1: Bioactive compounds produced by cyanobacteria

Organisms	Bioactive compounds	Ref
Microcystis aeruginosa	MicroviridinToxin BE-4 Siatoxin Antibiotic, anticancer	Carmichael, 1992
N. linckia and *N. spongiaeforme*	Borophycin	Banker *et al.,* 1998a
Lyngbyamajuscule	Apratoxin	Gutierrez *et al.,* 2008
Lyngbyamajuscula and *Lyngbyasordida*	Apratoxin D H-460 lung cancer 49	Han *et al.,* 2006
Lyngbyabouillonii	Apratoxin E U2OS osteosarcoma, HT29 colon adenocarcinoma, and HeLa epithelial carcinoma	Soria *et al.,* 2009
*Lyngbya*sp.	ApratoxinsBeC KB oral epidermoid cancer and LoVo colon cancer 25	Nogle *et al.,* 2001
L. bouilloni	Apratoxins F and G HCT-116 colorectal cancer cells 25	Soria *et al.,* 2009
L. majuscula	Aurilide B H-460 lung tumor 50	Nogle *et al.,* 2001
L. majuscula	Aurilide C NCIeH460 lung tumor 50	Orjala*et al.,*1995
Lyngbyabouillonii	Alotamide 51	Soria *et al.,* 2009
L. majuscula	Antillatoxin 52	Cardillina*et al.,* 1979
L. majuscula	Antillatoxin B 53	Cardillina *et al.,* 1979
L. bouillonii	BouillomidesAeB 54,55	Soria *et al.,* 2009
Symploca sp.	Belamide A HCT-116 colon cancer 56	Leusch*et al.,* 2001
Lyngbya sp.	Bisebromoamide HeLa	Mayer *et al.,* 2009
Lyngbya sp.	Biselyngbyaside HeLa	Mayer *et al.,* 2009
Calothrix	Calothrixin A HeLa	Gademann *et al.,* 2008
L. majuscula	Caylobolide A HCT-116	Gutierrez *et al.,* 2008
Phormidium sp.	Caylobolide B HT29	Volk *et al.,* 2008
N. linckia	Cryptophycin-	Liang *et al.,* 2005
N. spongiaeforme	Cryptophycin-8	Corbett *et al.,* 1996
Nostoc sp. GSV 224	Cryptophycin-1	Shin *et al.,* 2001
L. majuscule	Curacin A	Orjala*et al.,* 1995
Caulerpa sp.	Caulerpenyne	Gademann *et al.,* 2008

II. CONCLUSION

A distinct class of oxygenic photosynthetic bacteria, cyanobacteria are found in a variety of habitats around the globe. During the past two decades, their potential as a reliable source of novel therapeutic lead compounds has come to light as several bioactive molecules derived from cyanobacteria exhibit a wide range of activities, including antitumor, antibacterial, and antiviral effects, as well as protease inhibition. Cyanobacteria are advantageous as a microbial source for drug development since they are easier to culture than other microorganisms and need only basic inorganic ingredients for growth. So it appears that there is a scope for greater use of cyanobacteria in the drug development process. Additionally, because of the wide variety of microbes, cyanobacterial secondary metabolites may be a rich source of novel organisms.

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