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Seasonal Taxonomic Study of Attached Cyanophyceae Algae on Biological Treatment Pond Within Dura Refinery / Baghdad

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ABSTRACT

A seasonal taxonomic study was conducted of Attached Cyanophyceae algae on biological treatment pond in Dura refinery at Baghdad city for three seasons (Summer, Autum 2020, Winter 2021). The current study recorded (41 species) belonging to (13 Genus) of attached Cyanophyceae algae, including three Orders: Oscillatoriales were the dominant group (4genus, 16 species), followed by Chroococcales (5 genus, 15 species), and Nostocales (4 genus, 10 species). Cyanophyceae are characterized by ability to live, grow and reproduce in a wide range of environmental changes and pollution levels especially industrial waste. Cyanophyceae can be revived in the pond as it has the ability to break down petroleum and organic compounds.

Keywords: Biological treatment pond, Cyanophyceae, Dura refinery, Genus, Organic compounds

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دراسة تصنيفية فصلية للطحالب الخضر المزرقة الملتصقة في احواض التنقية البايولوجية في مصفى الدورة/ بغداد

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الملخص

شملت الدراسة دراسة فصلية تصنيفية لطحالب Cyanophyceae الملتصقة بأحواض المعالجة الاحيائية ضمن مصفى الدورة في مدينة بغداد لمدة ثلاثة مواسم (صيف وخريف 2020، شتاء 2021) سجلت الدراسة الحالية (41 نوعاً) تنتمي إلى (13 جنساً) من الطحالب Cyanophyceae وتضمنت ثلاث رتب: كانت مجموعة Oscillatoriales هي المجموعة السائدة (4 اجناس. 16 نوع)، ويتبعها Chroococcales (5 اجناس ، 15 نوع)، Nostocales (4 اجناس، 10 نوع). تتميز Cyanophyceae بالقدرة على العيش والنمو والتكاثر في نطاق واسع من التغيرات البيئية ومستويات التلوث وخاصة النفايات الصناعية Cyanophyceae ممكن إحياؤها في الاحواض والاستفادة من قدرتها على تفكيك المركبات البترولية والعضوية.

INTRODUCTION

Algae are found in various environments and are of different sizes from less than (1 µm) to larger than (700 feet), with algae product, oxygen and organic matter. The applicability of Cyanobacteria executes various roles in the treatment of water on bio-treatment ponds and enrich and enhance the water quality through photosynthesis and carry out bioremediation of some heavy metals and polycycliques aromatiques hydrocarbons (PAHs). Some cyanobacteria species are tolerant of some environmental parameters, such as extreme temperatures, pH, high salinity, oils and heavy metals, which makes them outstanding candidates for the water treatment plants in ponds [(1)].

Gas stations and oil refineries that were built within urban areas and close to rivers are among the most dangerous and polluting places [(2)]. This pollution is not limited to surface water but reaches the air and groundwater near oil refineries and gas stations [(3)].

The old types of oil refineries are built near the rivers and use large quantities of water inside the refineries during the refining stages. It includes cooling water in heat exchangers and condensers, in addition to brine. It is also used in induction devices, water vapor in large quantities, distillation towers, and separation devices. Then the water vapor is condensed and separated from the oil components. The water leaving the various stages of the filter contains a high percentage of hydrocarbon and sulfur compounds. Before being delivered to the river, the water passes through physical, chemical and biological treatment units [(4, 5)]. Biological treatment pond is one of the important units inside the refinery, in which organic solvents are removed through the use of bacteria and algae, these materials are used as food or work to accumulate on their bodies or turn them into sediments under special conditions [(1, 5)].

Taxonomic studies of algae in the treatment ponds of oil refineries are few according to the available sources Therefore, the research aims at a qualitative

and taxonomic study of the algae in the treatment biological pond.

MATERIALS AND METHODS

Study Site

The Dura refinery is located (17 km) south of Baghdad on the right bank of the Tigris River (Fig. 1). There are biological treatment ponds in which water from all units is collected before it reaches the river. The dimensions of the first pond range from (16 m × 32 m) rectangular in shape, and the second pond has a circular shape with a radius of 16 m (Fig. 2; A, B). The locations were determined using GPS with a longitude of (44.2558.87) and a latitude of (33.1635.22). The samples of algae were collected using a poly vinyl chloride (PVC) delimiter [6] from the study sites, preserved by adding a Lugol's solution. Attached algae were diagnosed by preparation of temporary [7-10].

Fig. 1: The tow study station of the Dora refinery on the Tigris River (Google site, 2021).

Fig. 2: A- Station 1, B- Station 2 biological treatment pond inside the Dura oil refinery.

RESULTS AND DISCUSSION

Anaerobic metabolism is a vital process concerning petroleum hydrocarbon biodegradation and bioremediation that reduces the risk of this waste on the environment using small organisms (bacteria and algae to destroy hydrocarbon oil [11, 12].

The study recorded 13 genus of attached Cyanophyta belonging to 41 species (Table 1). Three Orders of Cyanophyceae: Oscillatoriales were the dominant group (4 genera, 16 Species), followed by Chroococcales (5 Genera,15 species), Nostocales (4 genera,10 species), (Fig.3). Bioaccumulation is the ability of an organism to accumulate pollutants within its body in higher concentrations than what is present in the surrounding environment [13], as many organisms

such as algae have the ability to accumulate petroleum hydrocarbons in their bodies in high concentrations [14]. The important role in addressing environmental pollution, especially pollution by hydrocarbon compounds, is through its ability to accumulate these compounds, as it has been observed in coastal areas that are completely covered with oil. To be prepared shortly after the pollution incident [15], the bioconcentration factor depends on the lipid content in living cells and the greater lipid content in living organisms due to an increase in the bioconcentration factor of hydrophobic hydrocarbons, as it was found that high concentrations of petroleum compounds are found in lipid tissues. Since most of the Cyanophyta possess a gelatinous sheath, in addition to most of them possessing a high fat content, this is what makes them have the ability to accumulate hydrocarbons inside their bodies and their ability to live in biological treatment ponds more than other types of algae [16-18].

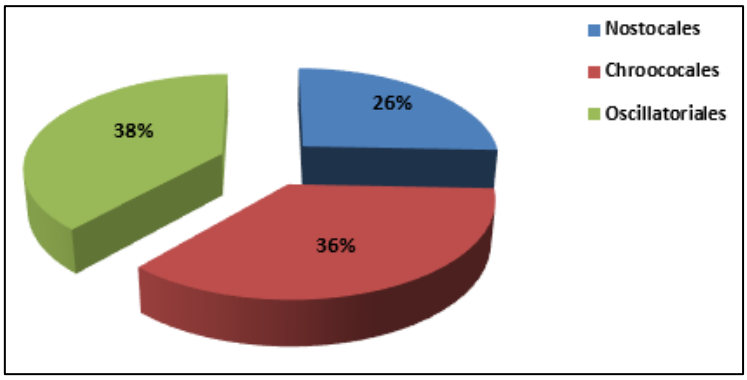

Fig. 3: Percentages of Cyanophyta groups diagnosed in biological treatment ponds during the study seasons (2020-2021).

Table 1: The Cyanophyta species record in a biological treatment pond within the Doua refinery during the study seasons (2020-2021).

Taxa \ Station	Station 1			Station 2		
	Summer	Autumn	Winter	Summer	Autumn	Winter
Division: Cyanophyta						
Order: Chroococcales						
Aphanocapsa biformis A. Braun		+	+	+	+	
A. delicatissma West and West		+	+	+	+	
A. elachista var. *planctonica* G. M. Smith	+			+	+	
A. endophytica G.M. Smith		+			+	
Aphanothece. castagnei (Breb.) Rabenhorst					+	+
A. gelatinosa (Henn.) Lemmermann					+	
Chroococcus. disperses. G..M.Smith					+	
Chroococcus. dispersus var *minor*.G..M.Smith		+			+	
C. tarius A.Braun//	+	+		+	+	
Coelosphaerium dubium Grunow	+					
Merismopedia convolute de Brebison	+			+	+	
M. elegans A.Braun		+				
M. glauca (Ehr.) Naegeli					+	
M. punctata Heyen				+	+	
M. tenussima Lemmermann					+	
Order Oscillatoriales						

Taxa \ Station	Station 1			Station 2		
	Summer	Autumn	Winter	Summer	Autumn	Winter
Lyngbya aerugineo-coerulea (Ktz.) Gomont			+			+
L. birgei G.M. Smith			+		+	
L. limnetica Lemmer.			+		+	
L. nordgardhii Wille			+	+		
Oscillatoria acula Bruhl and Biswas		+	+			+
O. agardhii Gomont						+
O. amphibia Agardh		+				
O. chalybea Mertens				+		
O. cortiana Meneghini		+				
O. lacustris (Klebahn) Geitler				+		
O. limosa Roth Agardh		+		+	+	
O. okenii Agardh				+		
O. tenuis Rabenhorst					+	
Phormidium africanum Lemmermann	+	+			+	
P. tenue (Menegh) Gom.				+		
Schizothrix *tinctoria* Gom.	+			+		
Order Nostocales						
Anabaena aequalis Borge		+				
A. affinis Lemmermann		+				
A. torulosa (Carm.) Lagerheim					+	
A. tanganikae West				+		
Nodularia spumigena Martens in Jergens				+		
Nostoc carneum Agardh		+			+	+
N. commune Vaucher.					+	+
N. muscorum Agardh.					+	+
N. linckia (Roth) Bornet and Thuret				+		
Chroococcidiopsis gelatinousm (Geitler) Bourrely	+					

CONCLUSION

Cyanophyceae are characterized by the ability to live, grow and reproduce in a wide range of environmental changes and pollution levels especially industrial waste. Cyanophyceae can revive in the pond and can break down petroleum and organic compounds.

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