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Mycoremidation of Petroleum Hydrocarbons of the Refinery Wastewater in Najaf/Iraq (2-mixiture of fungi)

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Abstract

The present study deals with investigate the possibility of some fungus in the removal of petroleum hydrocarbon and some pollutant from Najaf oil refinery wastewater.The study have two axes the first is isolate and diagnose fungus of oil waste water and the soils surrounding as it was isolated (5) species belonging to (3) genes, three isolate were selected which have thee frequency Penicillium sp. 49.51% ,A. niger 10.67% and A. terreus 34.95% in the experiment a mixture offungus used to remove oil hydrocarbon in the media center as the sole source of carbon and energy .The result showed that ,the mixture of A.niger and A.terreus remove(66.63%) of the weight of hydrocarbons existing in media and showed efficiency in reducing a conductivity, salinity and TDS and total hardness and hardness calcium, hardness magnesium, alkalinity and nitrite, nitrate, phosphate and sulfate by (70.51)% and (71.06)% and (59.43)% and (67.23)% and (63.77)% and (80.5)% and (76.87)% and (62.5)% and (67.2)% and (63.6)% (71.4)%, respectively , while the triple mixture were the lost in the removal of oil hydrocarbons and other parameters.

Keywords:

Introduction

Oil pollution problem result due to technical rapid development in the oil industry, which resulted in an increase in production and an increase is regularly in use, so the increased oil put up and its derivatives to the environment, particularly the aquatic environment from the large transport accidents [1]and waste oil refineries waste and shipping operations and unloading, storage and incidents of oil ships oil source to the oil inside the aquatic environment [2].

The oil is a mixture of hydrocarbons includes a large variety groups of organic compounds containing elemental hydrogen and carbon, so the term HCs includes various organic compounds atoms [3] and is a petroleum hydrocarbons of the most important environmental pollutants for being toxic to most organisms in the environment, particularly polycyclic

hydrocarbon aromatic, and because of the nature of solublity in fat for these compound a major role in bio-magnification through its transition in the food chain and it has mutagenic and carcinogenic properties [4,5].

I figured the importance of bioremidation of pollutants in recent years with the increase of oil derivatives leak as well as method used microbiology natural to reduce the concentration and toxicity of different chemicals such as petroleum derivatives and aromatic hydrocarbons and aliphatic and industrial solvents because of the ability of a number of microbiology (fungi and bacteria) on a biogegredation [6] and it into simpletransfere materials from water and carbon dioxide, materials and intermediate used by the fungus as a sole source of carbon and energy [7] and affect microbiology (, bacteria and fungi) an important impact in the biological analysis of the material hydrocarbon [8] .

The characterization of microorganism consuming hydrocarbons its ability to breake most of the oil components, stable genetically, and have the ability to multiply quickly, and has enzymes disintegration and the ability to compete with other microorganism naturally present in the contamination site and finally the advantage not to events negative and unsatisfactory side effects or producing materials metabolic toxic[9].

Aim of the study

- Study the possibility of processing petroleum hydrocarbons backward from Najaf refinery mediated by some fungi, it comes including:

1- isolate and diagnose the fungus from wastewater and soil surrounding the inside oil refinery in Najaf.

2 –use mixturefungi in the removal of hydrocarbons from waste waterof Najaf refinery and reduce electrical conductivity, salinity and TDS and total hardness and calciumhardness, magnesium hardness, alkalinity, nitrate, nitrite, phosphate and sulphates.

Material and Methods

Industrial wastewater collected from Najaf refinery wastewater that showed more numerous within the fungi isolated from soil and water, a *Pencillium sp*. and *A.terrus* and *A.niger* has design experience for (7) days and took the forms of water on probation for various tests on the first day, third,fifth and seventh, as well as model control (without adding the fungi) for the purpose of examining the possibility of these fungi in the treatment of hydrocarbons and some other pollutants.

Separation of hydrocarbons from the waste water

Total petroleum hydrocarbons (TPH) were extracted from wastewater -using separating funnel capacity (1L) by mixing 50 ml of industrial water with diethyl ether (99.8%) by 3: 1 (v / v) with shaking for 10 minutes at room temperature as separate class organic layer above the water was pulled from the bottom, then washed water layer again with (50) mL of diethyl ether and collected clean and dry flask [10].

Physical and Chemical Analysis

Electrical conductivity and total dissolved solid(TDS) measured by (Multi meter) and salinity ,total hardness, calciumhardness,magnesiumhardness, alkalinity and nitrite using the methods described in [11], nitrate, phosphate and sulfate using the methods described in [12] biomasswas estimate by the method described in [13].

Results and Discussion

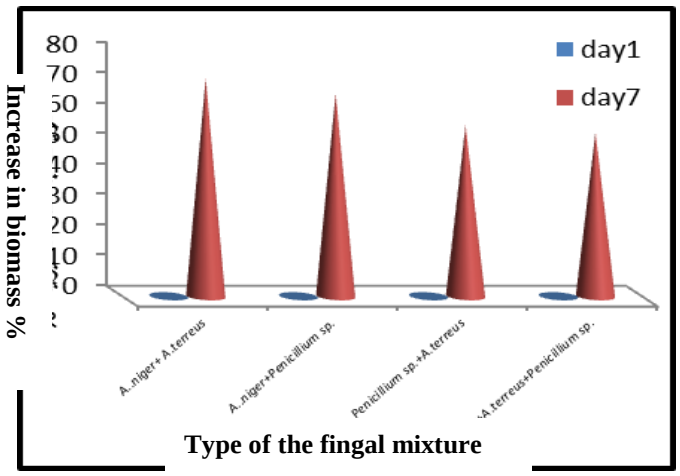
The study results showed a high removal of total hydrocarbons during the seventh day of the duration of the experiment attributed to breaking these compounds by mixture of fungus and its use as a sole source of carbon and energy [14] and release carbon dioxide, water and energy to be used to increase the biomass and build the necessary enzymes to

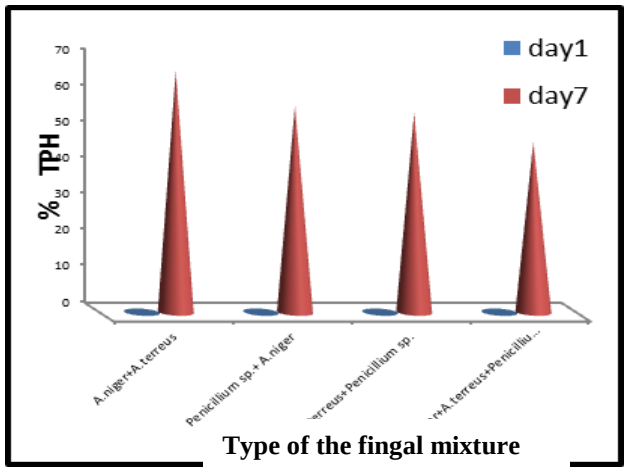
breaking.The ability of large removal of TPH due to adaptation of those fungi with contaminated components and thus the development of its own enzyme system was able to breaking organic compounds of high molecular weight [15] and secreted enzymes break complex hydrocarbons mixed with crude oil in the soil [16] aquatic environment river [17] and marine environment [18].

The concentration of total hydrocarbons has decreased from (4.012 to 1.587 and 1.699 and 1.780 and 2.113) g / liter and reached the highest percentage for removing hydrocarbons total mixture fungal *A.niger* and *A.terreus* (66.63%) on the seventh day of the duration of the experiment followed mix of (. *A.niger*+ *Penicilliumsp*) and (*A.terreus* + *Penicillium sp*.) and (*A.terreus* + *Penicillium sp.* + *A.niger*) by (57)% and (55)% and (47%) on respectively.

Biomass:

The results showed that there is a gradual increase in growth over a period of incubation and reached fungal isolates to the biggest growth on the seventh day [14]on the ability of fungi to increase growth in media includes crude oil, kerosene , diesel or motor oil as a result of the use of hydrocarbons as nutrient to increase growth in the media of PDA. The highest percentage increase in mixture of fungi*A.niger*+*A.terreus*) on the seventh day of the duration of the study was (71.68%), followed by the mixture of *(A.niger* + *Penicilliumsp*) and (*A.terreus* + *Penicillium sp.*) And (*A. terreus* + *Penicillium sp.* + *A.niger*) by (66.6)% and (56.4)% and (53.8)%, respectively



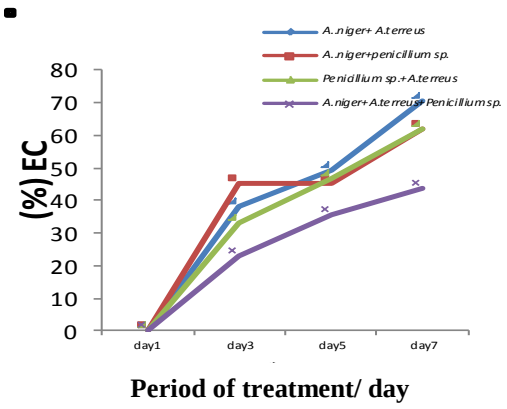


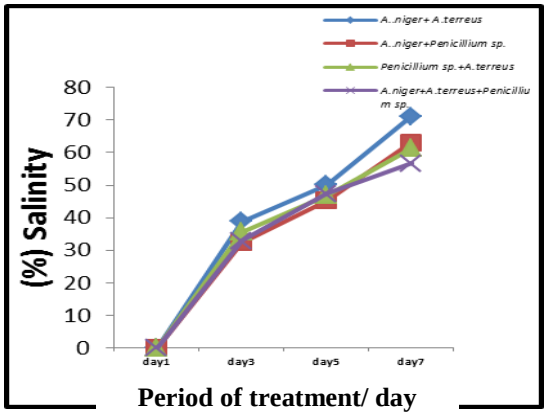
Figure(1) % to increase of biomass Figure(2)%Total Petroleum Hydrocarbon

Electrical Conductivity , Salinity and TDS

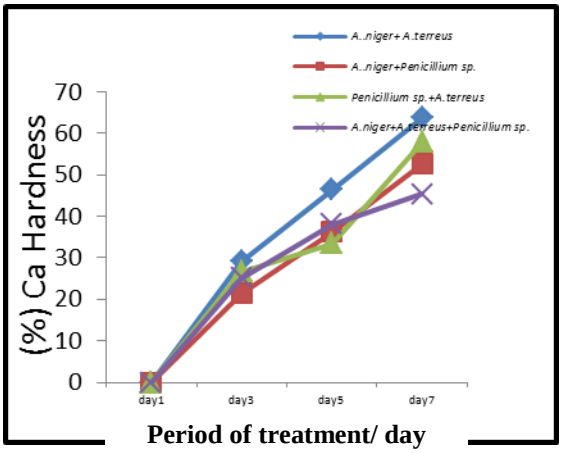
The study results showed the low value of electrical conductivity of the wastewater Najaf refinery when the treatment mix from (970 to 286.6) µs / cm recorded the highest removalby the mixture fungi *A.niger* + *A.terreus* on the seventh day of the period of study as a percentage total (70.51%), and that this value is high due to the wastewater loader ions and dissolved salts [2] and recored mixture of fungi *A.terreus* and *A.niger* highest percentage of removal (71.06%) between mixture of fungi and classified water waste Najaf refinery as water middle salinity according to the classification Laboratory of US salinity that ranged between (0.18-0.62) part per thousand as a result of realase water the container on salts and ions with waste [19] ,which attributed the low TDS concentration which is associated with hardness and the concentration of salinity to the TDS is a carbonate and bicarbonate and chloride and sulfate and nitrate and sodium and

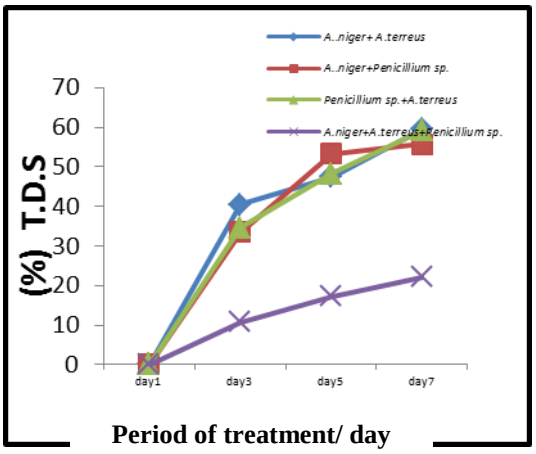
potassium, calcium and magnesium [20] and record mixturefungi*A.niger* and *A. terreus* the highest percentage of TDSremoval (59.43%) between mixture of fungi



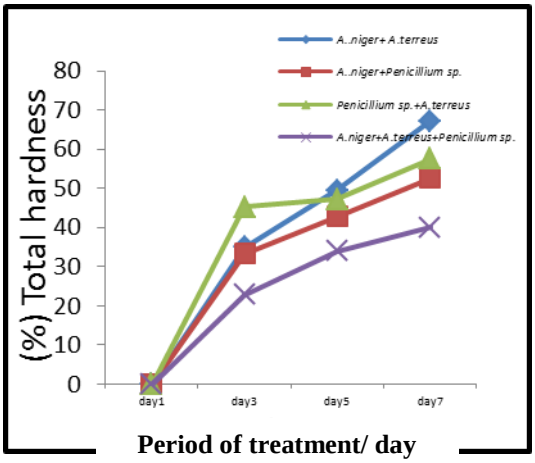


Figure(3)(%) ECFigure(4)(%) Salinity





Figure(5)(%) Ca HardnessFigure(6)(%) T.D.S



Figure(7)(%) Total hardness

Total Hardness,Calcium and Magnisum Hardness

Hardness is the presence of calcium and magnesium ions in the water [19] living fungal need cations such as calcium, magnesium, as well as sodium and potassium in concentrations less and these ion affect concentration in osmosic of organization of microorganisms[21]. The waste water Najaf refinery oil very hardness according to the classification [22] and it's hardness Calcium has been attributed to an increase in the decomposition of organic substances that increase carbon dioxide production and then increase in the transformation of calcium carbonate is dissolved into bicarbonate soluble calcium [23].Noting the total of (555 low hardness) mg / l to 255 mg / L and (286.6 mg / L) and (196.3) mg / L and 360 mg / liter of a mixture fungal (*.A.niger* + *Penicillium sp*) and (*A.terreus* + *Penicillium sp*.) and (*A.terreus* + *A.niger*) and the triple combination (*A.terreus* + *Penicillium sp.* + *A.niger*) in a row and reached the highest percentage of the total removal of hardness mixture of fungal and *A.nigerA.terreus* (67.23%) on the seventh day of the duration of the experiment.

The alkalinity of the water content of alcarbonat and bicarbonates and hydroxides function [12] and are affected by the alkalinity values of temperature and increase the decomposition of organic material and increasing CO2 concentration and the concentration of magnesium [24] and the results showed a decrease in the alkalinity values of Najaf refinery effluent high alkalinity values and attributed it to the activity microbiology in biodegradation of organic material such as converting calcium carbonate into bicarbonate [25] and the formation of carbonic acid in the water [26] or because of be carbon dioxide as a by-final operations bioremediation which is associated with water, which reduces alkalinity and mix fungus record *A.nigerA.terreus* and the highest value to the reduce alkalinity of (825 to 196.6) mg / L and the highest percentage of removal (76.87%) between studied fungi in the seventh day of the duration of the experiment

Nutiernts:

The nutrients is (Bio stimulator) that limitedbiodegradation. Given the importance of these elements in the growth of enzymes and construction used by living organisms in hydrocarbon break. [27]. The carbon a important element of the nutrients that you need microbiology and available in the oil waste as well as other nutrients such as phosphorus and nitrogen, and that the balance of nutrients essential for optimal success of bioremediation processes are CNP equal to 100: 10: 4 in general (1ppm) of ammonia (nitrogen ammonium) and 0 0.4 effective phosphate (orthophosphate) [28,29] and Record mix fungi (*A.niger* and *A.terreus*) highest percentage reached to remove nitrite (62.5%) and nitrate (67.2%) and phosphate (63.3%) between studied fungus .

Sulfates

Sulfatesion enters in the compound of crude oil parts such as paraffin and alkthiol and thiophens [30], microorganisms use it for the production ofsulfur amino acids (Sulfydryl amino acid) and vitamins [31] the decline in the value of the sulfate may be due to used as the receiver of the electron by microbiology in cases of strong crude oil pollution [32]. Low concentration of sulfates combination of double mixture (700.2 to 200) mg / L in the form of the seventh day (49) and record and mix the fungi*A.nigerA.terreus* highest percentage of removal (71.4%), followed by fungi between compact mix fungi (*A.niger* + *Penicillium sp.*) and(*A.terreus* + *Penicillium sp*.) and (*A.terreus* + *Penicillium sp.* + *A.niger*) by (64.2)% (55.2)% and (42.8) receptivity .

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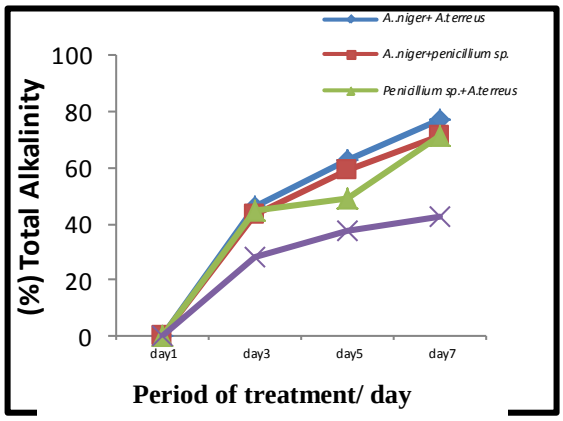
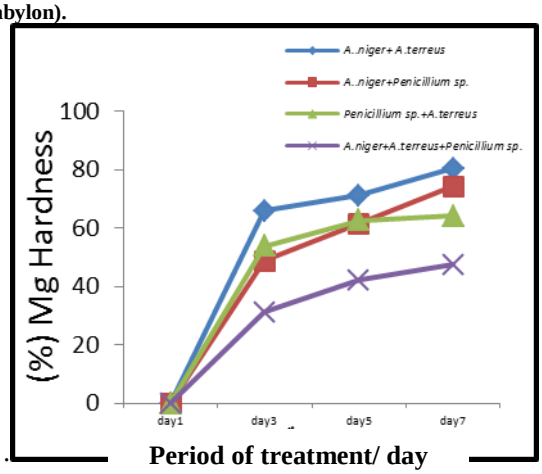
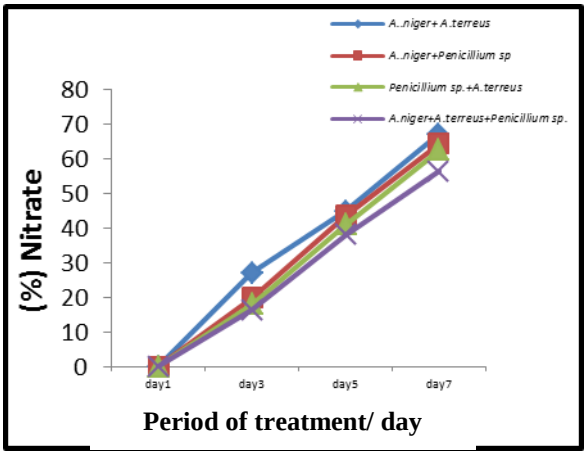
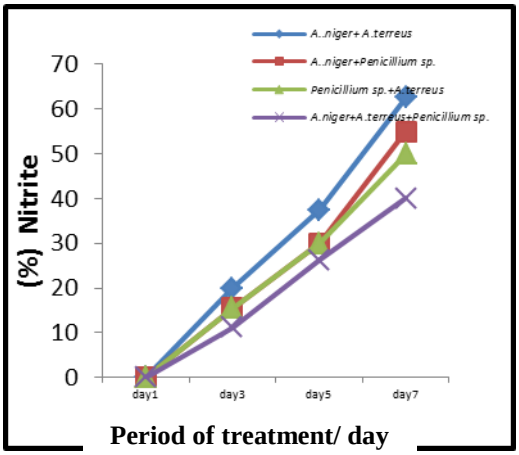


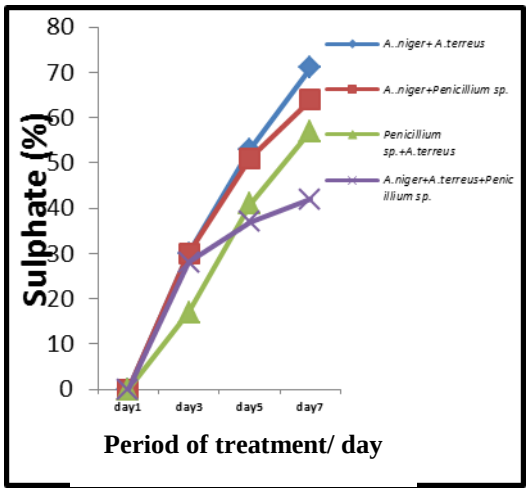


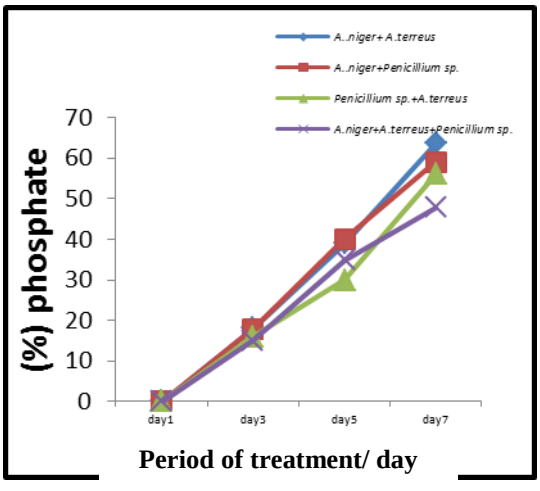
Figure(8)(%) Total AlkalinityFigure(9)(%) Mg Hardness





Figure(10)(%) NitrateFigure(11)(%) Nitrite





Figure(12)Sulphate (%)Figure(13)(%) phosphate

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