Assessment of physicochemical parameters of water after the inoculation of *Staphyllococcus*

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Abstract

Water pollution is an issue of great concern worldwide, and it can be broadly divided into three main categories, that is, contaminated by organic compounds, inorganic compounds, and microorganisms. In recent years, the number of research studies concerning the use of efficient processes to clean up and minimize the pollution of water bodies has been increasing. In this context, the use of bioremediation processes for the improvement of water quality is gaining considerable attention.[1] Bioremediation is a biological mechanism of recycling wastes in to another form that can used and reused by other organisms. Bioremediation using microorganisms shows great potential for future development due to its environmental compatibility and possible cost-effectiveness. Nowadays, the world is facing the problem of different environmental pollution. Microorganisms are essential for a key alternative solution to overcome challenges. Microorganisms are survive in all place on the biosphere because of their metabolic activity is astonishing; then come into existence in all over range of environmental conditions. The nutritional capacity of microorganisms is completely varied, so it is used as bioremediation of environmental pollutants. Bioremediation is highly involved in degradation, eradication, immobilization, or detoxification diverse chemical wastes and physical hazardous materials from the surrounding through the all-inclusive and action of microorganisms. The main principle is degrading and transforming pollutants such as hydrocarbons, oil, heavy metal, pesticides, dye's and so on. That is carried out in enzymatic way through metabolizing, so it have great contribution role to solve many environmental problems There are two types of factors these are biotic and abiotic conditions are determine rate of degradation. Currently, different methods and strategies are applied in the area in different part of the world. For example, biostimulation, bioaugementation, bioventing, biopiles and bioattenuation are common one. All bioremediation techniques it has its own advantage and disadvantage because it has its own specific application.[2]

Key Words – Water Pollution, Bioremediation, Microorganisms, Water Bodies, Immobilization.

Introduction

Several different physicochemical and biological processes are commonly employed to remove contaminants from industrial and domestic wastewaters before their discharge into the environment. [3]Conventional physicochemical methods such as electrochemical treatment, ion exchange, precipitation, osmosis, evaporation, and sorption are not cost-effective, and some of them are not environmentally friendly[4,5]. On the other hand, bioremediation processes show promising results for the removal of contaminants. Furthermore, this is an eco-compatible and economically feasible option. The bioremediation strategy is based on the high detoxification capacity of biological agents, which can remove pollutants from contaminated sites with high efficiency. In this regard, microorganisms can be considered as a biological tool for toxin removal because they can be used to concentrate, remove, and recover toxins from contaminated aquatic environments[6]. Several studies have been conducted using microorganisms for the uptake of organic and inorganic pollutants in polluted waters as an alternative strategy to conventional treatments. Bioremediation by microorganisms is very useful due to the action of microorganisms on pollutants even when they are present in very dilute solutions, and they can also adapt to extreme conditions.

In this chapter, previously published research data on the potential of the microorganisms that have been used for the bioremediation of polluted water is discussed. In-depth descriptive information on the bioremediation process uses various microorganisms, including bacteria, and the mechanisms of action, bioremediation efficiency, and current applications are provided together with suggestions to overcome the limitations associated with their large-scale and more efficient application. Future prospects for the potential use of genetic engineering techniques to develop prominent recombinant novel microorganism variants that are more efficient and improvements in the operation conditions of bioremediation technologies will also be discussed and explored.

Microorganisms are widely distributed on the biospher because of their metabolic ability is very impressive and they can easily grow in a wide range of environmental conditions. The nutritional versatility of microorganisms can also be exploited for biodegradation of pollutants. This kind of process is termed as bioremediation. It is continued through based on the ability of certain microorganisms to convert, modify and utilize toxic pollutants in order to obtaining energy and biomass production in the process [7]. Instead of simply collecting the pollutant and storing it, bioremediation is a microbiological well organized procedural activity which is applied to break down or transform contaminates to less toxic or non-toxic elemental and compound forms. Bioremediation uses naturally occurring bacteria, fungi or plants to degrade substances that are hazardous to human health or the environment. However, bioremediation can be effective only in places where environmental conditions permit microbial growth and activity. Where the conditions are not favourable for their growth, manipulation of environmental parameters is carried out to allow microbial growth and allow degradation at a faster rate[8].

These microbes consume the organic mass of the waste water and utilize the nutrients from sewage for their growth, ultimately enhancing the cleaning action of waste water. The treatment can restore water quality and increases the self-cleansing capacity of the water body. The process also helps reduce biochemical oxygen demand (BOD) in sewage and reduces odour.

Waste water often contains organic materials that are decomposed by microorganisms, which use oxygen in the process, and BOD is the amount of oxygen that is used by such organisms in breaking down the waste matter[9].

The microorganisms that are used already exist in nature and this prevents any harm to the environment. Sometimes, they are indigenous to a contaminated area, otherwise, they need to be brought in to the targeted site.

It has been found that as a result of this process, heavy metals and toxic chemicals are also reduced. It also leads to the suppression and elimination of harmful pathogenic bacteria such as E. coli from the treated water.

For a country such as India, where there is a huge lack of adequate sewage collection and treatment systems, this process could be highly beneficial[10]. Many Indian cities have either very poor or non-existent sewage treatment facilities; conditions in rural areas are no better.

One of the biggest advantages of bioremediation is that it can be carried out at the site that is polluted rather than by having to transport huge quantities of waste from the site[11].

However, the success of bioremediation depends on having the right microbes at the right place with the right environmental factors to support it. Also, for greater amounts of waste, enzymes may be needed as a catalyst to speed up the microbes' action[12]. This means every project has to be custom-designed, operated and maintained[13].

Bioremediators are biological agents used for bioremediation in order to clean up contaminated sites. Bacteria, archaea and fungi are typical prime bioremediators [14]. The application of bioremediation as a biotechnological process involving microorganisms for solving and removing dangers of many pollutants through biodegradation from the environment. Bioremidation and biodegradation terms are more interchangable words. Microorganisms are act as a significant pollutant removal tools in soil, water, and sediments; mostly due to their advantage over other remediation procedural protocols. Microorganisms are restoring the original natural surroundings and preventing further pollution [15]. The aim of review to express current trend the application/role of *Staphylococcus* on bioremediation and to contribute relevant background which is identified gaps in this area. Presently, it is hot research area because microorganism are eco-friendly and promising valuable genetic material to solve environmental threats.

Name of the test	At the river Khan station I	At the river Kshipra stationII	At the Joining point of Khan and Kshipra Station III
Turbidity	23.0	22.0	24.0
pH	9.1	8.9	8.5
Colour	Yellow	Greenish yellow	Greenish yellow
Total Alkalinity	380	352	370
Total Hardness	524	440	500
Chloride	320	260	265
Total Dissolved Solids (TDS)	750	600	600
Dissolved Oxygen (DO)	3.0	3.0	3.6
Minimum Probable Number(MPN)	1100	920	920
Biological Oxygen Demand(BOD)	30	26	26
Chemical Oxygen Demand(COD)	145	128	130

Material and Methodology-

In present study Physicochemical parameters studied were i.e. pH, BOD, turbidity, MPN, TDS, Chloride, Total alkalinity, Total hardness and DO by using methods from APHA,AAWA and WPCA at different sampling stations, which were selected for estimation. After initial analysis water sample were filled in container and 1 loopfull of inoculum (*Staphylococcus*)were inoculated in to it, after the incubation of 15 days, 30days and 45days physicochemical parameters were again studied.

Table.1 Physicochemical analysis of following stations.

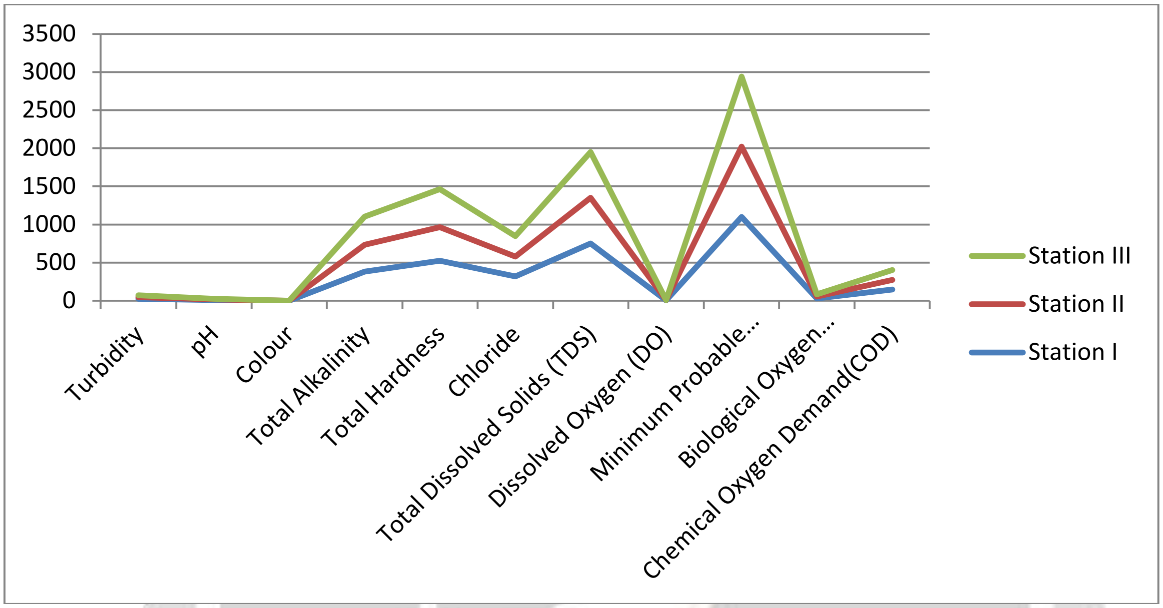
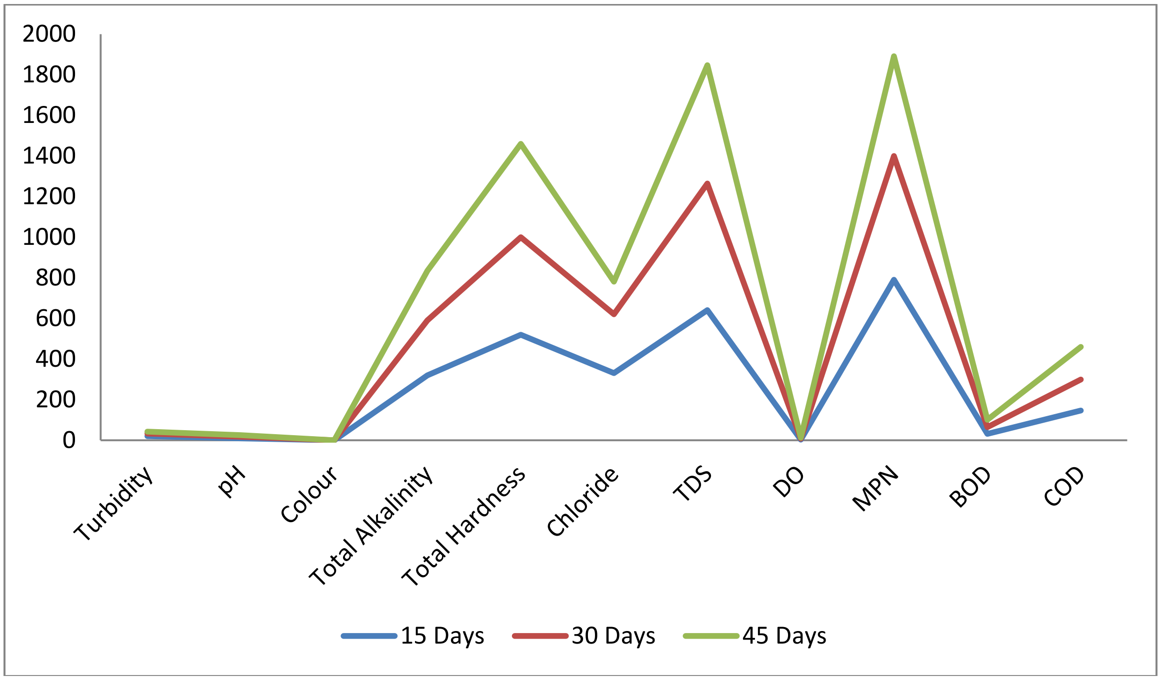


Table.2. Physicochemical analysis of river Khan after the inoculation of ***Staphylococcus.***

Name of the test	**15days**	**30days**	**45days**
Turbidity	20.0	12.8	9.4
pH	8.94	8.48	8.1
Colour	Yellow	Yellow	Yellow
Total Alkalinity	320	270	245
Total Hardness	520	480	460
Chloride	330	290	160
TDS	640	624	582
DO	3.6	4.2	5.0
MPN	790	610	490
BOD	31	34	36
COD	147	152	161



Result and Conclusion

Physicochemical estimation showed that turbidity, pH, total alkalinity, total hardness, chloride, TDS, MPN, BOD and COD were decreses while DO increases which indicate that water quality increases when treated with *Staphyllococcus* species. Biodegradation is very fruitful and attractive option to remediating, cleaning, managing and recovering technique for solving polluted environment through microbial activity. The speed of unwanted waste substances degradation is determined in competition with in biological agents, inadequate supply with essential nutrient, uncomfortable external abiotic conditions (aeration, moisture, pH, temperature), and low bioavailability of the pollutant. Due to this factors, biodegradation in natural condition is not more successful leads to be less favorable. As bioremediation can be effective only where environmental conditions permit microbial growth and activity. Bioremediation has been used in different sites globally within varying degrees of success. Mainly, the advantages is greater than that of disadvantages which is evident by the number of sites that choose to use this technology and its increasing popularity through time. Generally, different species are explored from different sites and they are effective in control mechanism.

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