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Bioremediation Based on Remote Sensing Technology in Urban Polluted River Treatment

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Abstract: With the continuous advancement of ecological civilization construction, the rapid improvement of social economy and the rapid progress of urbanization, serious pollution has been caused to the urban river water environment. Remote sensing technology can extract rich geological hazard information, and is an important means to guide the treatment of urban polluted rivers. The research purpose of this paper is the application of bioremediation based on remote sensing technology in the treatment of urban polluted rivers. In the experiment, taking the rivers A, B and C in M city as the research objects, the investigation and analysis were carried out from three aspects: the experiment of microbial remediation of urban polluted rivers, the application effect of polluted river sediment on water body remediation experiments and polluted river bioremediation.

1. Introduction

In recent years, all parts of the country have been actively carrying out urban river water environmental governance. In the past ten years, many cities have invested a lot of human, material and financial resources to improve the urban water environment. At the same time, it constantly explores and researches new technologies and processes of governance, such as research and pilot projects on environmental protection and ecological cleaning, and discusses the combination mode of ecological governance technology for different types of rivers. The intelligent information system is introduced to supervise sewage outlets and allocate water. Under the circumstance that various treatment technologies have reached a certain level and a single river treatment has achieved certain results, it is particularly necessary to conduct a comprehensive and systematic analysis and summary of urban river treatment technologies based on source pollution control [1].

With the continuous advancement of ecological civilization construction, the rapid improvement of social economy and the rapid advancement of urbanization, serious pollution has been caused to

the urban river water environment.Ramirez Losada VA studies paint factory waste is a serious pollution problem because the wastewater it produces is full of chemicals and toxic substances that can damage the water source and the health of the organisms that live there. The purpose of this project was to determine the removal capacity of total chromium and chlorides from skin wastewater by bioremediation using Chlorella. Three different tested products were investigated and showed that they are very efficient in reducing chromium and chloride ion concentrations and lead to new and novel alternatives for wastewater treatment in the tanning industry [2]. Elizabeth OM's research was designed to investigate the extent of bioremediation that occurred in livestock and crude oil contaminated soil samples treated with the help of Aspergillus niger and Pseudomonas aeruginosa. The eight systems are marked accordingly. Two systems for crude oil control and treated crude oil control will serve as controls, two systems for crude A. crus and treated as. crud were treated with Aspergillus niger only, and two for crude Aspergillus crusae. Pseudomonas aeruginosa and treatment Pseudomonas aeruginosa was treated with Pseudomonas aeruginosa only, the last two systems for crude A. niger and Pseudomonas aeruginosa were treated with Pseudomonas aeruginosa [3]. Bioremediation has also been widely used in the treatment of urban polluted rivers.

According to the research background, this paper studies the application and limiting factors of bioremediation technology, the treatment of urban polluted rivers, the impact and harm of urban polluted rivers, and the application of polluted river treatment, and clarifies the basic concepts, basic principles and remote sensing data of remote sensing technology. In the experiment, the ammonia nitrogen reaction process was used, and the river course profile was implemented according to the microbial enhanced restoration technology. Taking the A, B, and C river courses of M city as the research objects, from the microbial restoration of the urban polluted river course, the pollution of the river course sediment to the water body restoration experiment and pollution The application effect of river bioremediation is investigated and analyzed in three aspects.

2. Application of Bioremediation Based on Remote Sensing Technology in Urban Polluted River Treatment

2.1. Research Background

At present, the world is under the overall trend of structural adjustment of economic production capacity, cultural sharing and interoperability, and mutual learning and integration of science and technology. The economic and technological improvement of various countries is rapid and sustained improvement [4]. But with the extensive improvement of economy and society, there have been many phenomena of ecological environment destruction. The massive increase in population has made my country's per capita water consumption less than a quarter of the world's per capita value. In this context, river pollution in many areas has occurred frequently, resulting in serious water shortages in some parts of the country. Affect the normal life of local residents. The amount of water on the earth is generally constant, that is to say, unless the polluted water source is purified, there will be no new water source to supplement it important support [5]. My country's seven major river basins, as an important channel for water resources in my country, the pollution of the river basins has affected the normal circulation of waters across the country. Serious water conditions have collapsed in some areas. In some rivers, there has been a situation of "there is no water, and water is polluted". Affected by the deterioration of the water quality of the polluted rivers, the quality of life of the residents on both sides of the strait has declined, and the ecological benefits have been damaged, which directly limits the economic improvement of the region. Therefore, the

management of river wastewater is imminent. With the strong support of the state, new technologies such as sewage and wastewater treatment and its resource utilization have been improved to a certain extent, but the treatment of urban polluted river water is still one of the key issues [6].

2.2. Application and Limiting Factors of Bioremediation Technology

In recent years, bioremediation technology for treating soil in urban polluted river remediation has been well improved as it is a thoroughly cost-effective and environmentally friendly remediation technology compared to other physical and chemical remediation efforts. Most bioremediation treatments for oil-contaminated soils fall into two broad categories: biostimulation and bioaugmentation [7-8]. The biostimulation remediation method is mainly to regularly add nutrients such as nitrogen sources, phosphorus sources or organic nutrients to the polluted soil to stimulate the growth and activity of indigenous microorganisms to achieve the purpose of remediation. With the maturity and perfection of bioremediation technology, biostimulation and bioaugmentation technologies cannot be limited to a single nutrient and a single bacterial flora addition. Currently, the biodegradability of petroleum pollutants is affected by many physicochemical and biological factors, such as soil porosity, moisture, pH, nutrients, presence of petroleum degrading bacteria, pollutant concentration and bioavailability, etc. Some of the screened microorganisms could effectively degrade a single contaminant under laboratory conditions, but when they were introduced into actual field conditions with multiple contaminants, they did not perform as expected in experiments. Furthermore, introduced strains may have difficulty competing with indigenous microorganisms in the soil to maintain dominance or viability [9]. To increase the effectiveness of bioremediation, researchers often implement both bioaugmentation and biostimulation, which greatly increases the cost of bioremediation. Therefore, it is difficult to achieve effective bioremediation of oil-contaminated soils if only a single soil amendment, bioaugmentation or biostimulation method is used. Furthermore, bioremediation has many problems, such as expensive microbial preparations, long-term maintenance, and adverse effects in heavily oil-contaminated soils. These problems limit the large-scale application of bioremediation. Therefore, further research is needed to reduce the cost and enhance the effect of bioremediation [10-11].

2.3. Treatment of Urban Polluted Rivers

(1) Impacts and hazards of polluted rivers

The most important type of pollutants in polluted river water are nitrogen and phosphorus nutrients [12]. Both sides of urban rivers are often bordered by residential areas and roads, and are close to living areas. Once the water quality deteriorates, problems such as river blockage, black and odorous water, and collapse of the water ecological environment may occur, which will not only affect the normal flow of water in the river, but also reduce the quality of life of the surrounding residents, causing adverse effects on the lives of residents. The water quality of polluted rivers is unstable, and due to the deterioration of reclaimed water sources, the river ecosystem may collapse [13]. Its existence will limit local economic improvement and adversely affect local tourism and water quality in the lower reaches of the river. Therefore, the treatment of polluted rivers has practical engineering significance.

(2) Application of polluted river treatment

The remediation of polluted rivers is a comprehensive project [14]. The basic content includes not only the treatment of water quality, but also the planning of the surrounding environment. Urban

rivers with ordinary river banks on both sides of the river channel are mostly reserved for rainwater pipes, and the initial rainwater will bring in a large amount of plant humus. Hardening the river bank and building slope protection is beneficial to protect the river course, prevent soil erosion, and reduce the total amount of pollutants entering the river. In addition, polluted rivers in Beijing are often supplemented with reclaimed water from sewage plants, which makes it difficult to maintain the long-term water quality of polluted rivers. Slope wetland technology and submerged phytoremediation have potential purification ability, which is conducive to maintaining the quality of polluted river water, and can produce certain environmental aesthetic benefits. The rational use of related technologies can play a good comprehensive improvement effect. To sum up, the treatment of polluted rivers is not determined by the application of a simple technology, but a complex and cumbersome project that requires the collaboration of multiple technologies [15].

2.4. Remote Sensing Technology

(1) Basic Concepts

Remote sensing, that is, remote sensing, is a technology that detects and recognizes targets by sensing electromagnetic waves, visible light, and infrared rays reflected by a target or radiated by itself from a long distance [16].

(2) Basic principles

The principle of remote sensing technology is spectral properties. Through remote sensing instruments, the electromagnetic wave information and reflection spectrum from ground objects are collected, analyzed, processed, and imaged, and finally clear images of different objects are visually presented under the action of remote sensing technology [17].

(3)Remote Sensing Data Preprocessing

The purpose of data preprocessing is to provide a better foundation for data interpretation in the study area. The remote sensing image map and the collected DEM data in the lower Yalu River basin are used for preliminary data preprocessing, with the help of geometric correction; image fusion; image stitching ; image cropping and other software for processing [18].

3. Investigation and Research of Bioremediation Based on Remote Sensing Technology in Urban Polluted River Treatment

3.1. Materials and Methods

The inoculants were isolated, screened and preserved by our laboratory from the natural environment, respectively: photosynthetic bacteria - Rhodopseudomonas marsh, Bacillus subtilis-BSW, Bacillus subtilis-W14, Pseudomonas stutzeri-ID6.

3.2. Overview of River Channel Implementation of Microbial Enhanced Remediation Technology

This paper takes the A, B, and C rivers in M city as the research objects, and carries out the microbial enhanced restoration experiment of polluted river water body on these three rivers.

3.3. Ammonia Nitrogen Reaction Process

Urine excreted by humans and higher animals contains urea, and urea contains about 47%

nitrogen. The decomposition process of urea is rapidly hydrolyzed into ammonium carbonate under the action of urease, which is very unstable and easily decomposed into ammonia, carbon dioxide and water. Ammonia nitrogen in domestic sewage mainly comes from the hydrolysis of urea. Its reaction formula is:

$$CO(NH_2)_2 + 2H_2O \rightarrow (NH_4)_2CO_3 \quad (1)$$

$$C(NH_4)_2CO_3 \rightarrow 2NH_3 + CO_2 + H_2O \quad (2)$$

In nature, there are many ammonizing bacteria involved in the process of ammonification reaction, mainly including aerobic Pseudomonas fluorescens and prodigious bacteria, facultative denaturing bacteria and Clostridium spoilage. The bacteria that cause urea hydrolysis are called urea bacteria. Urea bacteria can be divided into two categories: cocci and bacilli. They are generally aerobic, but do not require much oxygen, and some strains can grow under anaerobic conditions.

4. Analysis and Research of Bioremediation Based on Remote Sensing Technology in Urban Polluted River Treatment

4.1. Microbial Restoration of Urban Polluted River Experiments

Add 90L, 30L and 70L of photosynthetic bacteria to A river, B river and C river respectively. Then add BSW, W14, ID6 every day. A river, B river and C river began to carry out bioremediation at the same time. The arrangement of inoculation is shown in Table 1 and Figure 1:

Table 1. Daily amount of bacteria used in each rivers

Strain	A river	B river	C river
Photosynthetic bacterium	90	30	70
BSW	30	10	50
W14	30	10	10
ID6	15	10	10

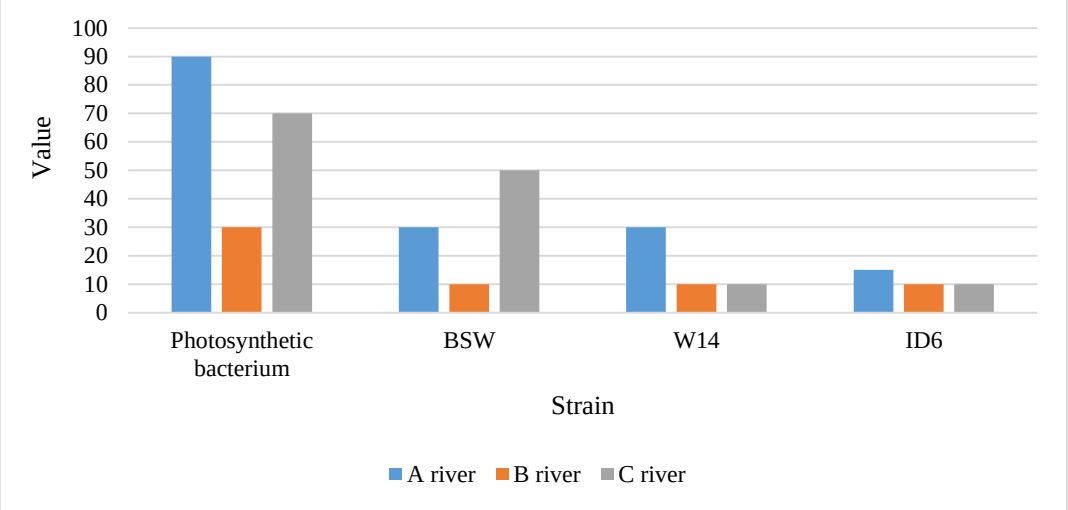

Figure 1. Comparison diagram of bacteria injection volume in the three river channels

4.2. Experiment on Water Restoration by Polluted River Sediment

In the remediation technology of river polluted water, the treatment of sediment is a focal point. When the sediment is deficient in oxygen, ammonia nitrogen will be released to the water, thus affecting the effect of water bioremediation. Therefore, we carried out sediment simulation experiments to explore the effect of sediment on the microbial remediation of polluted water bodies while remediating urban rivers. Take the A river bottom mud and mix it and pack it into three buckets with a capacity of 60L and a height of 1 meter, and then take the river water and pack it into three buckets, and the water volume in each bucket is about 60L. In order to monitor the changes of ammonia nitrogen and total nitrogen, the specific scheme is shown in Table 2 and Figure 2:

Table 2. Sediment simulation program

Experimental group	River water/L	Substrate sludge/cm	Temperature℃	Dissolve of oxygen mg/L
1#	60	20	17	0.84
2#	60	15	16	0.51
3#	60	10	18	0.25

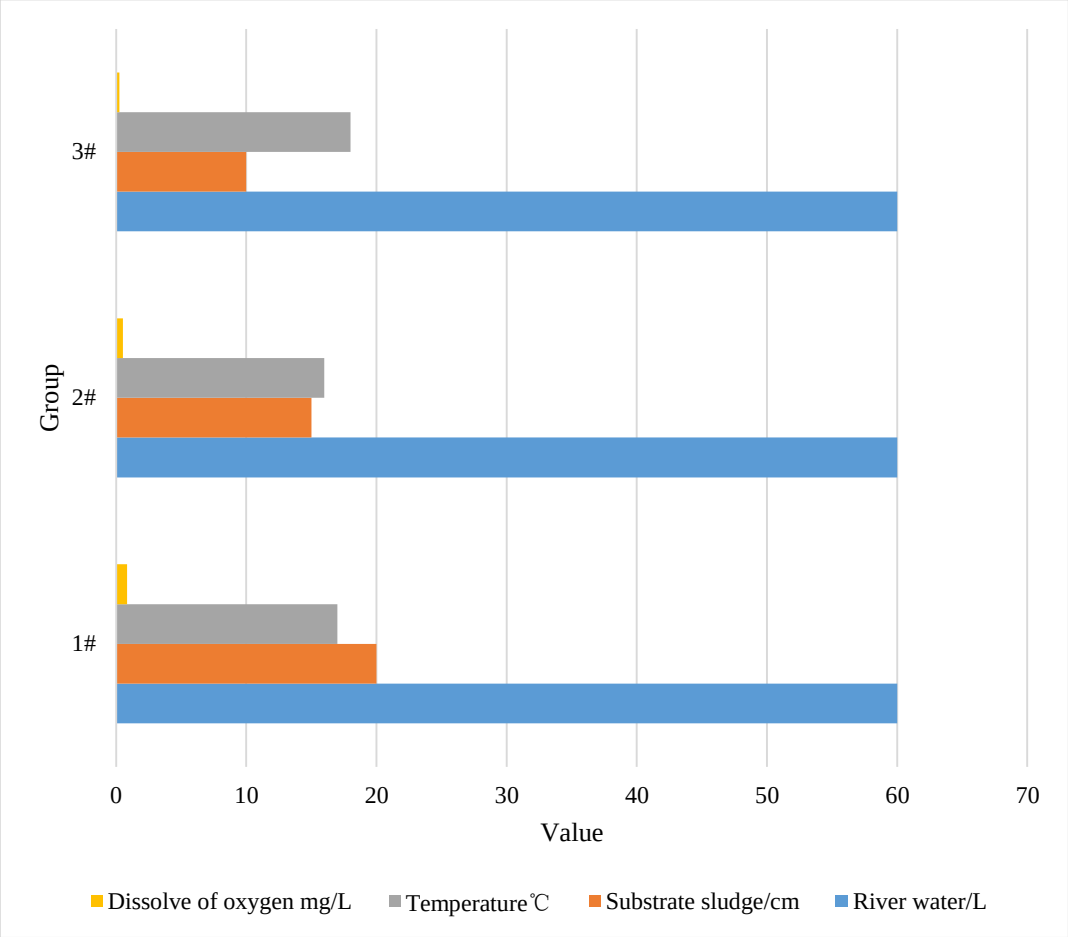

Figure 2. Experimental data comparing Fig

4.3 Application Effect of Bioremediation of Polluted Rivers

The removal rate of total nitrogen in the three rivers was higher than that of the control point within 10 days, indicating that the addition of exogenous microorganisms in the short term has a better denitrification effect, and it can be clearly seen that the four kinds of bacteria used together have the best effect. However, compared with River C, the addition of denitrifying bacteria ID6 showed obvious advantages in denitrification except for point S1. Point S1 may be because the initial total nitrogen concentration was lower and the denitrification effect was not obvious. The total nitrogen removal rates of the three rivers are shown in Table 3 and Figure 3:

Table 3. The TN removal efficiency of every river

Sample dot	1st day	2nd day	TN removal rate %
B1	15.61	12.54	28.3
B2	12.65	10.27	32.1
B3	18.34	13.56	39.6
S1	12.31	10.95	29.3
S2	21.35	19.87	31.5
S3	18.14	13.01	39.2
DI	12.63	10.51	20.8
D2	26.01	20.39	41.1
D3	19.30	14.67	38.1

In order to make better use of microorganisms for water purification, on the one hand, it is necessary to analyze the pollution status of the water environment, so as to use suitable bacteria or change the water environment to suit the growth of microorganisms, such as adding organic carbon sources in waters with an unbalanced carbon-nitrogen ratio to suit the Microbial growth and metabolism; on the other hand, it is necessary to improve the tolerance and adaptability of water purification microorganisms, or to screen and domesticate specific strains that can better adapt to the polluted water conditions. At the same time, the method of direct injection can also be changed, and the immobilized microorganism technology can be used. This technology can immobilize the

screened dominant bacteria that can degrade specific substances, so it can enhance the specificity and tolerance of the sewage treatment system. The effect is stable, and the degradation efficiency is obviously better than the traditional method.

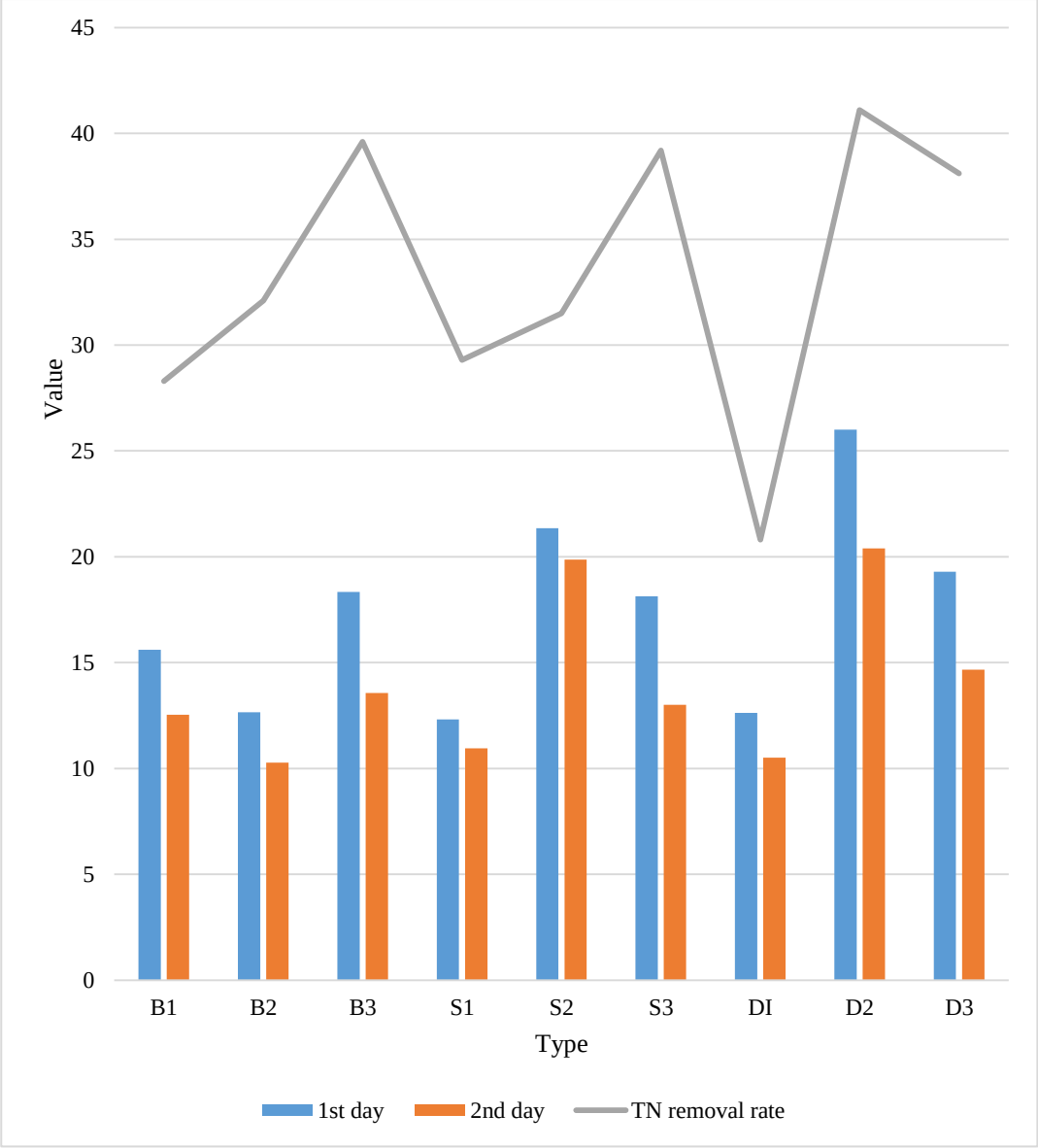

Figure 3. The TN removal efficiency of total nitrogen during the restoration of polluted river water body

5.Conclusion

In order to achieve sustainable and effective restoration of urban polluted river water bodies, the pollution source should be effectively controlled first, which can be gradually improved through the further implementation of the national government's energy-saving and emission-reduction policy and the "water special project". In terms of bacterial strain screening applications, not only focus on the results of laboratory biodegradation experiments, but also a large number of experimental data

for practical applications before a reliable restoration plan can be determined. For different urban polluted river water bodies, it is necessary to thoroughly understand the differences in water quality, water environment and pollution sources. When repairing, supplementary nutrients should be supplemented, or highly targeted bacteria should be added, or the polluted water bodies should be domesticated. Bacteria and other different technical means. Bioremediation requires the combined application of aquatic plants, fish, plankton, etc. while using microorganisms as the main force, and then uses physical and chemical methods as auxiliary means to form a good ecological circulation system and fundamentally restore the self-purification of water bodies. The ability to make the urban river once again become a beautiful landscape for citizens to leisurely visit.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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