Scholar Publishing Group
Academic Journal of Environmental Biology
https://doi.org/10.38007/AJEB.2022.030304
ISSN 2789-8407 Vol. 3, Issue 3: 27-34

Environmental Biotechnology in Environmental Pollution Control Based on Data Mining Algorithm

Romany Vijun*

Jawaharlal Nehru University, India

**corresponding author*

Keywords: Data Mining, Environmental Biology, Environmental Pollution, Pollution Control

Abstract: With the continuous development of computer technology, the application of computer technology, especially big data analysis technology, will be able to process a large amount of environmental monitoring information system data. Because the data sources of environmental monitoring information system data are complex and the amount of data is huge, this is also able to Mining the innate advantages in processing such characteristics of environmental monitoring information data. The purpose of this paper is to study the application of environmental biotechnology in environmental pollution control based on data mining algorithm. Using data mining technology, based on the evaluation of dioxin activity, the M lake was sampled, the dioxin activity of organic extracts in water and biological samples was detected, the main active components were identified, and the dioxin causing toxicity was identified. The experimental results show that all organic extracts of biological samples can cause aromatic hydrocarbon receptor activity, and dioxin-like substances accumulate seriously in shellfish. Provide certain theoretical basis and technical support for the further management and governance of M Lake.

1. Introduction

In recent years, with the acceleration of urban development, and the rapid increase in the amount of urban waste. Waste-to-energy technology is an effective measure to deal with the increasing urban waste [1]. However, improper operation in the garbage disposal process can easily cause chemical substances such as dioxins to pollute the environment. Dioxins in the atmosphere can enter the soil or water body during the process of atmospheric deposition, and indirectly cause soil and water pollution [2]. As a result, dioxin pollution is also common in soil, water and sediments in my country, and the pollution situation in some areas is very serious [3-4].

As an important manufacturing country in the world, my country has to deal with the huge

environmental pressure brought about by the continuous deterioration of the ecological environment [5]. Some scholars have advocated the idea that significant progress can be made using artificial habitat selection to achieve the desired biological patterns, an approach that uses principles of ecological evolution. Selected regions can be used directly for bioremediation applications or can be further analyzed and restored, for example by combining biological processes, synthetic biology and genetic engineering [6]. Other scholars elaborated on the main environmental challenges and risks facing Uzbekistan, as well as possible applications of environmentally friendly laser biotechnology for more effective and rational protection of ecosystems and large-scale reclamation of deteriorating areas. In this process, coherent lasers are used to optimize the natural processes involved in the bioremediation of xenobiotics or the bioaccumulation of metals. Furthermore, laser biotechnology can be widely used for more efficient recycling of contaminated soil, wastewater treatment, and to increase the growth rate of irradiated plants and their resistance to various macro- and micro-pollutants in air, soil, and water [7]. Therefore, it is of practical significance to study the application of environmental biotechnology based on data mining algorithm in environmental pollution control.

The focus of this paper is to analyze the current situation of dioxin pollution in my country and the commonly used detection methods for dioxin-like compounds, and on this basis, propose a data mining technology to improve the prevention and control of dioxin pollution. The innovation is based on the technical requirements required for the prevention and control of dioxin pollution, and proposes more specific and comprehensive detection measures for the prevention and control of dioxin pollution, in order to contribute to the practical needs of my country's dioxin pollution prevention and control.

2. Research on Environmental Biotechnology Based on Data Mining Algorithm in Environmental Pollution Control

2.1. Dioxin Pollution Causes Systematic Damage to Ecological Environment Security

As persistent organic pollutants, dioxins have the general hazards of persistent organic pollutants [8]. Dioxins in the air are often adsorbed on fine particles and accumulate in soil and water bodies through sedimentation. Because of their persistence, they remain in the environment for a long time and are difficult to be biodegraded. Once they enter the soil and water bodies, they are difficult to eliminate., resulting in soil and water pollution. At the same time, under such repeated deposition and volatilization, dioxins are continuously circulated and accumulated in the entire ecosystem, and then dioxins are dispersed in a large area or even the global environment, including the Antarctic and the Arctic, and finally the environment for human survival. Quality drops [9-10].

2.2. Commonly used Detection Methods for Dioxin Compounds

(1) Chromatography

Chromatographic detection of chemicals such as dioxins requires initial extraction and purification of the analytes in the sample, followed by separation using chromatographic columns and quantitative and qualitative analysis using similar detectors [11].

(2) Immunological methods

Compared with chromatography, the main advantages of immunological methods for detecting dioxins are: the detection time is short, and the detection process usually only takes a few hours; the activity is relatively simple, mainly dioxins. The requirements for samples, test procedures and

testers are loose; the cost of testing samples is also cheap. However, the method of obtaining polyclonal antibodies by immunizing animals with dioxin as a hapten also has its disadvantages. Antibodies prepared by immunizing rabbits with dioxin congeners and serum albumin can only specifically recognize polyclonal viruses [12].

(3) Biological methods

Compared with immunological methods, biological methods can detect more samples simultaneously and do not require complex preparations such as antibody preparation. However, this assay requires cell culture and the assay measurement time is long. Cell culture, although not difficult, is easily contaminated [13-14].

2.3. Data Mining Technology

Data mining was originally defined as the process of extracting valuable information from large databases, but with the development of information technology, data sources have become more and more abundant and abundant [15-16]. The process of finding valuable information in databases and electronic data streams. With the advancement of data mining methods in computer science, a large amount of data generated by environmental monitoring systems can be analyzed using data mining techniques to draw valuable conclusions. After using modern computer technology, some of these methods can describe the current situation of the environment, and some can predict the future environmental data, which can provide valuable help for the formulation of environmental management policies [17-18]. The implementation process of data mining is shown in Figure 1:

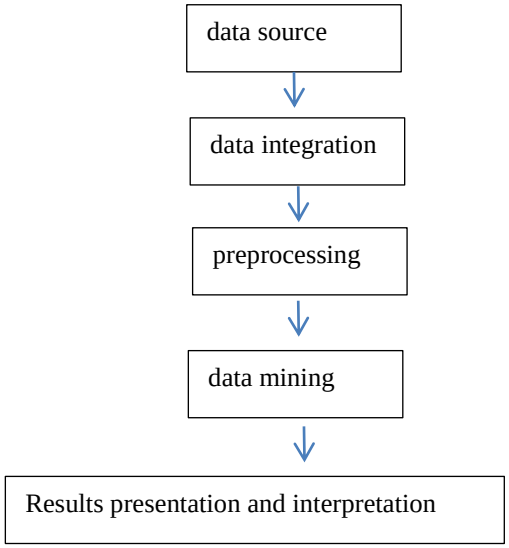

Figure 1. Implementation process of data mining

3. Investigation and Research of Environmental Biotechnology Based on Data Mining Algorithm in Environmental Pollution Control

3.1. Sampling Point Layout

N1 and S1 (N represents sediment and S represents water) in the water and sediment sampling points of M Lake are the central points of M Lake and are considered to be least disturbed by

humans; N2 and S2 are located in the semi-enclosed lake bay in the northwest of M Lake, Affected by the inflow of sewage into the lake and rivers, and there are dense industrial workshops and small chemical factories around, the water quality is inferior to Class V all year round, and algal blooms gather all year round. It is the lake area with the most serious water pollution in Lake M, and its sediment pollution is serious; N3 And S3 area is famous for sightseeing; N4 and S4 are lake bays in the north of M Lake, which are algal lakes; N5 and S5 are located in the northern part of the west coast of M Lake, which is the largest entrance of M Lake into the lake, which is affected by the quality of upstream water., its water pollution is serious, it is inferior V class, and the sediment also has serious pollution risks.

3.2. Collection and Processing of Samples

Surface water samples were collected from Lake M in January 2022, and 10L of water samples were collected at each sampling point. The water samples were stored in brown glass bottles, and the glass bottles were first washed with hexane, methylene chloride, methanol and ultrapure water, and washed three times with water samples on site. Samples are quickly transported back to the laboratory in an incubator with an ice pack. After the water sample was filtered through a 0.45um membrane, solid-phase microextraction technology was used to enrich the organic matter in the water. The extraction column was a SupelcoENVI-C18 column. 5m/min, the solid phase extraction column was activated with 5ml n-hexane, 5ml dichloromethane, 5ml methanol and 5ml deionized water before use.

There are biological samples collected from the M Lake area, which are carp, mussel, snail, and white shrimp. The biological samples were placed in a freeze dryer for lyophilization for one week, and then lyophilized. Weigh a certain amount of the denatured samples for extraction using an accelerated solvent extractor, and take 2 g of silicon that had been washed with n-hexane, methylene chloride and acetone in advance. diatomaceous earth, mixed with the sample and filled with the sample cell. The extraction conditions were: 1500 psi, the extraction temperature was 100 ° C., the static time was 10 min, and the extraction solvent was dichloromethane/n-hexane (V/V: 1/1), and extracted 3 times. The extracted sample was rotary evaporated to about 1 ml, the rotary evaporation flask was rinsed three times with 10 ml of n-hexane and dichloromethane mixed solution and transferred to a serum bottle, 5 ml of concentrated sulfuric acid was added, and the macromolecular fatty acids were fully shaken to remove macromolecular fatty acids, and the organic phase was collected. Add 10 ml of n-hexane and dichloromethane to extract twice. The collected organic phase was swirled and concentrated with nitrogen, and the volume was made up to 100ul with DMSO.

3.3. Evaluation of Dioxin Activity

At present, the relative potency (ReP) is the most widely used method to evaluate the toxicity of dioxin-like substances. ReP is usually expressed as the EC value of the standard substance TCDD divided by the EC value of the compound, as shown in formula (1).

$$ReP = EC_{\text{standard material TCDD}} / EC_{\text{compound}} \quad (1)$$

The toxic equivalents of environmental samples obtained according to GC-MS/MS are expressed in terms of toxic equivalents expressed relative to TCDD (TCDDEquivalents, TEQ). TEQ is the sum of the product of the concentration of the measured target compound and its corresponding

toxicity equivalent (Relative Potency) value, and the calculation formula is shown in formula (2).

$$TEQ = \sum_{i=1}^{n} Concentration_i \times TEF_i \quad (2)$$

4. Analysis and Research of Environmental Biotechnology in Environmental Pollution Control Based on Data Mining Algorithm

4.1. Dioxin Activity of Total Organic Extracts from Water Samples

Table 1 shows the detection results of aromatic hydrocarbon receptor activity of total organic extracts from water source water in five lake areas of M Lake. times), no dioxin activity was detected, as shown in Figure 2. All aqueous organic extracts were not cytotoxic to H4IIE-luc. Most of the known dioxin-like substances are relatively non-polar substances, and the adsorption coefficient of soil organic carbon is high, so they are easy to be adsorbed in sediments, but insoluble in water. The water body of Lake M poses no risk to human health.

Table 1. Detection results of aromatic hydrocarbon receptor activity

Five Lake District Sampling Sites	10 times concentrated	20 times concentrated	30 times concentrated	40 times concentrated
N1-S1	1.5	1.2	0.8	1.6
N2-S2	2.6	1.3	2.5	1.4
N3-S3	3.3	2.1	1.6	2.2
N4-S4	4.9	3.5	2.5	3.6
N5-S5	1.8	2.1	2.3	1.2

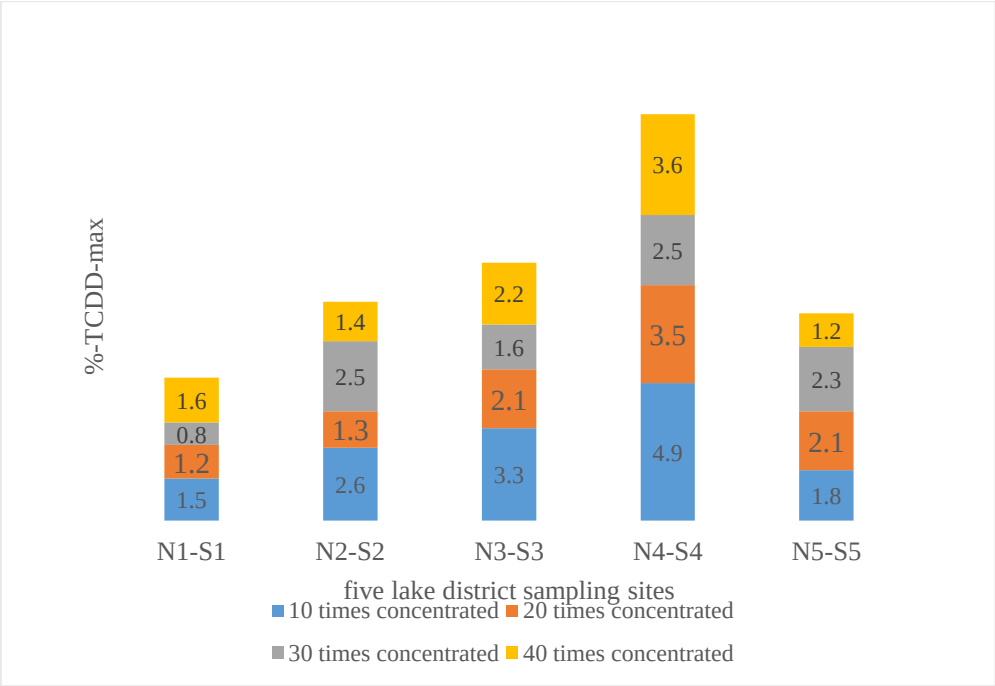

Figure 2. Dioxin activity of organic extracts with different concentration ratios of water samples from different lake areas of M Lake

4.2. Dioxin Activity in Biological Total Organic Extracts

In this study, total organic extracts from four organisms (carp, mussels, shrimp, and snails) collected from Lake M were tested for dioxin activity. The results showed that the TCDD-EQ of biological samples from Lake M ranged from 1.05 to 3.28 pgTCDD/g, wet weight (minimum: carp, 1.05 pgTCDD/g, wet weight; highest: snail, 3.28 pgTCDD/g,.wet weight), as shown in the table 2 shown. Shellfish live in aquatic organisms, and although they are in a lower trophic level, they have a strong ability to enrich dioxins (mussel: 2.99pgTCDD/g, wet weight). The concentrations of dioxins in the tested biological samples were all lower than the intake threshold for dioxins and their analogs in fish samples (6pgTCDD/g, wet weight), and there was no health risk from ingesting fish and shellfish. As shown in Figure 3.

Table 2. Toxic equivalents of -baiying in extracts of water biological samples(pgTCDD/g)

Fingerlings	TCDD-EQ(wet weight)	TCDD-EQ(dry weight)
Carp	1.05	8.88
Mussel	2.99	4.62
Shrimp	3.15	6.55
Screw	3.28	6.01

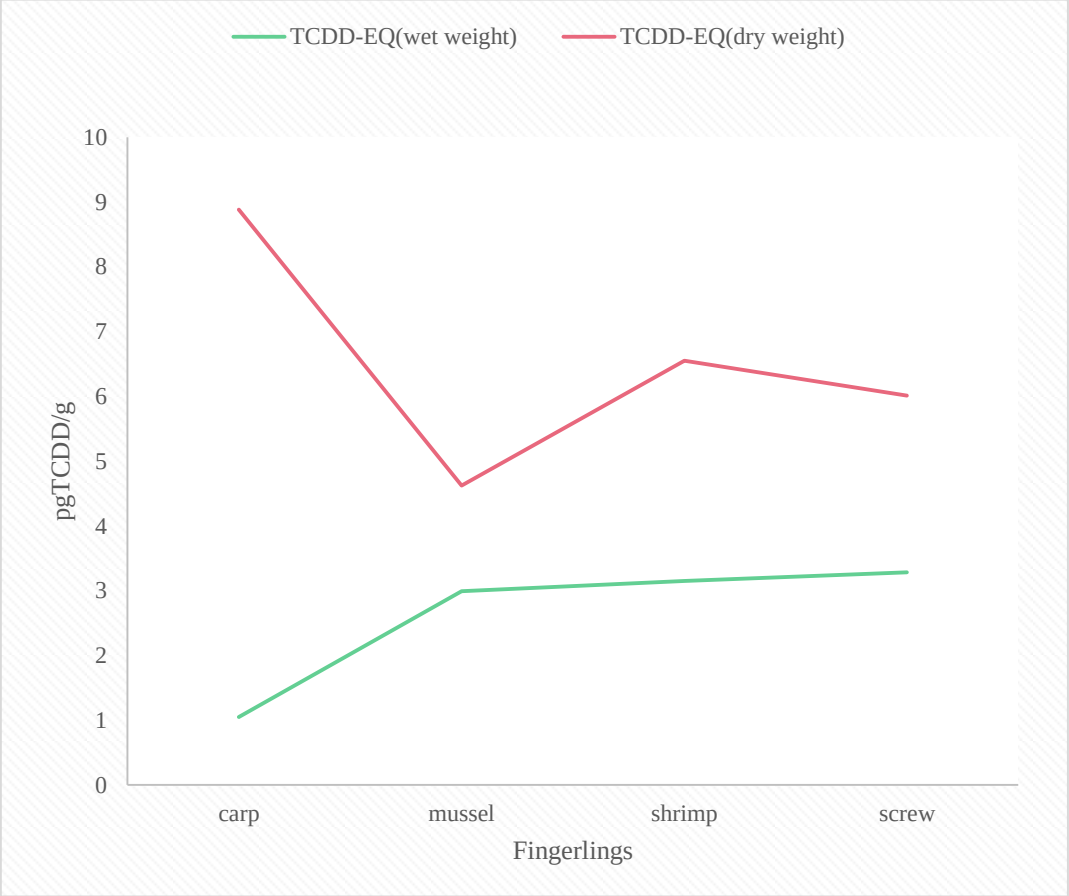

Figure 3. Test results of biototal organic extraction

5. Conclusion

The research on dioxins is currently receiving widespread attention in the world, and the research in this field in my country is still in its infancy. Therefore, the research results of this paper will help to promote the emission and control of dioxins in my country. The constructed dioxin activity detection can meet the needs of environmental protection departments and enterprises and institutions. It can not only provide a modern means of rapid response for dioxin pollution accidents and pollution source supervision and detection in different occasions, but also can be used for industrial production processes such as waste incineration. Provide reliable technical support, and at the same time, it can also make my country's research on dioxin monitoring reach the international forefront as soon as possible.

Funding

This article is not supported by any foundation.

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.

References

[1] Santos, R. O, Rehage, et al. Combining data sources to elucidate spatial patterns in recreational catch and effort: fisheries-dependent data and local ecological knowledge applied to the South Florida bonefish fishery. Environmental Biology of Fishes, 2019, 102(2):299-317. https://doi.org/10.1007/s10641-018-0828-x

[2] Rahman M J, Amin S, Nahiduzzaman M, et al. Influence of seasons, habitat sanctuaries, gears and environmental variables on the catches of hilsa shad (Tenualosa ilisha) in Bangladesh waters. Journal of environmental biology, 2018, 39(5SPEC.):767-776. https://doi.org/10.22438/jeb/39/5(SI)/21

[3] Perin G, Jones P R. Economic feasibility and long-term sustainability criteria on the path to enable a transition from fossil fuels to biofuels. Current Opinion in Biotechnology, 2019, 57(Environmental Biotechnology):175-182.

[4] Eskandari F, Shahnavaz B, Mashreghi M. Optimization of complete RB-5 azo dye decolorization using novel cold-adapted and mesophilic bacterial consortia. Journal of Environmental Management, 2019, 241(JUL.1):91-98.

[5] Mnif I, Ellouz-Chaabouni S, Ghribi D. Glycolipid Biosurfactants, Main Classes, Functional Properties and Related Potential Applications in Environmental Biotechnology. Journal of Polymers and the Environment, 2018, 26(5):2192-2206. https://doi.org/10.1007/s10924-017-1076-4

[6] Kulikowska D, Gusiatin Z M. Effect Of Temperature Conditions On Cu, Ni, Zn And Fe Complexation By Humic Substances During Sewage Sludge Composting. Environmental

Engineering & Management Journal, 2019, 18(1):213-223. https://doi.org/10.30638/eemj.2019.021

[7] Guest J, Novak P, Wang A. Anaerobic technology. Environmental Science: Water Research & Technology, 2018, 4(11):1720-1720. https://doi.org/10.1039/C8EW90040J

[8] Pandiyan, Rajesh, Ayyaru, et al. Non-toxic properties of TiO2 and STiO2 nanocomposite PES ultrafiltration membranes for application in membrane-based environmental biotechnology. Ecotoxicology and Environmental Safety, 2018, 158(Aug.):248-255.

[9] Sevda S, Sharma S, Joshi C, et al. Biofilm formation and electron transfer in bioelectrochemical systems. Environmental technology reviews, 2018, 7(1):220-234.

[10] Taneez M, Hurel C. A review on the potential uses of red mud as amendment for pollution control in environmental media. Environmental ence and Pollution Research, 2019, 26(22):22106-22125. https://doi.org/10.1007/s11356-019-05576-2

[11] Shetty C, Sowmya B J, Seema S, et al. Air pollution control model using machine learning and IoT techniques - ScienceDirect. Advances in Computers, 2020, 117(1):187-218.

[12] Taneez M, Hurel C. A review on the potential uses of red mud as amendment for pollution control in environmental media. Environmental ence and Pollution Research, 2019, 26(22):22106-22125. https://doi.org/10.1007/s11356-019-05576-2

[13] Hross M. Flow distribution improvements at the Stamford Water Pollution Control Facility. The NEWEA journal, 2019, 53(2):26-31.

[14] Rameezdeen R, Kaluarachchi M, Waidyasekara K. Antecedents of noise pollution control behaviour of employees of construction companies. Built Environment Project and Asset Management, 2022, 12(2):277-292.

[15] Hsrpd A, Fukuda P T, Tamaki P Y, et al. Computerized data mining analysis of keywords as indicators of the concepts in AHA-BLS guideline updates. The American Journal of Emergency Medicine, 2020, 38(7):1436-1440.

[16] Nguyen T V, Zhou L, Chong A, et al. Predicting customer demand for remanufactured products: A data-mining approach. European Journal of Operational Research, 2020, 281(3):543-558. https://doi.org/10.1016/j.ejor.2019.08.015

[17] Alsuwaiket M A, Blasi A H, Altarawneh K. Refining Student Marks based on Enrolled Modules' Assessment Methods using Data Mining Techniques. Engineering, Technology and Applied Science Research, 2020, Vol. 10(No. 1):5205-5010. https://doi.org/10.48084/etasr.3284

[18] Junaid K, Ejaz H, Younas S, et al. Detection of Klebsiella pneumoniae antibiotic-resistant genes: An impending source of multidrug resistance dissemination through raw food. Saudi Journal of Biological Sciences, 2022, 29(5):3347-3353. https://doi.org/10.1016/j.sjbs.2022.02.020