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Study on Acute Toxicity and Genotoxicity of Abandoned Pesticide Factory Polluted Site

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Abstract

Soil samples were collected from 6 different areas of the abandoned pesticide factory site, numbered p1, p2, p3, p4, p5, and p6, respectively. Based on the acute toxicity of Luminescent bacteria and Flea and the genotoxicity of Vicia faba root tip micronucleus, the ecotoxicological diagnosis of soil extracts from 6 samples was carried out. The results showed that the relative luminosity of the 6 kinds of extracts to luminescent bacteria were 50.7%, 56.3%, 43.7%, 53.0%, 49.6% and 67.6%, respectively. The 48-hour acute toxicity EC50 of the large flea was 6.15%, 8.65%, 0.57%, 2.52%, 0.33% and 14.94%, respectively. The results of the photobacterial experiment were basically consistent with the acute toxicity results of Flea daphnia, and the results showed that the soil pollution of the pesticide factory site was relatively serious.

Keywords

Large Flea; Photogenic Bacteria; Toxicity.

1. Introduction

With the acceleration of urbanization and industrialization, the polluted sites of various abandoned chemical enterprises have caused serious harm to human society and the ecological environment, and have become a worldwide environmental problem [1]. Soil environment management and restoration of polluted sites is an important task of environmental protection in my country, and the research on "countermeasures for soil environment management and restoration of contaminated sites" is also an important research content of the national environmental protection "Twelfth Five-Year Plan" [2]. Therefore, strengthening the pollution diagnosis of abandoned chemical polluted sites and assessing their human health and ecological environment risks can provide a scientific basis for the risk management of polluted sites and the implementation of restoration measures. Usually relying on chemical analysis of soil samples on site, but contaminated sites are often unable to identify target pollutants due to complex production history and no data for reference, which brings certain difficulties to chemical analysis, and it is impossible to determine the content of chemical pollutants alone. The environmental risk of pollutants is scientifically evaluated [3]. At present, chemical analysis and ecotoxicity indicators have been combined to diagnose soil pollution at home and abroad. Many countries have taken ecotoxicity indicators as an important basis for decision-making in

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the management of polluted sites. In this paper, a group biological test method was used to carry out ecotoxicological diagnosis of abandoned pesticide factory sites [4].

2. Materials and Methods

2.1. Experimental Materials

Soil samples were collected from 6 different areas, and were collected from 10-20 cm of the outer layer of soil in the abandoned pesticide factory. The specific distribution is shown in Table 1. The test soil samples were air-dried, ground and then sieved. The soil texture is silt loam, and the basic physical and chemical properties and pH values are shown in Tables 2 and 3.

Table 1. Distribution of Soil Samples from Abandoned Pesticide Plants

Serial number	Sample	Location
1	P1	Workspace
2	P2	Sewage treatment area
3	P3	Auxiliary facilities area
4	P4	Dangerous Goods Warehouse Area
5	P5	Workshop area
6	P6	Outside the factory

Table 2. Basic physical and chemical properties of soil in pesticide plants

Organic matter /(g/kg)	Cation exchange /(cmol/kg)	N/(g/kg)	P/(g/kg)	K/(g/kg)
13.87	12.26	1.33	1.61	16.23

Table 3. pH value of soil sample leachate

Serial Number	pH
P1	7.38
P2	7.31
P3	7.21
P4	7.35
P5	7.53
P6	7.41

2.2. Soil Extraction Extraction

The leaching test was mainly carried out with reference to "Solid Waste Leaching Toxicity Leaching Method-Horizontal Oscillation Method" with slight modifications. The extraction solution is pure water. Do 3 parallels. Take 20g of dry sample into a 500ml conical flask, add leaching agent at a solid-to-liquid ratio of 1:10, close the bottle cap and fix it vertically on a horizontal reciprocating constant temperature oscillator, and adjust the oscillation frequency to (110±10) times /min, the amplitude is 40mm, the extraction bottle is removed after shaking at room temperature for 8h, and it is allowed to stand for 16h. The leachate was suction filtered with a 0.45 μm microporous membrane, and then stored in a polyethylene bottle. After filtration, the pH value of the leachate was measured immediately. The results are shown in Table 3. Then put the liquid samples directly in the refrigerator at 4°C for use in the biological toxicity test.

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2.3. Biological Toxicity Test

2.3.1. Acute Toxicity Test of Luminescent Bacteria

The Microtox SOLO Reagent luminescent bacteria lyophilized powder stored at -22°C was revived with 1mL MicroTox dilution solution stored at 4°C for 15min, and 0.1mL of the revived bacterial solution was taken, and the luminescence intensity was read with the ATP mode of the DeltaTox toxicity detector, and the luminescence intensity was greater than 1 million photons numbers can be used for experiments. Take 1 mL of water sample, add 0.1 mL of osmotic pressure regulator solution, mix well, select the B-Tox mode of the DeltaTox toxicity detector for the experiment, first read the luminescence intensity of 0.1 mL of the resuscitated bacterial solution, and then take the osmotic adjusted water 0.9 mL of the sample was added to 0.1 mL of the resuscitated bacterial solution (3 parallels in each group, with MicroTox dilution as the control), and the relative luminosity was measured at a constant temperature for 5 min after mixing.

2.3.2. Acute Toxicity Test of the Large Flea

① Pre-test: prepare the water samples according to the concentration series of geometric series (the concentration interval can be wider, such as 0.1, 1, 10, 100).

A series of concentrations were made, 5 fleas were placed in each concentration, and 4 fleas were placed in parallel at each concentration, and the results were observed for 48 hours. The concentration and the maximum tolerated concentration range of the water sample to be tested can be inhibited by 100% large-scale pan movement through pre-experiment, and then the concentration of the formal test is designed within this range.

②Formal test: within the concentration range of the formal test, design 5-7 concentrations of test solution according to the concentration series of geometric series, put 5 fleas in each concentration, and 4 parallels in each concentration, and record each concentration at 48 hours. The 48hECs value was calculated by the number of inhibition of large-scale culprits at each concentration.

③ Quality assurance and quality control. Analytical pure potassium dichromate was used to determine the 24hEC of the experimental large-scale sao, which was between 0.5 and 1.2 mg/L.

2.4. Data Processing

Each group of experiments was repeated 3 times to obtain 3 groups of data, and SPSS19.0 was used to analyze the mean and standard deviation. The relative luminosity of luminescent bacteria was calculated by Deltatox system, and the 48hEC value and 95% confidence interval of large-scale Sao were calculated by SPSS19.0 software.

3. Results

3.1. Acute Toxicity Test of Luminescent Bacteria

Table 4. Acute toxicity test of luminescent bacteria

Relative Luminosity(L)/%	Toxicity level
70<L≤90	Low
50<L≤70	Middle
30<L≤50	High
0<L≤30	Very high
L=0	Extremely high

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Table 5. Acute toxicity results of photoluminescent bacteria in contaminated soil leachate

Sample Number	Relative Luminosity	RSD%	Toxicity level
P1	50.7%	1.2	Middle
P2	56.3%	7.2	Middle
P3	43.7%	2.1	Very high
P4	53.0%	2.0	Middle
P5	49.6%	1.6	Very high
P6	67.6%	2.7	Low

Through the acute toxicity detection of luminescent bacteria on the contaminated soil samples at 6 sites, it was found that the samples at 6 sites had acute toxicity, and the toxicity detection rate was 100%. Among them, P3 and P5 are highly toxic, P1, P2, and P4 are poisonous, and P6 is low toxicity. It can be seen that the pesticide factory has polluted the soil due to the long-term pesticide production and transportation. Through the biological toxicity test at different points inside and outside the factory, it is found that most of the contaminated soil is biologically toxic, and some points are toxic. Very large and has a certain impact on health effects.

3.2. Toxicity Experiment of the Large Flea

Table 6 shows the results of the acute toxicity of the large fleas. The toxicity evaluation standard mainly refers to the "Monitoring and Analysis Methods for Water and Wastewater" Biological Monitoring Methods for Water and Wastewater - 48h EC50 Acute Activity Inhibition Toxicity Grading Standard in the Large Flea Activity Inhibition Test, ≤1 is extremely toxic, 1-10 is highly toxic, and 10-100 is poisonous. The acute toxicity test of the polluted soil samples at 6 points showed that the samples at P3 and P5 were extremely toxic, P1, P2 and P4 were highly toxic, and P6 was poisoned. Consistent with the acute toxicity results of luminescent bacteria.

Table 6. Acute toxicity results of the polluted soil leachate of P. flea

Serial Number	48h,EC_{50}/%	Toxicity level
P1	6.15	High
P2	8.65	High
P3	0.57	Very high
P4	2.52	High
P5	0.33	Very high
P6	14.94	Middle

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