Industrial wastewater biological toxicity research status

Nan Xiao[1,a], Litang Qin[2,a], Xin Zhang[1,a], Yanhong Li[2,a]*, Fan Zhang[1,a],

[1]College of Environmental Science and Engineering, Guilin University of Techonlogy

[2]Experimental Center of Guangxi Mining Environment, Guilin University of Technology

Email: [a] xn597320102@foxmail.com

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Abstract: Toxicity test can intuitively reflect the combined toxicity of contaminated water bodies, predict and control is a necessary adjunct to chemical pollution, and is widely used to test surface water and industrial wastewater. This paper describes the significance of the various types of biological and toxicity tests, and from the type of toxicity tests are reviewed before domestic research used in various biological toxicity testing methods, and the prospect of its application.

Introduction

With the development of economic, industrial emissions is growing. Such a great variety of types and quantities of pollutants in wastewater, common pollutants in the environment work, presents the complex interactions of an organism toxic. Method for determination of environmental monitoring can be divided into physical-chemical analyses and biological monitoring. Physical and chemical indicators including turbidity and pH value, chroma, ammonia nitrogen, COD, BOD and so on. Although the analysis can be more rapid and sensitive determination, and representative of the nature of the water pollution, to serve as a basis for formulating standards for pollutants concentration control, but they have certain limitations. Toxicity of pollutants generated by the not entirely depends on the chemical parameters are exceeded. Biomonitoring can continuously monitor the impact of pollutants on the environment and on comprehensive toxicity analysis of industrial waste water, so using chemical analysis of biological toxicity testing as additional means to evaluate the water quality [1].

Characteristics of industrial wastewater pollution

Coking wastewater

Coking wastewater component is generally more complex, its main source of the production process including washing the dust water, cooling water, washing soda, separated during distillation separation of water, recycling waste water generated in the process [2]. Coke-plant wastewater due to the diversity of its sources. Its main ingredient is more complex, has the following characteristics [3]: 1.high concentration of pollutants; 2.refractory; 3.large capacity of drainage; 4.high content in organic substances; 5.one of the typical wastewater industry. Coking wastewater great harm, not only difficult to degrade *PAHs* in wastewater, but also strong carcinogen, causing serious pollution to the environment and direct threat to human health.

Printing and dyeing wastewater

Printing and dyeing wastewater processing mainly cotton, linen, chemical fiber and blended products of the printing and dyeing mill effluents. Printing and dyeing wastewater pollutants mainly

from the textile fiber itself and the process used in dyes, desizing wastewater before discharge printing production process, the waste water scouring, bleaching wastewater and waste silk, dyeing and printing process wastewater discharge dyeing, soaping wastewater and printing wastewater discharge finishing process wastewater. Features: 1.large amount of water; 2.high concentration and COD, most of the waste water is alkaline, color depth; 3.large fluctuations in water quality; 4.mainly organic pollution; 5.handling difficulty; 6.Some wastewater containing hazardous substances [4].

Printing and dyeing wastewater containing a large amount of organic pollutants discharged into water bodies will consume dissolved oxygen, destruction of the ecological balance of the water, endangering fish and other aquatic organisms. Sink to the bottom of the organic matter, due to the anaerobic decomposition of hydrogen sulfide and other harmful gases, deterioration of the environment. Color wastewater deep, serious impact on the receiving water body appearance. The main factors causing water colored dye. Currently the world's total production capacity of 600,000 tons of dye, of which more than 50 percent for textile dyeing; and in the textile printing and dyeing, 10% to 20% of the dye as a waste product. Most alkaline printing and dyeing wastewater into farmland, course land salinization; sulfate dyeing wastewater in soil under reducing conditions can be converted into sulfide, hydrogen sulfide.

Biological pharmacy wastewater

Biological pharmaceutical complex wastewater components, high content in organic substances, and high colloid solid content, pH value is not stable, relatively high temperature, wastewater contains color and smell, high SS content, easy to produce foam, refractory materials, Biohazard. Their specific features: 1.the high COD concentration; 2.SS concentrations is very high; 3.there are biodegradable and antibacterial effect of toxic substances such as antibiotics; 4.high sulphate concentrations; 5.complex; 6.small and intermittent water discharge, high shock loads; 7.high nitrogen content, mainly in the form of ammonia nitrogen and organic nitrogen [5].

Petrochemical wastewater

Synthetic rubber and synthetic petrochemical wastewater mostly plastics, fibers, detergents and other products, as well as benzene, naphthalene, methanol, glycerin, acetaldehyde wastewater and other chemicals in the production process, containing raw materials and products, by-products, its high content of organic matter and gave off a bad smell, need for precipitation, biological treatment or ozone treatment, such as activated carbon adsorption treatment [6].

Characteristics: 1.waste water emissions; 2.pollutants in complex; 3.wastewater treatment is difficult. Kinds of pollutant and diverse nature, some are biodegradable and may persist in the environment.

Biological toxicity category

For more intuitive and accurate understanding of typical wastewater ecological risk, you need to understand the typical industry wastewater on aquatic toxicity. Wastewater toxic effects on aquatic organisms acute toxicity, subacute toxicity, chronic toxicity, genotoxicity, endocrine disruption and behavioral toxicity of organisms.

Acute toxicity: refers to the sample in a relatively short time on biological toxicity, the subjects usually include 24h, 48h, 72h, 96h.

Subacute toxicity: is the subjects bio under a repeatedly violated by poison toxicity exhibited by the response, every interval in the experiment many times to join the same poison, to understand the biological toxicity of tolerance.

Chronic toxicity: refers to a long period of time (from a few days to dozens of day) toxic

long-term toxicity effects on test organisms, can understand the poison had no effect on the biological effects of acute subsequent toxic effects.

Genetic toxicity: is the poison of test organisms teratogenic, carcinogenic, mutagenic, can grow to understand the biological life, resulting in the development of toxicity response [7].

Endocrine disrupting chemicals: study on test animals specific organs, the toxicity and reproductive toxicity responses of cells, helps to study on the toxic mechanism of [8].

Behavior of organisms acute toxicity: is under the poison damage, behavior exhibited by the biological anomalies, often of animals (mainly fish), including range of motion, speed of action, activities and so on, in comparison with the normal behavior, integration of multiple sets of experimental data, explore the abnormal toxicity responses of organisms [9].

Significance of biological toxicity testing

Typical pollutants in wastewater by complex, high organic content, to determination of all concentrations of pollutants, and toxic effects of pollutants between had plus the joint, synergistic and antagonistic roles. The conventional project is the determination of physico-chemical analysis of inorganic contaminants and organic pollutants. Like COD, BOD, ammoniacal nitrogen, not reaction of toxic wastewater. Water quality standards and wastewater emission targets can be divided into indicators and a single index. Single indicators was based on the environmental pollution by toxic and hazardous chemicals and their toxicity to the development [10]. Environment in the accumulated of material gradually increased makes water environment standard in the single material of control index also yearly increased, this increased single material control index of method exists many insufficient: 1.single index no consider chemical material on ecological system of effect; 2.can’t from chemical material of concentration to judge its toxicity size; 3. can't found new of toxicity. So, even if the determination of pollutants to waters from being polluted by the representative nature, because you cannot predict the interactions between toxic substances and, therefore, difficult to analyze data from diverse pollutant concentration to predict the real hazards of waste water [11]. On the toxicity of pollutants are concerned, a certain pollutant toxicity to aquatic organisms, is not entirely depends on the concentration of chemical parameters such as standard. Therefore, physical and chemical monitoring of integrated analysis does not reflect the effects of pollutants on the environment and long term effects. In contrast biological monitoring not only reflect the impact of pollutants on the environment and on the impact of pollutants on the growth and reproduction [12]. Toxicity test is used to research and develop suitable indicators of industrial effluent toxicity control is particularly important.

Acute toxicity of progress

Acute toxicity testing methods including *Luminous bacteria* toxicity test, algal toxicity, *Daphnia* toxicity tests of water and fish toxicity test [13].

Luminous bacteria glowing is a normal metabolic activity, issued a blue-green light of wavelength 490nm. When the luminescent bacteria in contact with hazardous substances, bacteria respiratory disturbance or damage to or of a physiological process, glow effects will be subdued, *Luminous bacteria* toxicity test by measuring samples of *Luminous bacteria* glowing for a short time to judge the degree of toxicity of pollutants effects on the metabolic activity of living organisms and the sample [14].

Zhang use of the *Luminous bacteria* on the part of enterprises in Jinzhou city wastewater biological toxicity testing, physical and chemical indicators simultaneously test, comparing the two,

the results show that the use of *Luminous bacteria* can be detected enterprise wastewater discharge status [15]. Wang such as the use of *Luminous bacteria* acute toxicity test Qiqihar city part of the plant wastewater test, and the results were divided toxicity level, but also with the theoretical data to make comparison, the toxicity test to better reflect the quality comprehensive toxicity [16] . In summary, the analysis of toxic industrial waste water using *Luminous bacteria* was feasible method is rapid, simple, accurate and stable economy. And with chemical analysis, chemical separation technology, identification and removal of toxic substances in industrial waste water it provides an effective evaluation method.

Algae as primary producers of aquatic ecosystems, due to the small size, short life cycle, propagation speed, susceptible to environmental influence of various factors change in a short time, it is an ideal material for biological toxicity test . Yu use of biological toxicity *Chlorella pyrenoidosa* monitoring of industrial waste water, according to the toxic effects of phenol *Chlorella pyrenoidosa* linearly related to the law, in order to explore *Chlorella pyrenoidosa* as a biological monitoring, as with phenol reference toxicant, the quantitative characterization of industrial waste water pollution its comprehensive toxicity [17]. This result and the actual situation of water quality monitoring and evaluation methods basically.

Daphnia is a type of zooplankton, because of their rapid reproduction, short generation cycle, easy to train, and very sensitive to many toxic substances, is a standard test organism for toxicity test, widely used in the evaluation of the toxicity of environmental contaminants. Contamination of toxic to *Daphnia* in water damage in the reproductive and growth, and so on. *Daphnia* in mortality and fertility are commonly used as an indicator of toxicity testing [18]. Pan, using the large *Daphnia* to several water samples for toxicity testing of the pollution of township enterprises, large *Daphnia* to chemical plant outfall water sedimentation tank and leather factory drainage with high sensitivity [19]. Description of large *Daphnia* acute toxicity test can be used to monitor the toxicity of industrial waste water, is a sensitive, low cost and rapid toxicity testing methods. But for the *Luminous bacteria* and algae, *Daphnia* breeding work in the early trouble.

Fishes are very sensitive to changes in the water environment, water contains trace amounts of toxic and harmful substances can cause toxic reactions. Which are widely used in biological monitoring of toxic substances and waste, assessment, which quality standards and emission standards can be developed and the management of industrial waste water. Liu, to *Zebra fish* and *Peacock fish* for experiment object, on paper, and dyeing wastewater of acute toxicity effect for has research, exploration fish acute toxicity test as evaluation industrial wastewater toxicity method of feasibility, results displayed zebra fish, and peacock fish for wastewater the pollution gradient of reaction are has more obviously of differences, can more accurate to reflect wastewater of integrated toxicity and sewage factory wastewater processing facilities of processing effect [20].

At present, more and more researchers embarked on a variety of biological test methods. Zhang in order to assess the impact of wastewater on aquatic organisms, *Selenastrum capricornutum*, *Daphnia*, *Zebra fish* for a wastewater treatment system of printing and dyeing enterprises influent and effluent toxicity was evaluated [21]. Results showed that the water have a strong toxicity to three aquatic organisms, shows that the consistency of the results.

Summary

The review showed that using biological toxicity tests to evaluate the toxic industrial waste water is feasible, so ecotoxicity indicators should be introduced in the waste-water emission standards. Currently, researchers on various indicates biological acute toxicity experiment of research do have are compared full, can on various indicates biological do chronic toxicity experiment of research;

industrial wastewater in the contains large of organic, production wastewater also contains large of organic, can will various different nutrition level of indicates biological for production wastewater of toxicity test, and evaluation analysis out which species indicates biological can more fast, and simple of monitoring production wastewater biological toxicity.

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