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Research on Remediation of Soil Organic Pollution by Fenton-like Oxidation Technology

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Abstract: Fenton-like oxidation technology has the advantages of high remediation efficiency, mild conditions, and simple operation in the remediation of soil organic pollution. It has been widely used in the remediation and degradation of various organic pollution. The article briefly describes the development process and reaction principle of Fenton-like technology, and analyzes the remediation effects of different types of Fenton-like technology on organic pollution.

Keywords: Fenton-like, organic contaminated soil.

1. Introduction

As an important part of the ecological environment, soil is an important material basis for human survival. However, in the process of rapid social development, the extensive use of pesticides and fertilizers, the arbitrary discharge of harmful pollutants and industrial wastewater, and the accumulation and infiltration of various types of garbage infiltration have caused serious soil organic pollution and soil quality deterioration problems [1-3]. Especially some persistent organic pollutants, such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), DDT, etc., are highly toxic, biologically accumulative, and can migrate in the environment, causing damage to nearby residents. Long-term hazards. The current remediation technologies for soil

organic pollution mainly include physical remediation, chemical remediation and biological remediation. Fenton-like remediation technology is a kind of chemical remediation. Compared with other remediation methods, this technology has the advantages of high efficiency, mild conditions and simple operation. It has been widely used in the remediation and degradation of various organic pollution in the environment. The process is more environmentally friendly and will not cause secondary pollution to the soil. Therefore, Fenton-like remediation technology has become a popular technology for soil organic pollution remediation, and it is of great significance to study and discuss the development trend of Fenton-like technology in soil organic pollution remediation.

2. The development of Fenton-like technology

In 1894, the French chemist Fenton discovered that adding ferrous ions to hydrogen peroxide would produce strong oxidizing hydroxyl radicals (·OH). Since then, scholars have tried to use this method to degrade various organic pollution in the environment. However, the homogeneous Fenton reagent has obvious defects. Iron ions are easy to form precipitates during the reaction process. It is necessary to maintain the reaction pH at about 3 to maintain high oxidation efficiency, and the reaction rate is difficult to control and easy to produce side reactions, which may lead to organic pollution. Degradation is not complete.

3. Fenton-like technology

The Fenton-like reaction was developed based on the Fenton reaction. In response to the problem of the Fenton reaction, scholars have tried various attempts to improve the conditions of the Fenton-like reaction to increase the reaction efficiency, such as photocatalyst Fenton reagents, Chelating agent modified Fenton and heterogeneous Fenton and other technologies.

3.1 Photocatalytic Fenton

The photocatalytic Fenton technology promotes the efficiency of the Fenton reaction by adding light energy. The addition of light energy can increase the generation of hydroxyl radicals, and can effectively increase the conversion efficiency of trivalent iron and divalent iron, thereby avoiding precipitation Mass generation. Zheng Sican and others added a 20w 365mm UV lamp around the self-made UV-assisted reactor, which effectively increased the removal efficiency of toluene in the air, and the degradation products were all carbon dioxide [4].

3.2 Chelating agent modified Fenton

Chelating agent-modified Fenton uses various chelating agents to generate iron complexes to avoid the formation of iron precipitation. Common chelating agents are EDTA, citric acid, oxalic acid, tartaric acid and EDDS. For example, Zhang Qiuzi et al.

used the chelating agent sodium citrate to degrade petroleum hydrocarbons in the soil. The results showed that when the dosage of 0.15 mol/L sodium citrate was 4 mL, the degradation efficiency of petroleum hydrocarbons could reach 97.71% [5]. Among them, EDTA has relatively large complex constants with divalent iron and trivalent iron, which are 24.23 and 14.33, respectively. Therefore, EDTA is often used to promote the efficiency of Fenton reaction to solve the existing problems of traditional Fenton reagents [6].

3.3 Heterogeneous Fenton

Heterogeneous Fenton's reagent refers to the use of iron-containing solid catalysts instead of ferrous ions in the solution. The reaction is not carried out in the solution, but on the surface of the solid catalyst to catalyze the hydrogen peroxide to produce hydroxyl radicals. The macromolecules of pollutants will also be adsorbed on the surface of the solid material and be oxidized and decomposed by hydroxyl radicals. This indicates that the reaction is carried out on the surface of the catalyst, which can effectively avoid the production of iron precipitation and improve the degradation of organic pollutants. efficient. Moreover, the catalyst is solid and can be recycled by certain means to reduce the secondary pollution problem in the soil remediation process. Cai Jiaxi and others loaded iron on the surface of zeolite to prepare an iron-loaded zeolite heterogeneous Fenton catalyst, which was used to degrade petroleum-contaminated soil. When degrading 10 g of lightly contaminated soil, the catalyst dosage was 2 g, and hydrogen peroxide was added. The amount is 7.5 mL, and the degradation efficiency is up to 70.09% [7]. Chi Yongzhi et al. used the citric acid sol-gel method to prepare a zeolite-loaded Fe/Ce heterogeneous Fenton catalyst for the degradation of malachite green. The results showed that the COD degradation rate can reach 70% and the decolorization rate within 30 minutes. Up to 97.3% [8].

4. Outlook

With the emergence of Fenton-like technology, the traditional Fenton reaction has gradually overcome the shortcomings of the traditional Fenton reaction for the strict requirements of reaction pH and the catalyst is easy to form precipitation, and basically meets the environmental requirements of soil remediation. However, most of the current repair technologies are costly and difficult to meet the needs of actual projects. Therefore, finding some Fenton-like reagents with simple processing technology, low cost, easy mass production and environmentally friendly is the main development direction of soil pollution control in the future.

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References

[1] Fu Qiuguo, "Environmental behavior and fate of three representative new organic pollutants in soil and plant systems", Zhejiang University, 2016.

[2] Guan Xiaoxia, "Discussion on soil organic pollution remediation technology", Flowers, 2016, Vol. (12), p89-90.

[3] Xue Miao, Xie Jinliang, "Characteristics of heavy metals and organic pollution in the soil around municipal solid waste incineration plants in my country", Energy Conservation in Nonferrous Metallurgy, 2019, Vol. 35 (04), p60-65.

[4] Zheng Sican, Chen Tianhu, and Liu Haibo, et al., "Photo-assisted Fenton reaction to catalyze the degradation of toluene in gas", Environmental Science, 2015, Vol. 36 (10), p3590-3595.

[5] Zhang Qiuzi, Wei Yunxiao, and Jiang Yonghai, et al., "Catalytic oxidation capacity of hydrogen peroxide on petroleum hydrocarbon contaminated soil", Journal of Environmental Engineering Technology, 2017, Vol. 7 (01), p65-70.

[6] Pan Yue, "Study on the reaction mechanism of Fenton-like technology in the treatment of polycyclic aromatic hydrocarbons contaminated soil and calcium peroxide system", Shanghai Jiaotong University, 2019.

[7] Cai Jiaxi, Lei Yukun, and Zhang Shici, et al., "Experimental study on remediation of petroleum-contaminated soil by iron-bearing zeolite heterogeneous Fenton", Journal of Wuhan University of Technology, 2018, Vol. 40 (07), p78-83.

[8] Chi Yongzhi, Xi Yulan, and Li Xiuping, et al., "Preparation and characteristics of Fe/Ce/zeolite supported Fenton-like catalysts", Environmental Engineering Journal, 2012, Vol. 6 (09), p3068-3072.