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Research on Remote Video Control Technology for Total Amount of Groundwater Environmental Pollutants in Power Plants

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Abstract: Because the traditional remote control technology does not have the visualization effect, the control efficiency of the total amount of groundwater environmental pollutants is low. Therefore, the remote video control technology for total amount of groundwater environmental pollutants in power plant is proposed. Calculate the total amount of groundwater environmental pollutants in the power plant, determine the effective control range, and adopt remote video control algorithms to achieve remote video control of the total amount of groundwater environmental pollutants in the power plant. The experimental results show that the total control efficiency of groundwater environmental pollutants of remote video control technology is 11.78% higher than traditional control technology, which means that the remote video control technology has extremely high effectiveness.

Keywords: Groundwater; Total Amount of Pollutants; Remote Video; Control Technology; Power Plant

1. Introduction

The control of groundwater environmental pollutants in power plants in China is usually by remote control technology. Although the traditional remote control technology can control the groundwater environmental pollutants in the power plant, the control efficiency is low, which seriously limits the further development of the power plant sewage treatment technology[1]. Therefore, the remote video control technology for the total amount of groundwater environmental pollutants in power plants is proposed. In this paper, by calculating the sum of the three capacities of dilution capacity, self-purification capacity and migration volume, the total amount of groundwater environmental pollutants in the power plant is obtained. Then the control range of the total amount of groundwater environmental pollutants is determined. The remote control algorithm is used to optimize the remote video control algorithm of total groundwater environmental pollutants. By delay ratio, adjust the calculation formula of the remote video control process to realize remote video control of the total amount of groundwater environmental pollutants in the power plant. In order to verify the effectiveness of the remote video control technology for the total amount of groundwater environmental pollutants in the power plant designed in this paper, the simulation experiment is designed. The experimental results show that the remote video control technology can improve the control efficiency of groundwater pollutants, shorten the control time and have effectiveness.

2. Research on Remote Video Control Technology for Total Amount of Pollutants

Firstly, the control range of the total amount of groundwater environmental pollutants in the power plant is determined. Only when the remote video control can be realized within the total amount of the maximum pollutants can the remote control technology be effective. Therefore, after determining the control range of the total amount of groundwater environmental pollutants, the remote video control algorithm is optimized, the calculation steps of the remote video control algorithm are simplified, and the remote video control of the total amount of groundwater environmental pollutants in the power plant is realized.

2.1. Determine the control range of the total amount of groundwater environmental pollutants

The control of the total amount of groundwater environmental pollutants in power plants should be carried out based on understanding the total amount of groundwater environmental pollutants. Therefore, it is necessary to first grasp the regional hydrological environment and determine the pollutant indices and related parameter characteristics of the groundwater environment[2]. Then, calculate the degradation coefficient of pollutants according to the contaminated medium of different pollutants, and further determine the control range of the total amount of groundwater environmental pollutants in the area. The calculation process of the total amount of groundwater environmental pollutants is shown in Figure 1.

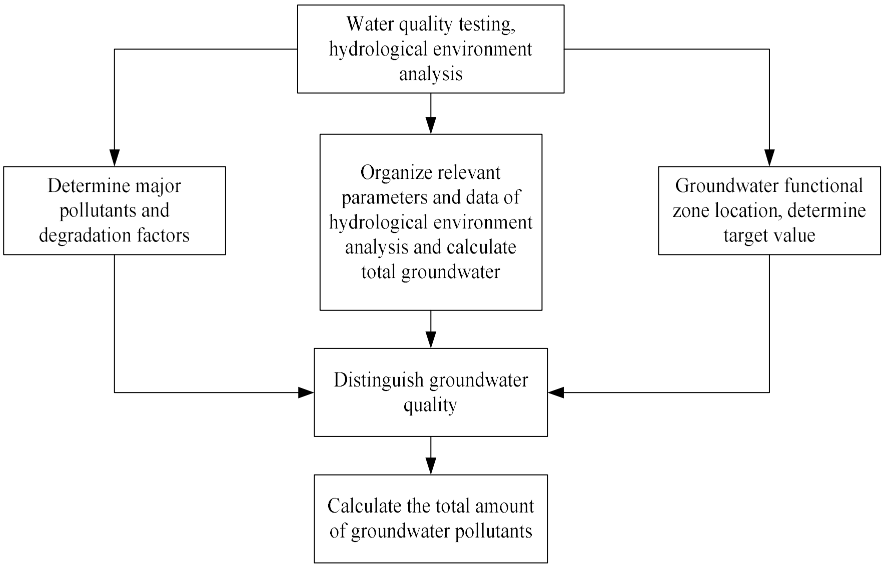

Figure 1. Calculation structure of the total amount of groundwater environmental pollutants

The sum of the three capacities of the dilution capacity, self-purification capacity and migration volume of the pollutants in the groundwater environment of the power plant is the total amount of environmental pollutants in the groundwater of the power plant[3].

The dilution capacity function expression for groundwater environmental pollutants is Q_1

$$Q_1 = \frac{10^{-3}}{T}\sum_{i=1}^{n}(C_1 - C_0)V_i \quad (1)$$

In this formula, C_1 represents the target concentration of a given contaminant, and the unit is mg/L. C_0 represents the initial concentration of a given contaminant, and the unit is mg/L. V_i represents the volume of groundwater, and the unit is m3. T represents the measurement duration of dilution capacity of groundwater environmental pollutants, and the unit is d. It should be noted that 10^{-3} is a unit conversion factor and has no substantial meaning. Considering the relationship of continuous usage of groundwater, make T tend to infinity, and it can be considered that the dilution capacity of groundwater environmental pollutants in this area is zero[4]. Since this study has a calculation period, the dilution capacity must be present in the groundwater environmental pollutants. Therefore, during the research process, the measurement time of the dilution capacity in the groundwater environmental pollutants T is limited to 30~50a.

According to the analysis in formula(1) it can be seen that, the larger the volume of groundwater, the lower the initial concentration of pollutants, the higher the target concentration of pollutants and the greater the dilution capacity of groundwater environmental pollutants; vice versa.

Under the premise that the constant of reaction rate of groundwater is limited to less than 10, the functional equation Q_2 for calculating the self-purification capacity of groundwater environmental pollutants according to the reversible reaction equation of groundwater is:

$$Q_2 = \sum_{i=1}^{n} K_i C_0 V_i \quad (2)$$

In this formula, K_i represents the degradation rate of groundwater environmental pollutants, and the unit is d-1.

The migration of groundwater environmental pollutants is mainly composed of the pollutants taken by the artificially pumped groundwater and the pollutants discharged by the groundwater runoff [5]. The functional equation of the migration of groundwater environmental pollutants Q_3 is:

$$Q_3 = \sum_{i=1}^{n} C_0 P_i + \sum_{i=1}^{n} C_s M_i \quad (3)$$

In this formula, P_i represents the amount of groundwater exploitation, and the unit is m3/d. C_s represents the standard value of groundwater environmental pollutants in the designated area, and the unit is m3/d; M_i represents the total discharge of groundwater, and the unit is m3/d.

The total amount of groundwater environmental pollutants in the power plant is the sum of dilution capacity, self-purification capacity and migration amount, and then the total amount of groundwater environmental pollutants Q is:

$$Q=Q_1+Q_2+Q_3 \tag{4}$$

That is:

$$Q=\sum_{i=1}^{n}\left(\frac{10^{-3}}{T}(C_1-C_0)V_i+C_0(K_iV_i+P_i)+C_sM_i\right) \tag{5}$$

With the above calculation, after the measurement error is controlled within a reasonable range, the total amount of groundwater environmental pollutants in the power plant is obtained, and then the control range of the remote video control technology for the total amount of groundwater environmental pollutants in the power plant is determined.

2.2. Optimization Algorithm Design of Remote Video Control

After determining the total amount of groundwater environmental pollutants in the power plant, the optimization algorithm of remote video control for total amount of groundwater environmental pollutants is proposed by reference to the in the literature. The optimization process of the algorithm introduces the delay ratio and sets the delay ratio, which effectively reduces the path delay difference in the remote video process, improves the visual quality of video control, and realizes the remote control of the total amount of groundwater pollutants. The remote video control process is shown in Figure 2.

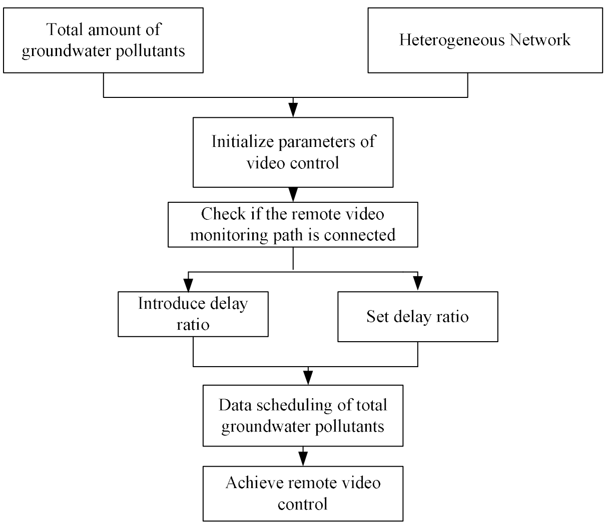

Figure 2. The remote video control process is shown

By introducing the delay ratio, the number of delay paths in the remote video control process is reduced, the control path congestion is avoided, the delay phase differences between the remote video control paths are shortened, and the total amount of groundwater environmental pollutants is scheduled and realized. Finally, the remote video control of the total amount of groundwater environmental pollutants in power plants is realized. At the same time, it also reduces the error of the control process, reduces the number of false positives, effectively improves the control rate and overall performance of the traditional control technology, and improves the control efficiency of the remote video control technology. The optimization design process of the remote video control algorithm is as follows:

Introduce the delay ratio in the control path[6] and calculate the control ratio of the path:

$$I=\frac{T_k}{\sum_{i\in n} RQT_j} \tag{6}$$

In this formula, I represents the control output ratio; T_k represents the delay value of each control path; R represents the number of paths that introduced the delay ratio; T_j represents the delay value after the delay ratio is introduced.

According to the above formula, it is derived that $\theta_{\min}\le\theta_I$ [7]. According to this derivation process, the limit value of the control path is obtained. The transmission window of the dynamic control path is adjusted by remote technology, and the adjustment equation is as follows:

$$N=D_k-\frac{\eta w D_k}{\theta_I}-(1-I) \tag{7}$$

In this formula, N represents the number of transmission windows of the control path; D_k represents the window size of the control path at the next time; η represents the lowest sub-path transmission ratio; w represents the driving item of the remote control technology.

After many experiments, it is determined that the remote video control effect is the most obvious when the value of $\theta_{\min}$ is 1.5[8]. Then, by setting up a limit window at the remote control output, the remote video control algorithm for the total amount of groundwater environmental pollutants in the power plant can be completed.

3. Experimental Argumentation Analysis

In order to ensure the effectiveness of the remote video control technology for the total amount of groundwater environmental pollutants in the power plant designed in this paper, the experimental argumentation is carried out. The experimental argumentation demonstrates that the groundwater environment should be of the same total amount of pollutants and in the same power plant for remote video control argumentation experiments. In order to ensure the rigor of the experiment, the traditional remote control technology was used as the comparison of experimental demonstration, and the total control efficiency of the water environment pollutants of the two technologies was counted. The experimental results are shown in Table 1.

Table 1. Comparison of Experimental Argumentation Results

	Remote video control technology	Traditional remote control technology
Total amount of pollutants (d)	50	50
Number of control paths (a)	4	6
Control time (h)	45	74
Total control rate(%)	98.78	87.91
Overall cost (ten thousand yuan)	15.63	28.49

According to the data analysis in Table 1, it can be seen that under the premise that the total amount of groundwater environmental pollutants in the power plant is 50d, the control path of the remote video control technology is less than that of the traditional remote control technology. Indicating that the control links of the total amount of pollutants are less. The control time of remote video control technology is shorter than the control time of traditional remote control technology for more than 24h. The total control rate of remote video control technology is 11.87% higher than the total control rate of traditional remote control technology, indicating that remote video control technology has high efficiency in controlling the total amount of water environmental pollutants. Besides, the cost of remote video control technology in the control process is 12.68 million yuan lower than the cost of traditional remote control technology. According to the above analysis, it can be determined that the remote video control technology for the total amount of groundwater environmental pollutants in the power plant designed in this paper is effective, and has good control efficiency when controlling the total amount of groundwater environmental pollutants. At the same time, it can reduce the control cost and improve the economic benefits for power plant enterprises.

4. Conclusion

This paper analyzes and designs the remote video control technology for the total amount of groundwater environmental pollutants in power plants. By determining the control range of the total amount of groundwater environmental pollutants, the remote video control algorithm is optimized to achieve effective control of the total amount of groundwater environmental pollutants. The experimental argumentation shows that the remote video control technology designed in this paper has extremely high effectiveness, can improve the control efficiency of the total amount of groundwater environmental pollutants, and reduce the control cost of enterprises. It is hoped that the research in this paper can provide theoretical basis and reference for the control technology of the total amount of groundwater environmental pollutants in power plants.

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References

[1] Zhou Zhichao. Research on total pollutant control based on groundwater environmental capacity [D]. Xiamen University, 2016,12(56):101-103.

[2] Gu Hao, Xu Hongfei, Chen Weibing. Research on Industrial Pollution Total Control System Based on Internet of Things Technology [J]. Internet of things technologies, 2016, 6(11):84-86.

[3] Xiao Jianhua. Discussion on the control of total pollutant discharge in environmental protection [J]. Metallurgical Collections, 2016,46(5):69-72.

[4] Li Tingshun, Liu Zesan, Yu Zhuo, Huang Qi. Simulation of Remote Communication Control Signal Intrusion Detection and Simulation for Power Equipment [J]. Computer Simulation, 2017,34(03):377-380.

[5] Feng Xin, Jia Kewen, Jia Kebin. Research on Remote Video Surveillance Technology of Middle Route Project of South-to-North Water Transfer [C]// National Signal and Intelligent Information Processing and Application Conference. 2016,48 (09): 203-205.

[6] Zhang Naifeng. Study on the Influence of Pollutants in a Power Plant in Guangdong on Groundwater Environment [J]. Underground Water, 2018,43(3):78-79.

[7] Chen Ming, Wang Jingwei, Han Ming, et al. Study on the migration law of ammonia nitrogen pollutants in a power plant in groundwater [J]. Site Investigation Science and Technology, 2016,28(s1):27-30.

[8] Shu Hui, Chen Haohua, Shi Quan. The Control System Design of Total Amount of Industrial Pollution Based on Internet of Things [J]. Journal of Nantong Vocational University, 2016, 30(3):72-77.