Evaluation Method of Low-pollution Water Purification Effect under the Background of River Wetland Water Ecological Restoration

Fushan Zheng, Hongxia Dong, Mingjuan Bi, Tiantian Chen
Laiwu Vocational and Technical College, Laiwu, 271100, China

Abstract: Considering the application of traditional evaluation methods, in the evaluation of low-pollution water purification effect under the background of river wetland water ecological restoration, there is no calculation of multi-layer geological purification effect relation between low-pollution water, so the evaluation vector of purification effect is low. To this end, a new method for evaluating the purification effect of low-pollution water under the background of river wetland water ecological restoration was designed. First, the least square method was used to obtain the purification effect parameters of low-pollution water in the survey area, and the final results were fitted to determine the purification effect parameters of low-pollution water. Then, the purification effect relation between multiple layers of low-pollution water is calculated to ensure that the calculation result is within the adjustable range of river wetland water ecological restoration. Then, the evaluation factor load matrix is constructed to satisfy the comprehensive evaluation of data. Finally, the evaluation of the purification effect of the low-pollution water was given and scored to complete the evaluation of the purification effect of the low-pollution water. Experiments were designed, and the results showed that the evaluation vector of the purification effect of the designed evaluation method was significantly higher than that of the control group, which could achieve accurate evaluation of the purification effect of low-pollution water.

Keywords: River wetland; Ecological restoration background; Low-pollution water purification; Effect evaluation

1. Introduction

Under the background of river wetland water ecological restoration, the evaluation of low-pollution water purification effect has practical significance for promoting river wetland water ecological restoration. In China, the research on the evaluation method of low-pollution water purification effect has been developed from standard index evaluation method to weighting matrix evaluation method. In the actual operation, the traditional evaluation method fails to take into account the specific index requirements of low-pollution water purification effect, complex logical relationship, instability and other characteristics, and is prone to inaccurate evaluation, resulting in poor water ecological restoration effect of river wetlands [1]. In order to solve this problem, before designing the evaluation method of low-pollution water purification effect, the research in the background of river wetland water ecological restoration mainly consists of two main tasks: water purification and water search. Firstly, the distribution characteristics and change rules of low-pollution water should be mastered. Then, the depth of low-pollution water should be understood by mastering the distribution of low-pollution water and water layer. Based on the survey results, the evaluation method design for the purification effect of low-pollution water should be carried out [2]. Therefore, under the background of river wetland water ecological restoration, it is necessary to ensure that the obtained data have certain timeliness and reliability. In combination with the current situation of low-pollution water purification, accurate evaluation of its purification effect is made, and then targeted Suggestions for river wetland water ecological restoration are proposed. It provides professional data support for the evaluation of low-pollution water purification effect and related work under the background of river wetland water ecological restoration in the later stage.

2. Evaluation Method of Low-pollution Water Purification Effect under the Background of River Wetland Water Ecological Restoration

2.1. Measurement of purification effect parameters of low-pollution water

Combined with the background of river wetland water ecological restoration, the design of low pollution water purification effect evaluation method will be carried out as follows. The effect parameters of low-pollution water purification can represent the effect of low-pollution water purification at a macro level. According to the concentration of each index of low polluted water, the purification effect of low polluted water was analyzed. The basic purification effect parameters of low polluted water were composed of PH value, TP, TN, NH3-N and CODMn of low polluted water. The representative values of standard parameters of low-pollution water purification effect under the background of river wetland water ecological restoration are shown in Table 1.

Table 1. Representative values of standard parameters of low-pollution water purification effect

Parameter	PH	TP	TN	NH3-N	CODMn
Standard values	6.5-8.5	0.25	1.0	2.0	11.5

In Table 1, TP refers to total phosphorus; TN is for total nitrogen; Nh3-n is ammonia nitrogen; CODMn is the permanganate index. As shown in Table 1, single-well pumping method is used to accurately measure the purification efficiency parameters of low-pollution water. Multiple measurements were taken to record the data and to observe the changing characteristics of the data. Since there are many external influencing factors in the measurement of purification effect parameters of low-pollution water, the observation Wells of low-pollution water should be reasonably arranged under the conditions of economic permission to solve the problem of multi-solution of purification effect parameters of low-pollution water. Under the background of river wetland water ecological restoration, the geological layer is greatly disturbed, and the determination of the middle boundary involves many boundary problems. Therefore, the pumping test was carried out at the monitoring point before the measurement of the purification effect parameters of the low-pollution water, and the flow velocity of the low-pollution water was controlled by optimizing the low-pollution water [3]. At the same time, 3~5 pumping Wells were arranged in the pumping test room to observe the changes of water level in Wells after 5min, 10min and 15min. Due to the small change of water level, observation points at different depths in the well were designed and corresponding objective parameter functions were established based on the observation points, and the measurement results were arranged into a table, as shown in Table 2.

Table 2 Measurement results of purification efficiency parameters of low-pollution water

Determination of deep layer	PH	TP	TN	NH3-N	CODMn
10m	7.5	0.26	0.88	1.5	10.9
15m	7.0	0.25	0.96	1.6	10.5
20m	6.5	0.24	0.84	1.6	11.1

According to the information in table 2 above, the purification effect parameters of low-pollution water were obtained by measuring the depth of different layers, and the purification effect parameters of low-pollution water in the survey area were obtained by using the least square method, and the final results were fitted to complete the measurement of the purification effect parameters of low-pollution water [4].

2.2. The purification effect of low pollution water was calculated

As a key element that directly affects the water ecological restoration of river wetland in the later period, the geology-related purification effect plays an important role in the evaluation of low-pollution water purification effect. According to the following, the special geological conditions of river wetland will be integrated, and the relation value of purification effect between multiple layers of low-pollution water will be calculated, so as to realize the evaluation of purification effect of low-pollution water. This paper adopts the ecological index evaluation method proposed by Swedish scientist Hakanson. According to the physical properties of the low-pollution water and the behavior characteristics of the metal elements contained in the river wetland under the background of water ecological restoration, the purification effect of the low-pollution water is effectively evaluated, and the risk value of the multi-layer geological purification effect evaluation data of the low-pollution water is calculated in combination with the risk evaluation experience of various ecological environments [5]. The specific calculation is shown in Formula (1).

$$Rr = b * (Km - Rf) \quad (1)$$

In Formula (1): Rr refers to the risk of data evaluation of purification effect between multiple layers of low-pollution water; K refers to the evaluation of hidden dangers; m refers to the low-pollution water purification data; b refers to a variety of external factors that affect the purification effect of low-pollution water; R refers to the geological structure characteristics of river wetlands; f refers to the main control factor for the evaluation of the purification effect of low-pollution water. Based on the above calculation formula, the potential risks in the evaluation data of the purification effect between multiple layers of low-pollution water are determined. When the calculation result is within the adjustable range of river wetland water ecological restoration, it proves that the evaluation result is feasible. When it is beyond the adjustable range, it is necessary to revise the evaluation

data of purification effect of multi-layer geology of low-polluted water and recalculate it until it meets the requirements of data evaluation.

2.3. Construct evaluation factor load matrix

By clarifying the purification effect relation between the multi-layer geology of low polluted water and extracting the key evaluation factors, the following method will be adopted to construct the load matrix of evaluation factors to carry out the next design of the evaluation method [5]. First, the corresponding data sample matrix is established, and the representation method of this set of matrix is defined as y, then the corresponding sample combination of y is represented as $y_i = \{y_{i1}, y_{i2}, \cdots\cdots y_{ij}\}$, and j is the number of principal components for evaluation of low-pollution water purification effect. Cloud data processing is adopted to pre-process the collected data, unify the format of data storage, and realize effective analysis of the composition of low-pollution water. Then, the linear function that can realize dynamic analysis of data is selected, and the design standard of Function *PCA* is defined. The advantages of data processing in traditional evaluation methods are retained and orthogonal directions are converted to data in feature space. According to the eigenvalue of the data, the purification effect of low-pollution water is arranged from good to bad, and the data set of group m is the data set that retains the most data variation structure [5]. Finally, the variance of the characteristic data is calculated numerically. The calculation formula is as follows, as shown in Formula (2).

$$l\,a = \sqrt{\left[I_n - \frac{1}{n}C^2\right]^2} \tag{2}$$

In formula (2), l refers to the mapping data corresponding to the purification effect of low-pollution water; I refers to a unidirectional matrix with multiple characteristic elements. According to the above formula, the projection evaluation of the purification effect of low-pollution water can be carried out, and the corresponding evaluation factor load matrix can be established by combining the unit and coverage of the projection, so as to satisfy the comprehensive evaluation of the data.

2.4. The low pollution water purification effect evaluation assigns the score

According to the evaluation factor load matrix established above, the following will be the last step of the evaluation method, and the evaluation of low-pollution water purification effect will be assigned a score. Firstly, according to the Delphi data processing method, the weight degree of multiple groups of values was compared, and the method of expert scoring was adopted to simulate the evaluation of low-pollution water purification effect data from two aspects of technical input and purification effect. Based on the basic comparison index, the interval value data was divided into 0~60 points, 60~75 points, 75~85 points and >85 points. The cost value of the investment in low-pollution water purification was integrated and dynamic evaluation method was adopted to comprehensively assign various evaluation indexes of low-pollution water purification effect [6]. In addition, the method of establishing the kernel function can be used to carry out the statistics of multilevel index variables, and the evaluation index of low-pollution water purification effect with large weight value can be endowed with higher weight value, and the weight proportion among data and dynamic relationship between weights can be analyzed to realize the evaluation of low-pollution water purification effect. The weight data can also be sorted from large to small. The larger the value is, the better the purification effect of low-pollution water will be, and the worse it will be.

3. The Experiment

3.1. Experimental preparation

In order to construct the experiment, it is convenient to compare the applicability of the purification effect evaluation method designed in this paper with the traditional evaluation method. Seven sampling sections were uniformly arranged from the river intake to the river outlet along the river flow direction, with the spacing between each section being about 300m and the serial number being 1-7 sampling sections.

Water samples and sediment sampling method: Three sampling points are uniformly arranged along the river width of each sampling section. Two water samples are taken from the top and bottom of each sampling section. Six water samples are taken from each section and mixed in equal volume as water samples for testing. One mud sample was taken from each sampling point, and the 3 mud samples were air-dried and mixed with the same mass as the test mud sample. The sampling frequency was once per week. The collected data was normalized by using MyCloud simulation experiment software. According to the characteristics of the evaluation system of low-pollution water purification effect as the test basis, the traditional evaluation method and the evaluation method designed in this paper were respectively used for simulation experiment, and the traditional evaluation method was set as the experimental control group. The main content of the experiment is to test the purification effect evaluation vector of the two evaluation methods so as to evaluate the evaluation method with higher evaluation accuracy. In this simulation experiment, a total of 7 groups of experiments were conducted on the sampling section 1-7. According to the evaluation vector of purification effect measured by MyCloud simulation experiment software, the experimental results were recorded,

and then the evaluation ability of the two evaluation methods for the purification effect of low-pollution water was judged.

3.2. Experimental results and analysis

According to the experimental steps designed above, the experimental data of sampling section 1-7 were collected, and the evaluation vector of purification effect under the two evaluation methods was compared. The comparison result of the evaluation vector of purification effect was shown in Table 3.

Table 3. Vector comparison of purification effect evaluation

Experimental section coding	The evaluation index	Evaluation vector of purification effect	
		The experimental group	The control group
Section 1	PH	0.90	0.55
Section 2	PH	0.91	0.51
Section3	PH	0.86	0.49
Section 4	PH	0.88	0.48
Section 5	PH	0.84	0.46
Section 6	PH	0.81	0.41
Section 7	PH	0.92	0.42

According to Table 3, the following conclusions can be drawn: the highest evaluation vector of purification effect of the evaluation method designed in this paper is 0.92, and that of the experimental control group is 0.55. The designed evaluation method has stronger evaluation ability, which can achieve accurate evaluation of the purification effect of low-pollution water.

4. Conclusion

The simulation results show that the designed evaluation method can meet the overall design requirements and can be widely used in the evaluation of low-pollution water purification under the background of river wetland water ecological restoration. The design evaluation method can not only accomplish the task that the traditional evaluation method cannot, but also provide academic significance for the design of the evaluation method of the purification effect of the low-pollution water with the guidance of the purification effect relation between the multilayer geology. The only shortcoming of this paper is that there is no in-depth analysis on the construction technology of low-pollution water quality improvement project, which is believed to be one of the future research directions of low-pollution water purification under the background of river wetland water ecological restoration.

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