DEVELOPMENT AND RESEARCH OF WATER ENVIRONMENT QUALITY EVALUATION SYSTEM OF TIANJIN WATERS *

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Abstract: Water environment quality evaluation system of Tianjin waters will play a promoting role for the environmental information in the region of the ocean water, environmental assessment and marine engineering businesses efficiency, and it can provide the necessary basis for marine environmental management and protection decision-making of water. This paper studies the environment assessment standards, assessment methods and system structure in the Tianjin waters. By meanings of using VB6.0 and SQL Server2000, this evaluation system based on low-cost, simple, fast, convenient principle realizes the function of user management, data management, and graphics output and so on, and meets the needs of data analysis, evaluation and management on the current marine water environment and supports decision-making.

Key words: Seawater quality, Tianjin waters, Water environment, Quality evaluation

INTRODUCTION

The water environment quality assessment is defined as a process of analyzing environment factors and quantitatively evaluating the water quality in a water environment region. We can understand and master the variable trend of water quality through the evaluation results, which will accurately reflect the pollution status and degree of the assessment waters. Eventually it will provide scientific basis for the utilization, protection, layout and management of the water resources. The credibility of the assessment results is both relaying on the accuracy of raw monitoring data and the scientific characteristic of assessment methods. In the practice, single-factor index method is often used for the water quality assessment. But there exist amount of uncertain factors in the water environment and the concept of water quality types and classification standards is quite fuzzy, thus fuzzy mathematics is widely used in the comprehensive assessment of water quality. In this paper, the assessment standard is based on seawater quality standard (GB3097-97).

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Assessment method

In this paper, single-factor index method is applied, which is defined as using a water quality type belonging to a single factor to determine the comprehensive type of the water environment. That is to say, the type of water quality will be identified via comparing the raw monitoring data value of a factor with the standard value of the corresponding factor.

The assessment model can be described by the following equation.

$Pi = Ci / Cio$

Where *Pi* is standard index of No.*i* factor (single-factor standard index), *Ci* is the in situ measured concentration of No.*i* factor, *Cio* is the standard concentration value of No.*i* factor.

Pi values >1 represents the No.*i* factor concentration exceeding the standard value. Thus this factor can not satisfy the requirements of marine functional zones of the assessment waters.

According to the pollution index, we will evaluate the current environment quality status and pollution levels of the assessment waters.

Assessment factor

According to the current water quality standard and the actual situation of Tianjin waters, we chose 10 indexes as assessment factor including COD, SS, active silicate, oil, heavy metal (Cu, Cd, Pb, Zn, Hg) and sulfur compounds.

DEVELOPMENT AND DESIDN OF THE SYSTEM MODEL

In this system, VB6.0 Chinese Enterprise version is used as development tools, SQL Server 2000 as the background database, GIS as assistant tools. Raw data is processed in the means of organization, storage, extraction, and then the water environment quality evaluation system is built. The system will provide basis for information interaction between users and application system, at the same time, the water environment status of the assessment waters is evaluated. Through analyzing the water environment quality status and the exceeding standard rate, it will be more convenient for the development and pollution control of Tianjin waters.

Water quality management zones of Tianjin waters

Based on seawater quality stadard (GB3097-97) and marine functional zones of Tianjin, seawater quality management standards are identified in different marine functional zones of Tianjin, and the seawater quality management zones are distinguished into four types as the following description.

Type I: The Tianjin waters, except for mixing zones, Type II ,Type III, Type IV belong to this type. The main function of this type is to satisfy the water-using requirements of marine fishery (including seawater farming and growth).

Type II: The Tianjin waters, from 2m inshore isobaths to coastline and except for mixing zones, Type III,Type IV,are identified to this type. The main function of this type is to satisfy the water-using requirements of salt industry and bathing beach.

Type III: The Tianjin waters, within 2m inshore isobaths of Dagang Baishuitou and near the Dagu anchorage ground are Type III. The main function of this type is for draining flood, draining sewage and shipway.

Type IV: Type IV includes both sides of Tianjin Harbor shipway, Central Fishing Port of Tianjin Hangu Gaojiabao and offshore oil exploration areas. The main function of this type is for port, shipway, draining floods, draining sewage and oil exploration.

Analysis of system function

Users of this system are mainly researchers who need to evaluate water quality of the assessment waters and others who want to know the current water quality status. The system is mainly divided into

three parts: system user management, data management (raw monitoring data and assessment results), graphics management (plane graph and table management). The specific functions are showed below.

- System user management: It restricts system access to only authenticated users,
- Raw monitoring data management: It deals with the raw monitoring data including input, output, delete, and alter and so on,
- Plane graph management: It provides the output of the raw monitoring data in the form of histograms and isograms,
- Table management: It provides the output of the raw monitoring data and assessment results in the form of table.

Design of system structure

Based on the functional analysis and user requirements, the system structure will be designed. The model of water environment quality evaluation system of Tianjin waters presents in Figure1.

Users will first see the login form in the initialization of the system, which validates users authority. Users who have the authority just only enter the username and password to login the system. Users can alter their password if they want to. Then the system is operated. Firstly users should come to the raw monitoring data management form. There users can deal with the raw monitoring data including input, output, addition, delete, alter and so on. Then in the case that the raw data is accurate, users can go to the assessment data management form to work, such as displaying the results and storing the results into database.

In plane graph management form, the raw monitoring data can be output in the form of histograms and isograms, and also users can analyze distributing law of a factor in different sites. In table management form, the raw monitoring data and assessment results can be output in the form of table.

In the system, what users do is just to click the corresponding buttons and then the system will do the job.

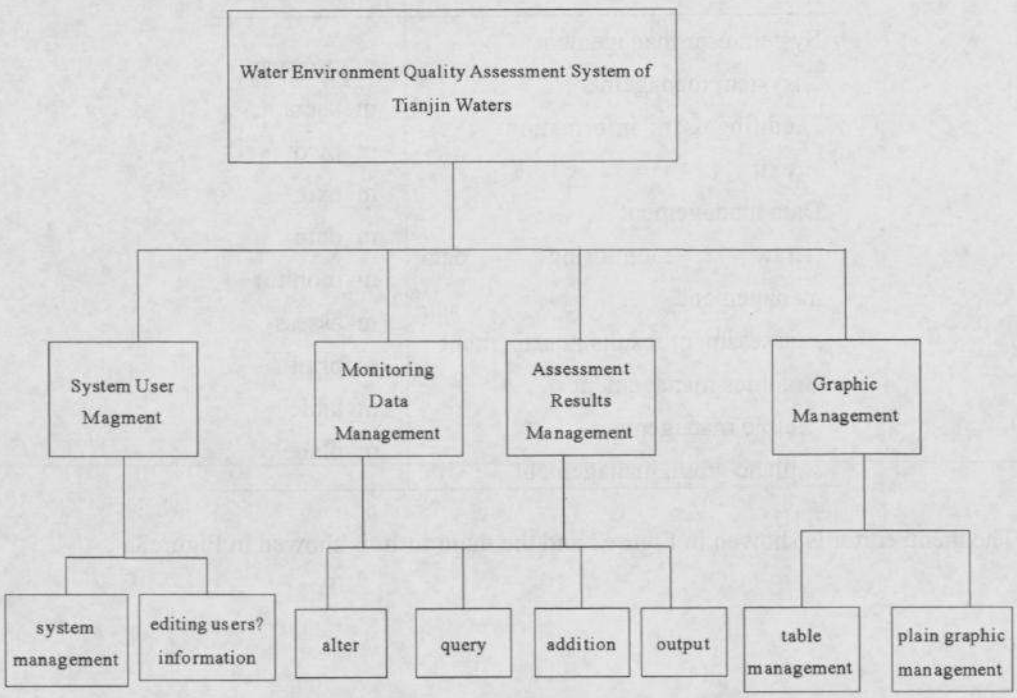

Fig.1 the model of water environment quality evaluation system of Tianjin waters

Development tools

In this system, VB6.0 is used as development tools, SQL Server 2000 as the background database, GIS as assistant tools.

Development technology

In order to design the water environment quality evaluation system of Tianjin waters, we need such technology as below.

- The basic programming method of the chosen development tools
- The basic background database method, such as creating table and view
- The common use of SQL statement
- ADO database access technology

Design of database structure

The design of database structure plays a very important role in the stage of overall design. A good database structure can simplify the development process and the system function will be clearer.

In this system, the database is named as water quality of Tianjin waters. There are four tables in the database including raw monitoring data table, assessment results table, login information table and assessment standard table.

Design of login form and main interface form of the system

When the system is initialization, users will first see login form, and only the users who have the authority can access to the system. If users have succeeded to login, the main interface form will present.

The main interface form is the startup object of the system. We set the startup object through engineering/property in the circumstance of VB6.0, and in the main form, we choose the tools/menu editor to edit the system menu. The property of the system menu is in Table 1.

Tab.1 the property of the system menu

title	name
System user management	m_userman
…system management	m_users
…editing users' information	m_pwd
…exit	m_exit
Data management	m_data
…raw monitoring data management	m_monitor
…assessment results management	m_assess
Graphics management	m_print
…table management	m_table
…plane graph management	m_plane

The menu editor is showed in Figure2 and the main form is showed in Figure3.

Fig.2 menu editor

Fig.3 main form

When users click exit button, system will automatically disconnect the connection with database, and system will be shutdown.

Design of data management form

The data management form is subdivided into two modules—raw monitoring data management for-
m and assessment results management form.

In raw monitoring data management form, users can query all raw monitoring data. If users find mistakes or omissions, they can rectify the errors just through clicking the corresponding buttons.

In assessment results management form, the m-
ain function is showed as below.

- Presenting all assessment results and testing the type of the monitoring sites
- Presenting assessment results of a single factor
- Storing assessment results into background database
- Selecting the type of water quality in a site.

Design of plane graph form

If users have chosen an assessment factor and click the corresponding button in choosing water quality factor form, system will jump to plane graph form. The distributing law of the chosen factor will presents in the form of histograms. In the histograms, x-coordinate stands for the sites and y-coordinate stands for the raw concentration of the factor in corresponding sites. The choosing water quality factor form is used for choosing assessment factor, of which users want to view the distributing law in different sites. For example, Figure4 shows the histogram of active silicate, and Figure5 is the isograms of active silicate.

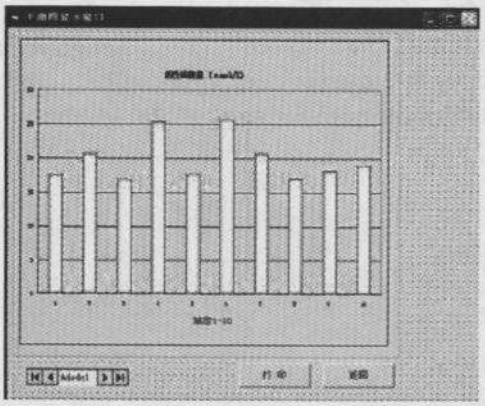

Fig.4 the histogram of active silicate

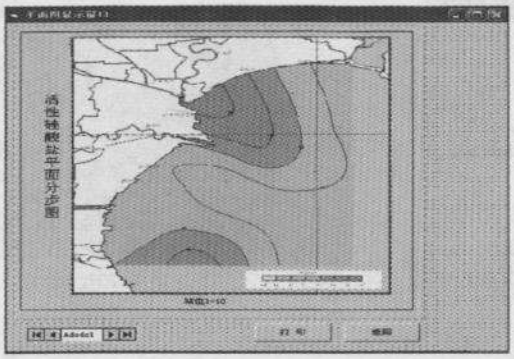

Fig.5 the isograms of active silicate

CONCLUSION

The development of water environment quality of Tianjin waters is based on 908 special projects of the marine chemical investigation of coastal waters in Tianjin (908-TJ-09). The data used for testing the system is from 10 sites in 2006 winter. In this system, VB6.0 Chinese Enterprise version is used as development tools, SQL Server 2000 as the background database, GIS as assistant tools, and modular way is used for developing the system. The system can provide many functions such as managing, analyzing and evaluating raw monitoring data, and the assessment results can be output in the form of histogram, isograms and table. Through the system, users can comprehensively understand various information of water quality in Tianjin waters and intuitively query and analyze assessment results. At the same time, raw monitoring data from different waters and different sites can also be disposed in this system. Finally this system can provide a powerful scientific basis for comprehensive utilization of seawater, scientific management of the waters and sustainable development of ocean resources.

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