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Prediction of Water Quality Evaluation for Fish Ponds of Aquaculture

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Abstract: This study used a regression method to build model for predicting water quality for the fish pond. From aquaculture practitioners' point of view, how to effectively control the water quality for the fish pond is very important. In basis of the experience of aquaculture practitioners, temperature, pH, conductivity, salinity, and last monitored oxygen content influence the water quality (here, called influencing factor). Life and death of fish are determined by water quality as well as water quality is decided by oxygen content. Therefore, the evaluation of the water quality is according to oxygen content. Regression method is often used for statistical analysis and prediction. In regression method, model is established by dependent variables and independent variables. In this study, the five influencing factors are represented as independent variables and the oxygen content is seen as dependent variable. From the experimental result, the oxygen content can be kept in the reasonable range.

Keywords: Regression method, water quality, aquaculture.

1. INTRODUCTION

Aquaculture is an important traditional industry in East Asia, including China, Japan, Korea, and Taiwan. In Taiwan, the area of aquaculture is nearly 35,000m^3 and the economic gross value of aquaculture accounts for about 43% of fishery [1].

In this work, for reducing costs and increase revenue, we try to predict the water quality according to oxygen content in the water. For prediction of water quality, regression method is used in here. Regression method builds the relationship of model between dependent variables and independent variables. We collect data from a biotechnology company in Taiwan, and then the data have been sorted out and divided into training and verification data. Regression method is also used in a lot of field, including medicine research [2], engineering [3], agriculture [4], and so on.

Provided by the biotechnology company, the experimental environment of fish pond is shown as Fig. 1 and Figs. 2-3 show the water quality purification system and equipment of water quality monitoring system in experimental environment, respectively.

2. PREDICTION OF WATER QUALITY EVALUATION FOR FISH PONDS

In this section, we simply introduce prediction of water quality evaluation for fish ponds by regression method.

The unreasonable data should be removed before executing regression method. After the data was gathered, and sorted out, the model is established by regression method. Then, the prediction results can be got through the model. The detail steps are shown below.

Step 1: Gather and sort out data

When the data is gathered from the biotechnology company, the data are sorted out and organized. Then, we should remove the unreasonable data. The data is divided into training and verification data.

Step 2: Building model by regression method

According to the training data, regression method is used to build model. We can try the power to build model, and then find the best power.

Step 3: Verify model and prediction

After building model, verification data was used for verification and prediction. According to the model, the predicted data were obtained.

3. EXPERIMENTAL RESULT

On the basis of the above section, model can be built by those steps. The experimental steps are shown as the following:

1. Gather and sort out data

The data from 1st May 2016 to 5th May 2016 are collected every 20 minutes. In this work, there are five inputs and one output. The inputs are conductivity, pH, salinity, temperature, and last obtained oxygen content in the water. The output is oxygen content in the water. Then, the unreasonable data is removed. The data is divided into two parts, including training and verification data.

2. Build model by regression method

In input part, the five inputs put in. In output part, the one output put in. Then, we set quartic as the powers of regression by the stepwise method. The number of training data is 120. After modeling, *R-value* of the

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model is 0.94239 and is shown in Fig. 4.

3. Verification and prediction

In this step, inputs and output also put in input part and output part, respectively. The total of the number of testing data is 17. From the result, the predicted ranges are shown from 3.7 ppm to 4.3 ppm.

4. CONCLUSIONS

In this work, the water quality is predicted by using regression method. From our experiment, the range of the water quality (represented by oxygen content in the water) can be predicted reasonably. If the water quality is not in reason range by predicting, aquaculture practitioners can use their equipment to let the water quality keep in the regular range immediately. Therefore, aquaculture practitioners can control costs effectively and keep water quality well.

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Fig. 1 The experimental environment of fish ponds.

Fig. 2 The water quality purification system.

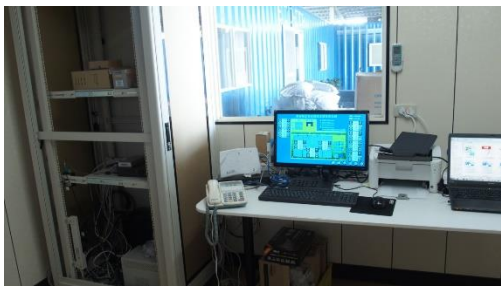

Fig. 3 Equipment of water quality monitoring system.

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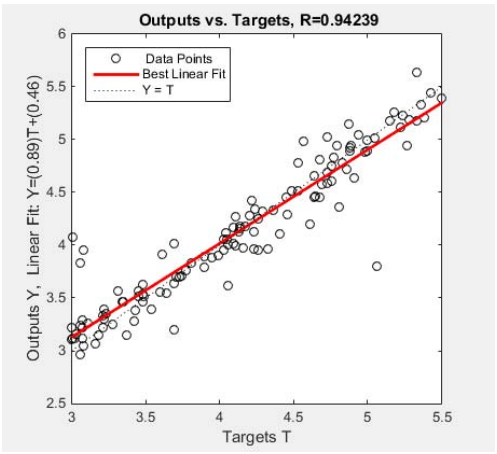

Fig. 4 Result of modeling data.