Comprehensive Assessment of Surface Water Quality and Their Suitability for Drinking and Irrigation Uses
Case Study of Karun and Dez River Basin

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1-Introduction

Rivers are the primary natural resource that many of them are used as drinking water and consumption water in sectors such as industry, manufacturing, agriculture, aquaculture, animal husbandry, forestry, hydropower, transportation and recreation. For all these activities, rivers must have a healthy ecosystem and constant water quality (Ustaoglu et al., 2020; 1). Therefore, since rivers are the main source of fresh water for human use for different purposes, understanding the quality of water used for various purposes, including drinking and irrigation, and its potential adverse effects on human life and plant growth is essential to preventing problems and optimizing general human health and producing a sustainable crop (Sudhakaran et al., 2020:1). In addition, having reliable information on water quality is essential for the effective protection, control and management of river water against degradation (Barakat et al., 2016: 284). Therefore, the purpose of this study is to evaluate the water quality of Karun and Dez river systems in Khuzestan province and to analyze the suitability of their water quality for drinking and agricultural purposes. In fact, this study makes it possible to describe the physicochemical properties and evaluate the suitability of these surface waters for drinking and irrigation based on the analysis of qualitative parameters.

2-Methodology

In this study, in order to monitor surface water quality, data and information of water quality physicochemical parameters (WQP) of 8 quality assessment stations of Karun river basin and 4 quality assessment stations of Dez river over a period of 17 years (2003-2019) obtained from Khuzestan Water and Power Organization were used. The studied parameters in the present study were prepared monthly and includes temperature, Total

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soluble solids (TDS), Electrical conductivity (EC), Acidity (pH), Bicarbonate (HCO3-), Sulfate (SO42-), Calcium (Ca2+), Magnesium (Mg2+), Sodium (Na+), Potassium (K+), Chloride (Cl-), Turbidity (Turb), Sodium adsorption ratio (SAR), Total hardness (TH). Finally, the average water quality data of different stations for each year were extracted and a matrix was prepared from the data and were evaluated using SPSS 22 statistical software, Excel 2013, GIS and various indicators.

Data analysis methods

Evaluation of river water quality for drinking purposes using water quality index (WQI)

In the present study, in order to process the data and evaluate whether the water quality of the studied rivers is suitable for drinking or not, their quality was evaluated by calculating the water quality index (WQI).

The WQI calculation equations are as follows:

$$RW = \frac{AW}{\sum_{i=1}^{n} AW} \quad (1) \qquad\qquad Q_i = \left(\frac{C_i}{S_i}\right) \times 100 \quad (2)$$

$$SI_i = RW \times Q_i \quad (3) \qquad\qquad WQI = \sum_{i=1}^{n} SI_i \quad (4)$$

WQI results were evaluated based on the following scale; 0-25 (excellent), 26-50 (good), 51-75 (poor), 76-100 (very poor) and> 100 (inappropriate) (Yadav et al., 2012: 430).

Evaluation of river water quality for irrigation purposes

To process the data and evaluate whether the water quality of the studied rivers is suitable for irrigation purposes or not, their quality was evaluated by calculating irrigation parameters such as Sodium Adsorption Ratio (SAR), Percentage of Sodium (Na%), Magnesium Hazard (MH), Permeability Index (PI), Kelly index (KI), and Electrical Conductivity (EC).

3-Results and Discussion

The values of the parameters in the quality assessment stations of Karun and Dez rivers The results of one-way analysis of variance (ANOVA) to investigate the significant difference in quality parameters between quality assessment stations in Karun and Dez rivers showed that there is a statistically significant difference between all parameters in the studied stations except the pH parameter ($P<0.05$). According to the results, in Karun River, the highest concentration of parameters was observed in Salmaniyeh and Darkhovain stations and the lowest in Susan and Shahid Abbaspour dam lake stations and in Dez River, Bamdezh and Dezful stations had the highest and lowest quality parameters, respectively.

Comparison of water quality status of monitoring stations in Karun and Dez rivers for drinking based on WQI is presented in Figure (1). Based on WQI results, the overall mean WQI in Karun River was 125.34 and in Dez River was 83.46, which indicates the degree of " Unsuitable" water quality (WQI >100) of Karun River and the degree of "Very poor" quality (75<WQI<100) in Dez River for drinking.

Assessing the suitability of water quality of Karun and Dez rivers for drinking
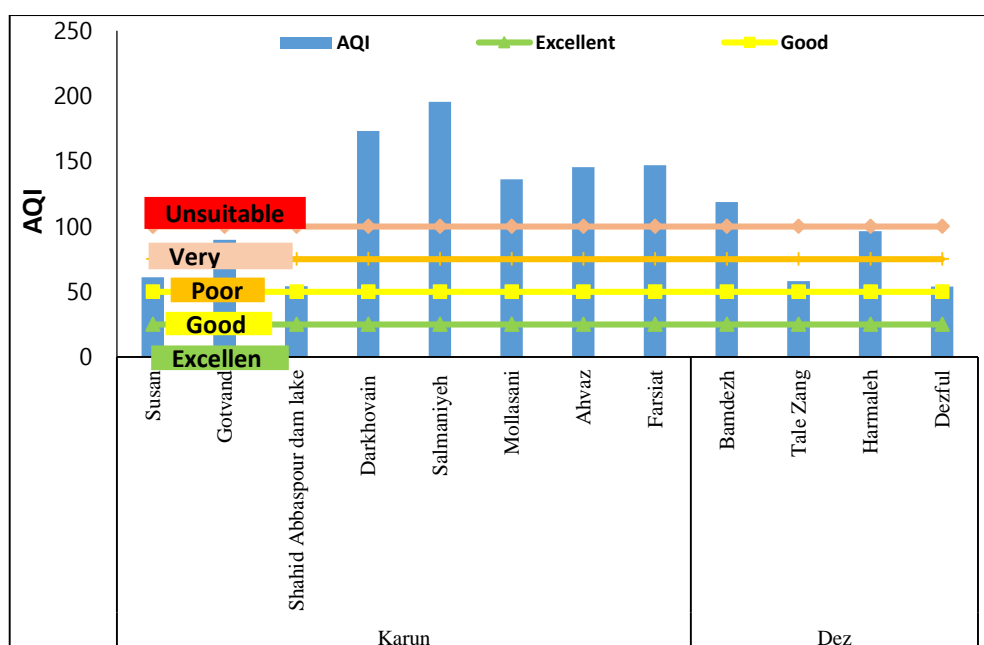

Fig. (1): Comparison of WQI value between quality assessment stations of Karun and Dez rivers during 2003-2019

Assessing the suitability of water quality of Karun and Dez rivers for irrigation purposes

In addition, SAR, Na%, MH, PI, KR, PS and EC parameters were calculated to assess the suitability of rivers for irrigation purposes. The results of these parameters showed that water quality of Karun and Dez River are based on EC (permissible - permissible), (%) Na (permissible - good), SAR (excellent - excellent), PI (average - average), KR (average - excellent) and MH parameters (suitable- suitable), and indicating that rivers water quality is generally relatively good and safe in general, with the exception of a few sampling stations, which are unsuitable for irrigation purposes.

4-Conclusions

This study highlights the importance of using water quality indicators that provide a simple interpretation of monitoring data to help improve water quality, because based on these indicators and PCA, it can be concluded that related human activities along the banks of the Karun and Dez rivers, especially in recent years, affect their water quality.

Keywords: Water Quality Monitoring, Water Quality Indicators, Multivariate Statistical Techniques, GIS, Karun and Dez River.

5-References

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