Available online at www.CivileJournal.org

Civil Engineering Journal

Vol. 4, No. 12, December, 2018

Artificial Neural Network Model for the Prediction of Groundwater Quality

Basim H. Khudair [a*], Mustafa M. Jasim [b], Awatif S. Alsaqqar [c]

[a] *Assistant Professor, Department of Civil Engineering, University of Baghdad, Baghdad, Iraq.*

[b] *Assistant Lecturer, Department of Civil Engineering, University of Baghdad, Baghdad, Iraq.*

[c] *Assistant Professor, Department of Civil Engineering, Uruk University, Baghdad, Iraq.*

Received 29 July 2018; Accepted 20 November 2018

Abstract

The present article delves into the examination of groundwater quality, based on WQI, for drinking purposes in Baghdad City. Further, for carrying out the investigation, the data was collected from the Ministry of Water Resources of Baghdad, which represents water samples drawn from 114 wells in Al-Karkh and Al-Rusafa sides of Baghdad city. With the aim of further determining WQI, four water parameters such as (i) pH, (ii) Chloride (Cl), (iii) Sulfate (SO_4), and (iv) Total dissolved solids (TDS), were taken into consideration. According to the computed WQI, the distribution of the groundwater samples, with respect to their quality classes such as excellent, good, poor, very poor and unfit for human drinking purpose, was found to be 14.9 %, 39.5 %, 22.8 %, 6.1 %, and 16.7 %, respectively. Additionally, to anticipate changes in groundwater WQI, IBM® SPSS® Statistics 19 software (SPSS) was used to develop an artificial neural network model (ANNM). With the application of this ANNM model, the results obtained illustrated high prediction efficiency, as the sum of squares error functions (for training and testing samples) and coefficient of determination (R^2), were found to be (0.038 and 0.005) and 0.973, respectively. However, the parameters pH and Cl influenced model prediction significantly, thereby becoming crucial factors in the anticipation carried out by using ANNM model.

Keywords: Assessment and Prediction; Groundwater Quality; Human Health; Water Quality Index; Artificial Neural Network Model.

1. Introduction

For sustaining life, safe drinking water is one of the fundamental needs of every human on earth, due to which it must be available to all people in an adequate amount via safe and accessible ways of water supply. The increased demand for clean drinking water draws attention towards the management of groundwater quality. Especially in developing countries, where the issues regarding the accessibility of clean water have become acute, the groundwater quality assessment is imperative. Approximately, one-third of the world's populations have been found to use groundwater for drinking. With an added advantage of being extracted at several places, the groundwater makes the transportation via pipe redundant. Generally, water having a constant composition is hygienically reliable, due to which the water can be distributed occasionally, without any treatment. However, simple and cheap treatment (e.g. disinfection) is often inevitable. On the other hand, alteration in the groundwater quality caused due to natural substances, in addition to, anthropogenic activities in the surrounding soil can show its repercussions on the public health if left untreated [16]. Recently, in Iraq, the flow rates of surface waters has decreased significantly, owing to the policy of the surrounding countries of the source, which in turn has led to the shortage of water required for irrigation and drinking. Therefore, there is an urgent need to evaluate the groundwater quality for ensuring appropriate use of groundwater resources for

* Corresponding author: dr.basimal-obaidy@coeng.uobaghdad.edu.iq

http://dx.doi.org/10.28991/cej-03091212