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ASSESSMENT OF AVERAGE CONTRIBUTIONS OF POINT AND DIFFUSE POLLUTION SOURCES TO NITRATE CONCENTRATION IN GROUNDWATER BY NONLINEAR REGRESSION

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Abstract

Different anthropogenic influences and irresponsible actions pollute all the components of the environment and groundwater is no exception. Nitrates, which are one of the most common groundwater contaminants, come from different sources and they are not always easily detectable. The paper presents a study of a groundwater quality at the Varaždin wellfield in the north part of Croatia. The nitrate concentration at this location has been above the maximum allowed concentration for several decades, which has made the opening of new wellfields costly. Spatial distribution of the nitrate concentration at the wellfield is developed using Kriging interpolation method. An illegal dumpsite consisting of waste from a poultry farm has been identified as a nitrate pollution source. The paper shows that nitrate concentrations depend on the distance from the dumpsite. The results are shown in a scatter diagram and regression curves are fitted in the data based on modified Exponential, Logistic, Gompertz and Richards functions. Average contributions of point-source pollution to the groundwater nitrate concentration at the observed wellfield are assessed by using regression curves through the application of a theorem of the mean value for integrals, which are found to be in range 17.23-52.58 mg/L NO_3^- for the overall nitrate amount. This shows that the application of mineral fertilisers in agriculture is not always the only main cause of the increase in groundwater nitrate concentrations. Contributions from diffuse sources are assessed by the regression curves as well and they are found to be in range 30.52-53.10 mg/L NO_3^-. The sources of pollution are divided in an anthropogenic and non-anthropogenic group. The anthropogenic contributions are found to be 70.33 mg/L NO_3^-, whereas the non-anthropogenic sources contribute with 5.40 mg/L NO_3^- to the total nitrate concentration at the Varaždin wellfield.

Keywords: groundwater, nitrate contamination, nonlinear growth function, pollution source

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