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Numerical Study on the Migration Law of Typical Chlorinated Organic Matter

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Introduction

With the change of China's urbanization expanding in ubiquity, the security issues presented by metropolitan groundwater, particularly groundwater in modern regions, stand out. The purpose of this study was to conduct a groundwater contamination investigation in an abandoned chemical plant in the Chinese province of Jiangsu in order to predict and quantify the migration process of contaminants in a micro confined aquifer. First, hydrogeological drilling, groundwater well monitoring, pumping tests and laboratory permeability tests helped identify the most serious pollution factor by obtaining data on regional hydrogeological parameters and contaminants: chloroform. The Groundwater modelling System (GMS) was then used to create a groundwater flow model, which was checked using the general-purpose parameter estimation (PEST) package.

Furthermore, in view of the three-layered multi-species model for transport (MT3DMS) in GMS, a vehicle model was laid out. The results show that chloroform's plume range diffuses with the flow of water, but the concentration of the contaminant has remained several times higher than the safety standard for a long time due to its slow diffusion rate and inability to naturally degrade. Under pressure, the contaminant spread vertically to the soil layer above the micro confined aquifer, causing direct contamination. Additionally, it is anticipated that the contaminant in the micro confined aquifer will migrate to the clay layer and become enriched there. The first confined aquifer, on the other hand, hasn't been seriously polluted in 20 years. Finally, a sensitivity analysis of the parameters reveals that precipitation recharge and hydraulic conductivity have a significant impact on groundwater contamination in the Yangtze delta region.

Description

Groundwater is an important source of freshwater that can be found in almost every area with a lot of people and is found all over the world. A growing number of studies have shown that human activities continuously pollute groundwater. Inorganic substances (heavy metals), organic substances, bacteria and even radioactive sources make up the majority of the contaminants in groundwater. Of these, organic contaminants have the most persistent and harmful effects on the environment. This is due to the fact that organic contaminants can persist in soil and groundwater for an extended period of time and are slow to naturally degrade. Organic matter has polluted the soil and groundwater of many plots in the Yangtze delta region, one of China's most developed areas. This is due to the fact that, as a result of the growth of the economy and the industrialization process, a significant number of chemical and pesticide production businesses have relocated, resulting in problems with organic pollution in the abandoned locations. A review performed by Li shows that halogenated organics are the most serious impurities in the groundwater and soil of China's natural contamination destinations. Additionally, chlorinated petroleum hydrocarbons (chloroform and 1, 2-dichloroethane) make up the majority of the halogenated organics. Aquifers in the Yangtze River Delta, on the other hand, have distinct regional compositions [1-3].

Take Suzhou as an illustration. The groundwater is primarily found in the first and second confined aquifers, which are the shallow, middle and deep aquifers. In shallow aquifer systems, phreatic and micro confined water are the two types of groundwater. Examination investigations have discovered that the natural contamination of groundwater in Suzhou is predominantly moved in shallow springs and micro confined springs have turned into the fundamental wellspring of home grown water around here. As a result, research into the migration patterns of contaminants in organically polluted groundwater and the safety of groundwater in shallow aquifers should be prioritized for resident's health. In order to provide direction for the control and prevention of shallow groundwater contamination, this should be done. The timely prediction and identification of areas at risk of pollution is the key to preventing groundwater contamination. The Groundwater Modelling System (GMS) is software that has been around for a while and is very accurate at simulating the flow of groundwater and the movement of contaminants. This can help identify areas that are at risk, keep an eye on pollution and prevent risk factors. In this manner, it has been generally utilized.

The researchers looked into potential risk factors in the Kodaganar river and the basin's aquifers after predicting the migration of total dissolved solids (TDS) in the Sengulam lake using a pollution transport model. Valivand developed a model to simulate the nitrate pollution of groundwater brought on by agricultural activities and urban sewage on the basis of the code for the three-dimensional multi-species model (MT3DMS) in GMS. Ahmed created a destination and migration model of heavy metals moving from the surface to groundwater in order to model the diffusion of contaminants in dry regions. Gedeon used GMS to predict the ammonium nitrogen and chloride levels at the Wang-Tien landfill site for ten years by building a contaminant transport model and collecting data on the study site's geology, hydrology and rainfall [4]. Using a groundwater flow model (MODFLOW) and a data file from MT3DMS, Ghoraba solved the issue of contaminant migration and time-varying concentrations in the central Nile Delta. Predicting the concentration of contaminants at any point in the aquifer level through the migration of the aquifer at the horizontal plane is the primary focus of current research on the transport of contaminants, as shown by the mentioned studies: Predicting the transport behavior of contaminants from the surface source to the aquifer through soil. Among sorts of springs, the unsaturated zone and phreatic springs have principally been the focal point of existing examination. Micro confined springs stand out enough to be noticed and specialists have become progressively keen on concentrating on these frameworks. For instance, Tune led a concentrate on the progressions in groundwater level changes in the shallow bound spring of Hauraki waterfront plain, New Zealand throughout recent years. According to the findings of the study, rainfall and groundwater extraction are the primary drivers of changes in groundwater level in this plain. Other influences on groundwater level include tides, groundwater extraction and rainfall. Li, on the other hand, looked into the effects of drainage rate and soil properties on the fluctuations and settlement in groundwater that was brought on by dewatering in a coastal micro confined aquifer. She used experimental data to build mathematical models that matched and she also looked into how dewatering affected the ground settlement. However, it is important to note that although there have been a lot of studies on micro confined aquifers, there have only been a few on actual contaminated sites. In the meantime, the migration law of organic pollution in micro confined aquifers and its influence on adjacent aquifers are still unclear due to differences

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in regional and soil layer properties and the lack of studies on shallow aquifers, particularly micro confined aquifers, in East China [5].

Conclusion

In addition, previous studies lacked comprehensive investigations into and research on the actual polluted sites and mostly assumed that areas surrounding the leakage sites are harmed after the leakage. This study therefore simulated the migration behavior of typical chlorinated petroleum hydrocarbons (chloroform) in a micro confined aquifer and its impact on other adjacent aquifers using a real organic pollution site in the Yangtze Delta region of East China. This study aims to learn more about how organic pollution sites in the Yangtze Delta are treated by looking at the cases.

Acknowledgement

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Conflict of Interest

None.

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