ABSTRACT

Groundwater in Sudan is the main water supply source for drinking water and domestic use for more than 80% of the human population and is found under about 50% of the country's area.

Khartoum state the capital of Sudan is not covered with sewerage system except for a small area at Khartoum centre and industrial areas in Khartoum North covering only 25% of the area. The main sewage treatment system in the other areas of the state is septic tanks and disposal wells.

This study seeks to estimate the extent of ground water contamination due to septic tanks in Khartoum city, it presents a case study in which a contaminant transport model, (MT3D) is used to so predict the level of contamination of groundwater due to septic tank effluent (Ammonia was considered to be the major output contaminant from septic tanks).

The model results show that an increase in the ammonia concentration was projected in the vertical directions through the ground layers and horizontal directions to the point source areas.

Considering a threshold value of ammonia concentration of (1.5 ppm) according to the Sudanese Drinking Water Standards, the study shows that the contamination front emanating from the use of septic tanks travels horizontally at a rate of (500 m/year) reaching to the depths of (75 m) below the water table after 60 years from the beginning of simulation period (time zero).

الخلاصة

تعتبر المياه الجوفية المصدر الرئيسي لإمدادات المياه لأغراض الشرب والاستعمال المنزلي لاكثر من 80 ٪ من السكان في السودان وتغطي هذه المياه حوالي 50 ٪ من مساحة البلد. وقد أوضحت الدراسة أن شبكة الصرف الصحي لا تنتشر في جميع ولاية الخرطوم وإنما بمناطق محددة في مركز الخرطوم والمنطقة الصناعية في شمال الخرطوم. أما في المناطق الأخرى فان احواض التخمير وآبار التخلص من المياه تمثل السبيل الاكثر انتشارا لمعالجة مياه الصرف بالولاية.

قامت هذه الدراسة باستخدام نموذج (mt3d) لتقييم حجم التلوث المتوقع من المياه الجوفية بولاية الخرطوم والذي يمكن ان ينتج بسبب الاستمرار في استخدام طرق الصرف الصحي التقليدية (احواض التخمير + ابار الصرف الصحي).

أظهرت نتائج النموذج زيادة في تركيز الامونيا في الاتجاه العمودي من خلال طبقات الارض وكذلك في الاتجاه الافقي في منطقة الدراسة.

تعتمد الشروط السودانية لمياه الشرب تركيز (1.5 mg/l) كالحد الاقصى المسموح به لتركيز الامونيا, وقد تم في هذه الدراسة استخدام هذا الحد لقياس مدى تقدم التلوث في منطقة الدراسة. حيث خلصت النتائج الى ان التلوث الناتج من احواض التخمير ينتقل افقيا بمعدل (500 م/العام) وانه سوف يصل الى عمق 75 م بعد 60 سنة من بداية المحاكاة.

DEDICATION

This thesis would be incomplete without a mention of the support given me throughout the entire venture by the most wonderful individuals;
My mother, my father, brothers, sisters and stepmother;
I dedicate this work for their love, support and encouragement.

ACKNOWLEDGMENTS

- I wish to thank Dr Salma Yehea Head of the Department of Civil Engineering for facilitating this Thesis. I express my sincere thanks to Dr. Abdalla Mohammed Taha Shigidi for his persistent encouragement to carry out this work and his assistance during the investigation and for his valuable supervision and continuous help throughout this study and manuscript preparation.
- I also thanks Dr. Yosuf Ali Yosuf and Dr. Mohammed Ali Al-Haj Alloba for their valuable suggestions they made after reading the manuscript and for the fruitful discussions.
- My appreciation and gratitude is extended also to all those who have helped me to complete this work from the Department of Civil Engineering and the Higher Studies Department in Sudan University for Science and Technology.

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SYMBOLS

a.m.s.l	Above Mean Sea Level
Ca	Calcium
Cl	Chloride
Co_3	Carbonate.
Conc.	Concentration
C^o	Degree Centigrade
Cm	Centimeter
Cm^2	Square Centimeter
Cm^3	Cubic Centimeter
F	Fluoride
Fe	Iron
Fig.	Figure
Figs.	Figures
H	Total Head
Km	Kilometer
Km^2	Square Kilometer
l/hr	Liters Per Hour
l/s	Liters Per Second
M	Meter
M^2	Square Meter
Mg/l	Milligram per Liter
Ph	Measure of the hydrogen – ion concentration in water
ppm	Part Per Million
Q	Discharge
T	Transmissivity
TDS	Total Dissolved Solids
USGS	United States Geological Survey
UTM	Universal Transverse mercator
V	Velocity
WHO	World Health Organization