



شبكة المعلومات الجامعية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ





شبكة المعلومات الجامعية



# شبكة المعلومات الجامعية

## التوثيق الالكتروني والميكرو فيلم

# جامعة عين شمس

التوثيق الالكتروني والميكرو فيلم

## قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
علي هذه الأفلام قد اعدت دون أية تغيرات



## يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of  
15 – 25c and relative humidity 20-40 %



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# بعض الوثائق الأصلية تالفة



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بالرسالة صفحات  
لم ترد بالأصل

# **EFFECT OF HYDRAULIC PROPERTIES OF FILTER MEDIA ON THE DESIGN OF TRICKLE IRRIGATION NETWORK**

**By**

**ABD EL- HALIM MOHAMED ZAYTON**

B.Sc. Agricultural Engineering, Alexandria University, 1981.

M.Sc. Agricultural Engineering, Cologne, Germany, 1991.

A thesis submitted in partial fulfillment  
of  
the requirements of the degree of

**DOCTOR OF PHILOSOPHY**

in

**Agricultural Science  
(AGRICULTURAL MECHANIZATION)**

Agricultural Engineering Department  
Faculty of Agriculture  
Ain Shams University

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2001



## Approval Sheet

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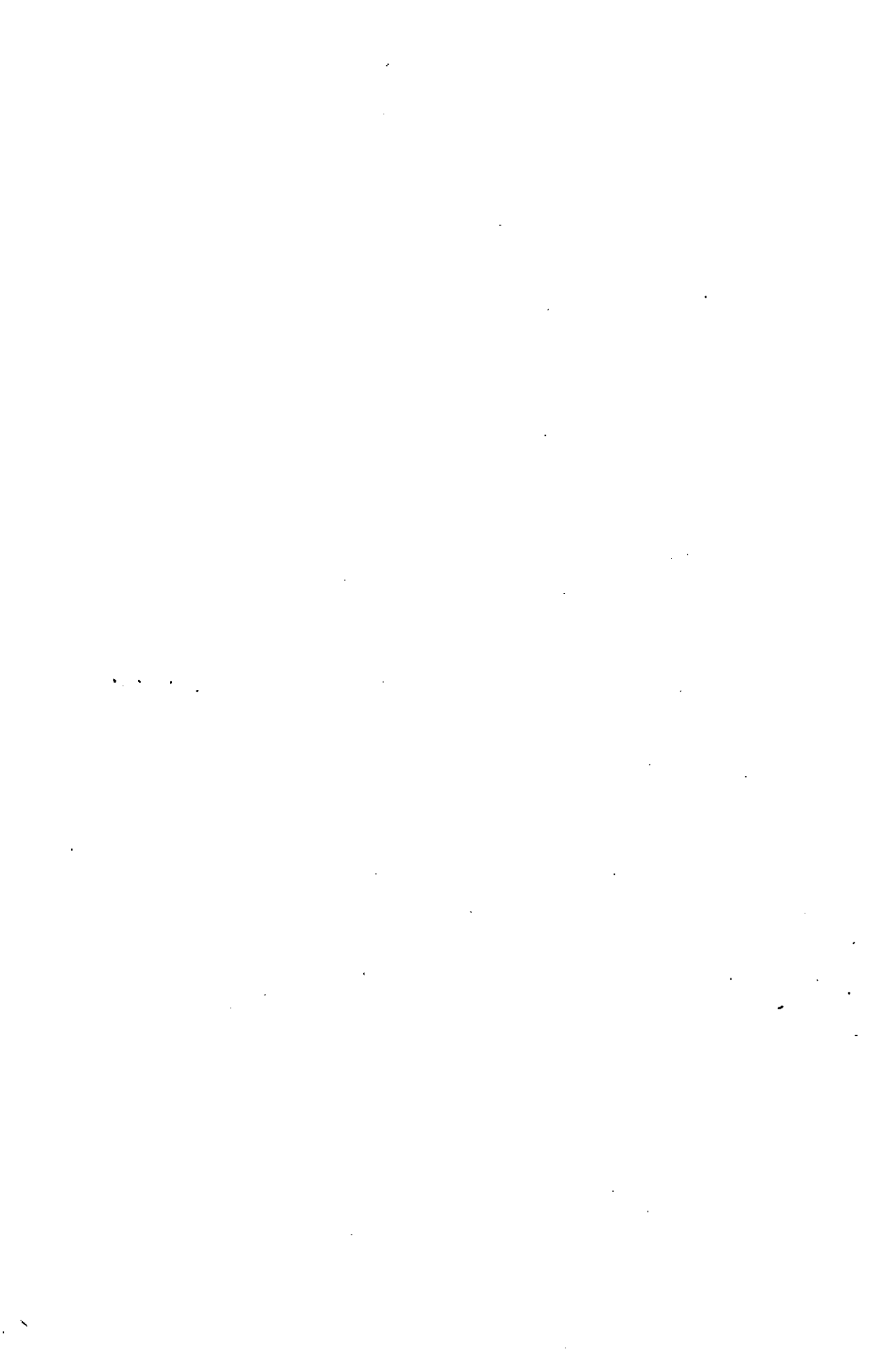
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## **ABSTRACT**

**Abd El-Halim Mohamed Zayton. EFFECT OF HYDRAULIC PROPERTIES OF FILTER MEDIA ON THE DESIGN OF TRICKLE IRRIGATION NETWORK. Unpublished Doctor of Philosophy dissertation, University of Ain Shams, Faculty of Agriculture, Department of Agricultural Engineering, 2001.**

Series of laboratory experiments were conducted to investigate the filtration performance of different types of filter media. These experiments were divided in two main parts. The first one was to determine some physical and chemical properties of five different foreign and local media types. The second was to evaluate the filtration performance of each media type under different operating conditions of sedimentation loads and filtration depths. Emitter clogging problem under these different operating conditions was investigated. Five different emitter types were also used. The statistical split-split-split plot design was chosen for this study. A mathematical model was developed to simulate the trickle irrigation performance under different operating conditions. Experimental results were employed to verify the model prediction accuracy and to test its sensitivity.

Summary of the obtained results is given as follows:

### **A. Laboratory experiments.**

1. The coefficients of permeability ( $k$ ) are strongly related to the grain effective diameter ( $D_{10}$ ) and the porosity of the filter media.
2. Media size is the main factor affecting removal efficiency and pressure loss development.
3. Sedimentation loads are the second most important factor affecting the media filter performance. Generally removal efficiency decreased with increasing the sedimentation loads.
4. An improvement of the removal efficiency due to increasing filter bed depth from 30 to 50 cm was noticed.

5. The flow rate reduction through the filter media decreased as the porosity and the permeability of the media increased.
6. Head loss development across the filter is an important indicator for the time at which the filter needs to be backwashed.
7. The susceptibility to clogging of the tested emitter types varied according to its type, sedimentation loads, and removal efficiency.
8. Empirical equations were generated to estimate the emitter-clogging ratio of the tested emitter types. Removal efficiency and sedimentation loads were incorporated in this equation.
9. Obtained results indicated that the use of crushed silica and crushed basalt (2) media types, E-2 and Supertif emitter types under operating condition of at least 50 cm and sedimentation loads of 10.00 to 20.00 mg/L contribute to better performance of the trickle irrigation system..

#### **B. Mathematical model.**

1. The model predicted the flow rate for any media type under different operating conditions with prediction accuracy of about 86%.
2. The model predicted well the head losses for all media types. The lowest prediction accuracy of 87% was found at 10 mg/L sedimentation load.
3. The model predicted the standing time of the different media types with prediction accuracy ranging from 90 to 92%.
4. The model predicted fairly the emitter discharge with respect to its operating time specially at sedimentation loads of 10 and 20 mg/L.
5. The correlation coefficient between predicted and measured values were 91.18, 92.3 and 87.5% for values of filter discharge rate, head losses and emitter discharge respectively.

From the above results it is concluded that the developed model could be used safely for choosing the media type, filter sizes based on the irrigation water quality and emitter type.

**Key words:** trickle irrigation, filtration, filter media, irrigation water, emitter, clogging, modeling.

## **ACKNOWLEDGEMENTS**

The author wishes to express his sincere gratitude to his major professor and supervisor, Dr. Mohamed Nabil **EL AWADY**, Professor Emerit. of Agricultural Engineering, Ain Shams Univ. Dr. El AWADY has been an unfailing source of encouragement, assistance and friendship for which the author will always be grateful.

Special thanks are due to Dr. Azmy Mahmoud **EL-BERRY**, Professor of Agricultural Engineering, Cairo Univ., director of the Agricultural Engineering Research Institute, for his invaluable guidance, expert advice and continued encouragement throughout this study.

The author is indebted to Dr. Mohamed Abdel -Magid **GNAIDY**, Assistant Professor of Ag. Eng., Ain Shams Univ., for his guidance and invaluable comments throughout the course of the study.

The author wishes to express his deep and sincere thanks to Dr. Abdalla M. **ZEIN EL-DIN**, Professor of Agricultural Engineering, Alex. Univ., for his invaluable guidance throughout the theoretical part of this study. His timely assistance and his patience in reviewing this manuscript are greatly appreciated.

Sincere thanks are extended to all staff members of the Tractor Testing Station, Agri. Eng. Res. Institute, Elsabahya, Alex., for their valuable advice and providing all needed facilities.

Last, but not least, the author thanks his beloved father, mother, wife and family for their understanding and support throughout his study.

