Arsenic Removal from Contaminated Groundwater

Sirshendu De • Abhijit Maiti

The Energy and Resources Institute

Arsenic Removal from Contaminated Groundwater

Arsenic Removal from Contaminated Groundwater

Sirshendu De • Abhijit Maiti

teri

The Energy and Resources Institute

ISBN 978-81-7993-383-1

Suggested citation

De, S., and Maiti, A. *Arsenic Removal from Contaminated Groundwater.* New Delhi: The Energy and Resources Institute (TERI), 2012.

Published by
The Energy and Resources Institute (TERI)
TERI Press
Darbari Seth Block
IHC Complex, Lodhi Road
New Delhi – 110 003
India

Tel. 2468 2100 or 4150 4900
Fax 2468 2144 or 2468 2145
India +91 • Delhi (0)11
E-mail teripress@teri.res.in
Website www.teriin.org

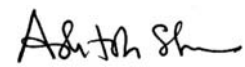
Printed in India

Foreword

Contamination of drinking water with arsenic is now being considered a worldwide problem. Several parts of South East Asia and various other parts of the world are suffering from this issue. Prolonged use of arsenic intake above the permissible level (50 ppb in India and 10 ppb in USA) leads to diseases like skin cancer and digestive disorders, which are grouped under the disease arsenicosis. In India, the people around the Gangetic plains in particular are more vulnerable to this menace. The government has made an effort to mitigate this problem, but this is limited to boring deep wells (beyond 200 ft) only. This cannot be a long-term solution as it aggravates the recession of the underground water table and eventually leads to penetration of arsenic to greater depths and above its tolerable limit. Therefore, development of pertinent removal technologies of arsenic from groundwater is an active field of research. The developed technology should be technically efficient and cost effective because more than 98% of people suffering from arsenic contamination belong to villages. Thus, low-cost, efficient arsenic removal technology is a crucial aspect that needs to be addressed keeping in mind the problems associated with rural India.

Arsenic Removal from Contaminated Groundwater offers a comprehensive study on hydrogeochemistry and geochemistry of arsenic, conventional removal technologies, and a cheaper version of technology using treated laterite and various aspects to make this technology efficient. Hydrogeochemistry of arsenic-contaminated water, various technologies involved and used for the removal of arsenic, application of raw laterite as arsenic adsorbent from water medium, acid activation on raw laterite in the context of characteristics changes and arsenic adsorption behaviour, and acid–base treated laterite as arsenic adsorbent are discussed. The book also delves into the current state of research in this field.

The authors have made an attempt to make this book as comprehensive as possible. I am sure that it will be a useful reference material for students and researchers in this field and wish the authors success.



Dr Ashutosh Sharma
Professor (Dept of Chemical Engineering)
Indian Institute of Technology, Kanpur

Preface

In this book, occurrence, distribution, hydrogeochemistry of arsenic in groundwater and feasibility of raw laterite (RL) and/or treated laterite (TL) as arsenic adsorbent are discussed in detail. Raw laterite samples collected from various locations were subjected to different treatment methods to enhance the adsorbent performance for arsenic removal from contaminated groundwater in continuous fixed-bed mode operation.

Chapter 1 gives an overview of the state of current research in this area, while Chapter 2 details the hydrogeochemistry of arsenic contaminated water. Chapter 3 focuses on various technologies involved and used for the removal of arsenic. The application of RL as arsenic adsorbent from water medium is discussed in Chapter 4. The results of adsorption in batch mode is presented under different operating conditions such as pH of solution, adsorbent dose, contact time, arsenic concentration, temperature, and speed of agitation. The adsorption kinetics in stirred tank vessel is predicted by applying shrinking core model. The model is also applied to contaminated groundwater (CGW)/ RL system. The chapter gives an account of the continuous fixed-bed column performances of RL bed.

In Chapter 5, the acid activation on RL in the context of characteristics changes and arsenic adsorption behaviour is discussed. Both batch and column mode adsorption of arsenic using acid-activated laterite is investigated under different operating conditions. In Chapter 6, the results of acid–base TL are presented as arsenic adsorbent for CGW. A design of household column filter using TL bed is also proposed to remove arsenic from CGW.

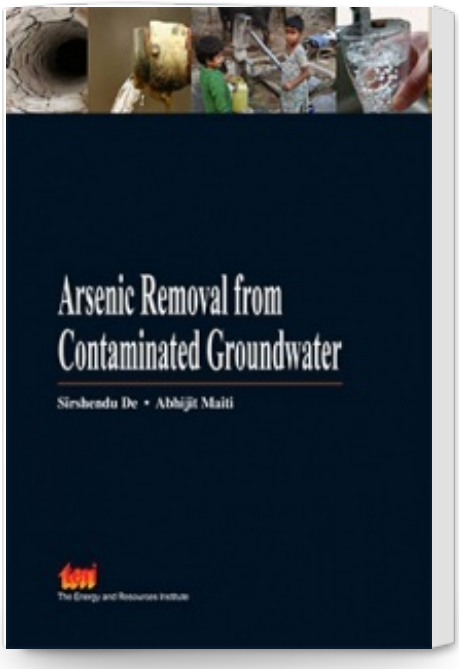
We hope this book will be a useful reference to students, researchers, and faculty in this field.

Acknowledgements

The authors gratefully acknowledge the financial support provided by the Department of Science and Technology, Government of India. Analysis and administrative facilities provided by the Department of Chemical Engineering, Indian Institute of Technology, Kharagpur, are also acknowledged.

We are thankful to our family members, especially our children, who have constantly supported us through this endeavour.

Arsenic Removal From Contaminated Groundwater



Publisher : TERI Press

ISBN : 9788179933831

Author : Sirshendu De, Abhijit Maiti