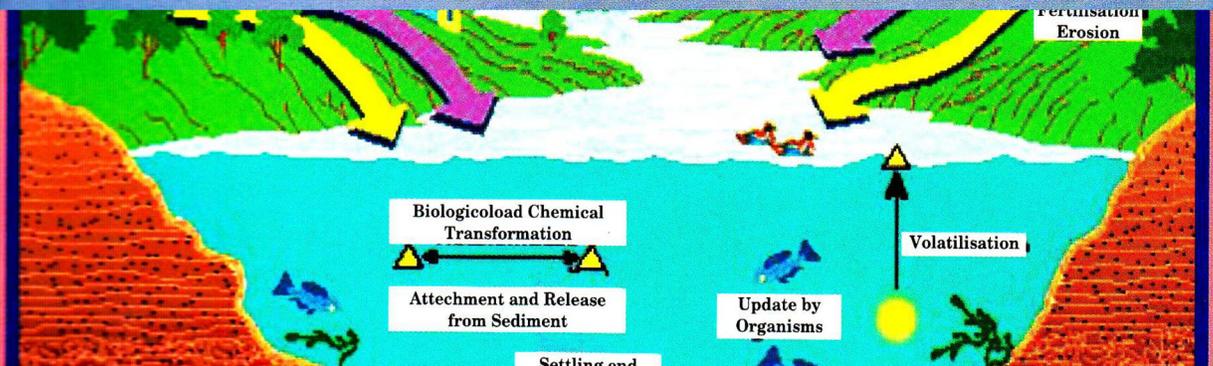
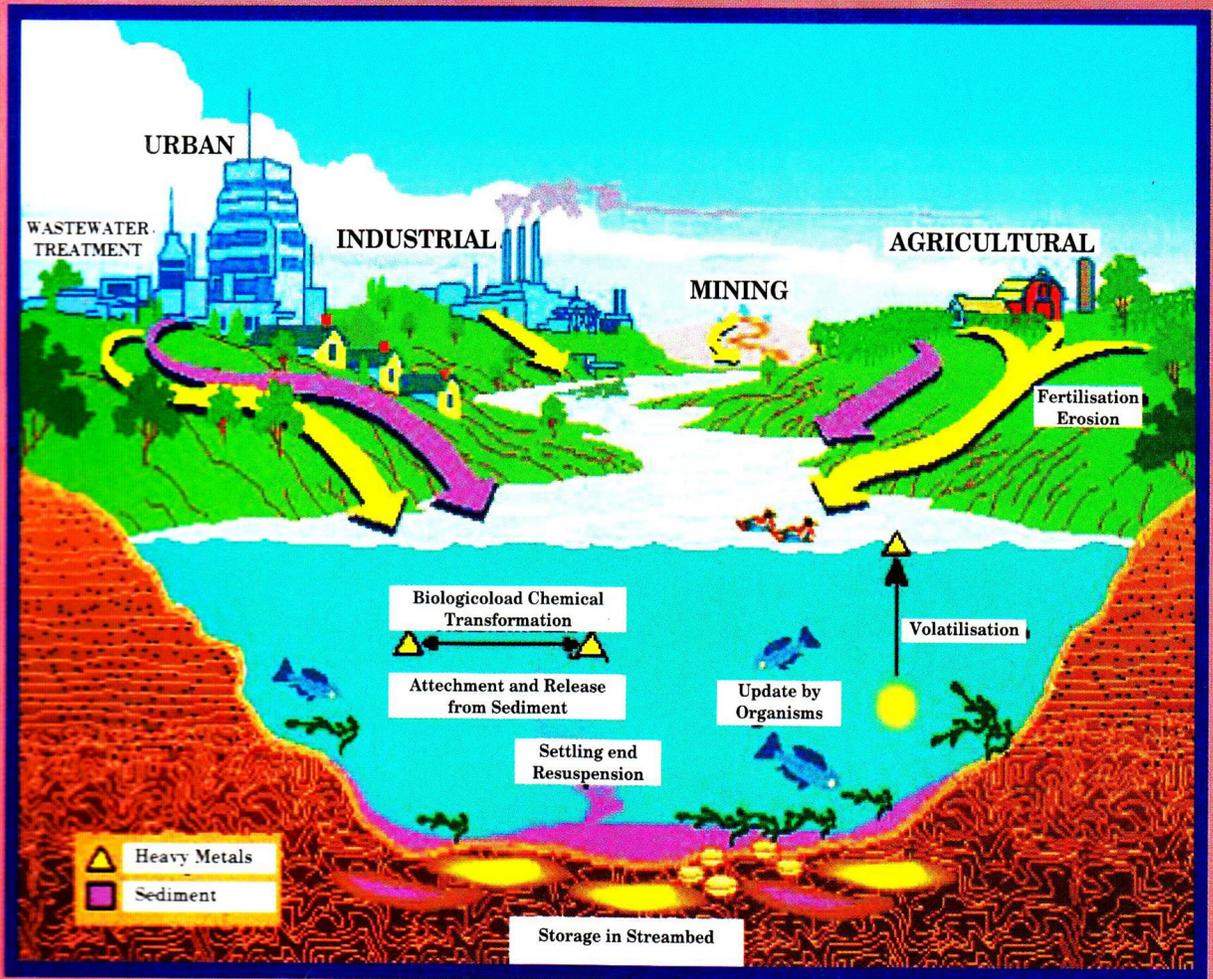


Heavy Metals in Soils and Plants

HEAVY METALS IN SOILS AND PLANTS



G.L. Malival
K.P. Patel

AND PLANTS

1

Heavy Metals in Soils and Plants

G. L. Maliwal
K. P. Patel



Agrotech Publishing Academy
UDAIPUR

Published by :

Mrs. Geeta Somani
Agrotech Publishing Academy
11A-Vinayak Complex B
Durga Nursery Road, Udaipur - 313001
Mob. : 9414169635, 9413763031
Email : agrotechbooks@rediffmail.com
Website : www.agrotechbooks.com

Information contained in this book has been published by Agrotech Publishing Academy and has been obtained by its authors believed to be reliable and are correct to the best of their knowledge. However, the publisher and its authors shall in no event be liable for any errors, omissions or damage arising out of use of this information and specially disclaim any implied warranties or merchantability or fitness for any particular use. Disputes if any, are subjected to Udaipur jurisdiction only.

Reprinted 2016

First Edition 2011

© Authors

ISBN : (13) 978-81-8321-206-9

ISBN : (10) 81-8321-206-9

Typeset by :

Image Print Media

17, Subhash Nagar

Mob. : 9413467622, 02942413922

Printed at :

S.S.S. Printers

New Delhi - 110002

PREFACE

We are living in Iron age. Human civilization started with the accidental discovery of metals especially copper. Since then human civilization has taken long strides with the help of metals. We can now fly in the air, travel on land and enjoy oceanic journey with their help. Plants and animals have tested them since long. Chlorophyll contains magnesium and iron, blood contains iron, bones contain calcium. All these metals are beneficial but all metals are not so. Beneficial ones become toxic when present in large amounts and lead to metallic pollution.

Demographic growth, increasing urbanization, industrialization and change in life style triggering greater use of detergents, domestic sprays, medical wastes *etc.* are expected to produce large quantities of anthropogenic wastewaters with different composition. In the country about 22900 MLD of domestic wastewater and 83048 MLD of major industries wastewater are generated. Moreover, 4415954 tonnes per annum of hazardous waste are generated from 13011 industries in the country. These wastewaters contain one or combination of heavy metals depending upon their source of origin. Heavy metals are among the most dangerous contaminants of environment. The accumulation of the heavy metals in various human or animal organs-liver, kidney *etc.* lead to various diseases. Thus metallic pollution has assumed serious proportions. The heavy metals have presented a danger to living species, Cd, Cr, and Pb need special mention. Since soil can no longer bear a greater loading of these metals, vegetation can be the only means to extract and reduce them. But this reduction in soil might increase their concentration in humanbeings and animals. The metallic effluents meeting rivers poison fish and the birds feeding on them are poisoned in return.

Presently about 15% of India's water resources are consumed in domestic and industrial requirements and share of these two sectors will grow to about 30% by 2050. The total water supply to urban population will be 90 km³ and to industries, it will be 81 km³ by 2050. Therefore, production of industrial wastewaters will multiply in quantity with more contaminants like heavy metals including organic compounds and dissolved toxins. The present share of 85% of available water resources to agriculture will go down to 68-70% by 2050 and it is estimated that about 1.5 M-ha of land can be irrigated from available wastewater of the country by integrated management.

The present human civilization is plagued with metallic pollution. Therefore, there is need to understand the basic ideas lying behind it. The nature of metals, the way they become absorbed, solubilize in the soil, contamination in soil and water, amount needed and toxic levels need special description. Monitoring may help in controlling their levels, and at the same time may help in forecasting. Besides, soil and plant factors to affect on uptake of heavy metals by plants as well as plant growth have been thoroughly discussed. The impact of biotransfer of heavy metals on animals, humanbeings and aquatic life have been highlighted. At the last authors have tried to give remediation measures for contaminated soil and wastewater. The authors have tried to collect the relevant information from standard literature at command.

The authors acknowledge the assistance received from all the sources of books, journals, reports.

It is hoped that this book will help in drawing attention of the general readers towards growing menace of metallic pollution and also be useful to students, teachers, researchers, extension workers, planners and administrators. Although efforts have been made to make it errorless yet some mistakes might have crept in. We shall be grateful to receive comments and suggestions to improve the next edition for which no stone will be left unturned.

Previously while writing the book entitled, "Crop Production with Wastewater", it was felt by Senior Author that metallic pollution might form the subject of a new book, this lead to the preparation of this book. M/s Agrotech Publishing Academy gladly accepted the proposal to print this book for readers. The authors thank them.

- G.L. Maliwal & K.P. Patel

ABOUT THE AUTHORES

Dr. G.L. Maliwal (b.1942), retired from the post of Research Scientist (Professor), GAU, Anand in November 2002. During the last 38 years of active research and education Dr. Maliwal made valuable contributions in the field of irrigation water quality, soil salinity, utilization of wastewater in agriculture, water management and dryland farming. He has worked on different positions at University of Udaipur and Gujarat Agricultural University. He is author of 4 books and has published over 210 research papers and articles in national and international journals of high repute. He has been awarded i) Sardar Patel Agriculture Research Award for 1998-99 by Govt. of Gujarat and ii) Hari Om Ashram Prof. J.P. Trivedi Award” by GAAS, Ahmedabad. Before retirement, he was Principal Investigator of NATP-MM_project on “Use of Urban and Industrial Effluent in Agriculture” Anand Centre, GAU, Anand.

Dr. K.P. Patel (b.1959) obtained M.Sc. Ag. from PAU and Ph.D. from I.A.R.I. and working as Research Scientist (Professor) at AAU, Anand. Dr. Patel has made a valuable contribution in the field on micro-nutrients, heavy metals, pollutant elements and utilization of wastewater in agriculture. He has handled different projects financed by ICAR, SSPA, Rallis, FAI, Unimark, Coromandel Fertilizer Ltd., IOCL, PPIC, GACL, Deptt. of Forest and Environment, Govt. of Gujarat and AGRI BOR, Mumbai, He has been awarded i) Sardar Patel Agriculture Research Award, ii) Chaudhary Devi Lal outstanding AICRP Award 2001 (jointly) iii) FAI Golden Jubilee Award and iv) Hari Om Ashram Prof. J.P. Trivedi Award. He has attended the training at EPA, Chicago, USA on Advances in Analytical techniques related to use of effluent in Agriculture.

ABOUT THE BOOK

The wastewater generated from urban and industries contain heavy metals depending upon their source of generation. Water is becoming a scarce commodity even for irrigation purpose when its present share of 85% of available water resources is likely go down to 68% by 2050. Under this situation, the farmers have to use such wastewaters for irrigation.

Heavy metals are among the most dangerous contaminants of environment. The accumulation of heavy metals in various human or animal organs leads to various diseases. The **heavy metals** have presented a danger to living species, Cd, Cr, and Pb need special mention. Since soil can no longer bear a greater loading of these metals, vegetation can be the only means to extract and reduce toxicity of heavy metals. But this reduction in soil might increase concentration in animals and humanbeings. Therefore, there is need to understand nature of metals, the way they become absorbed, the amounts needed and the toxic levels.

While choosing the subject matter and problem, emphasis has been given to adsorption, solubility of metals in soil, contamination in soil and underground water, soil-water-plant relationship includes soil and plant factors affecting uptake, bioavailability of heavy metals and their impact on crop production as well as uptake and biotransformation in animals, humanbeings and aquatic life. Remediation techniques are discussed at the last.

It is hoped that this book will prove very useful to students, teachers, researchers, extension workers, planners and administrator. Although every effort has been made to make it errorless yet some mistake might have crept in. We shall be grateful to receive critical comments and suggestion to improve the next edition.

SYMBOLS AND ABBREVIATIONS

A. Symbols

Ag	- Silver
Al	- Aluminum
As	- Arsenic
Au	- Auron (gold)
B	- Boron
Be	- Berium
Br	- Bromide
Ca	- Calcium
Cd	- Cadmium
Cl	- Chloride
Co	- Cobalt
Cr	- Chromium
Cu	- Copper
Fe	- Iron
H	- Hydrogen
Hg	- Mercury
I	- Iodine
K	- Potassium
Mg	- Magnesium
Mn	- Manganese
Mo	- Molybdenum
Na	- Sodium
Ni	- Nickel
O	- Oxygen
P	- Phosphorus
Pb	- Lead
Pt	- Platinum
Pu	- Plutonium
S	- Sulphur
Sb	- Antimony
Se	- Selenium
Si	- Silicon
Sn	- Stanous (Tin)
Ti	- Titanium
Tl	- Thallium

U	- Uranium
V	- Vanadium
W	- Tungsten
Zn	- Zinc

B. Abbreviations

%	- per cent
°C	- degree celcius
A.A.U.	- Anand Agricultural University
AB-DTPA	- Ammonium Bicarbonate Diethylene Triamine Pentaacetic Acid
ADP	- Adenosine diphosphate
AMU	- Aligarh Muslim University
ATP	- Adenosine triphosphate
C.E.C.	- Commission of European Community
CaCO ₃	- Calcium Carbonate
CEC	- Cation Exchange Capacity
CPCB	- Central Pollution Control Board
CSSRI	- Central Soil Salinity Research Institute
Cu-TETREN	- Copper - tetra ethylene penta amine
DTPA	- Diethylene Triamine Pentaacetic Acid
EC	- Electrical Conductivity
EDDS	- Ethylene Diamine Disuccinate
EDTA	- Ethylene diamine tetra-acetate
EPA	- Environmental Protection Agency
EU	- European Union
FYM	- Farm Yard Manure
g ha ⁻¹	- gram per hectare
g kg ⁻¹	- gram per kilogram
g pot ⁻¹	- gram per pot
G.A.U.	- Gujarat Agricultural University
g/m ²	- gram per square meter
gL ⁻¹	- gram per liter
GPCB	- Gujarat Pollution Control Board
H.A.U.	- Haryana Agricultural University
H.P.C.	- High Power Committee
I.A.R.I.	- Indian Agricultural Research Institute
kg ⁻¹	- per kilogram

Lpcd	- Liter per capita daily
meq 100g ⁻¹	- milliequivalent per 100 gram
mg day ⁻¹	- milligram per day
mg kg ⁻¹ or mg/kg	- milligram per kilogram
mg	- milligram
mgL ⁻¹ or mg/L	- milligram per liter
M-ha	- Million hectare
MLD	- Million Liter Per Day
mM	- millimolar
MMTPA	- million metric ton per annum
MPKU	- Mahatma Phule Krishi Vidhyapeeth
mt	- million ton
mv	- millivolt
NAAS	- National Academy of Agricultural Science
NTA	- Nitrilo Triacetic Acid
NY	- New York
P.A.U.	- Punjab Agricultural University
pH	- Negative logarithm of hydrogen ion concentration/ activity
Ph.D.(Agri.)	- Doctor of Philosophy in Agriculture
PME	- Post Methanation Effluent
ppb	- parts per billion
ppm	- parts per million
T.N.A.U.	- Tamil Nadu Agricultural University
TPA	- tonnes per annum
t/yr	- tonne per year
TCP	- Tricalcium Phosphate
UP	- Uttar Pradesh
USA	- United States of America
USEPA	- United States Environmental Protection Agency
USPH	- United States Public Health
WHO	- World Health Organization
µg cm ⁻¹	- microgram per centimeter
µg day ⁻¹	- microgram per day
µg kg ⁻¹	- microgram per kilogram
µg L ⁻¹ or ngL ⁻¹ or µg/L	- microgram per liter
µg/g or µgg ⁻¹	- microgram per gram
µm	- micrometer

Heavy Metals in Soils and Plants



Publisher : Agrotech
Publications

ISBN : 9788183212069

Author : Maliwal GL And
Patel KP

Type the URL : <http://www.kopykitab.com/product/7076>



Get this eBook