

Hazardous Chemicals

Overview, Toxicological Profile,
Challenges, and Future Perspectives

Edited by
Malvika Chawla • Jaspal Singh • R.D. Kaushik



Hazardous Chemicals

This page intentionally left blank

Hazardous Chemicals

Overview, Toxicological Profile, Challenges,
and Future Perspectives

Edited by

Malvika Chawla

Academic Editing, Jwalapur, Uttarakhand, India; Big4Bio, A Division of BigBio Communications,
San Francisco, CA, United States

Jaspal Singh

Department of Chemistry, Faculty of Sciences, Gurukula Kangri (Deemed to be University), Haridwar,
Uttarakhand, India

R.D. Kaushik

Department of Chemistry, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India



ACADEMIC PRESS

An imprint of Elsevier

Academic Press is an imprint of Elsevier
125 London Wall, London EC2Y 5AS, United Kingdom
525 B Street, Suite 1650, San Diego, CA 92101, United States
50 Hampshire Street, 5th Floor, Cambridge, MA 02139, United States

Copyright © 2025 Elsevier Inc. All rights are reserved, including those for text and data mining, AI training, and similar technologies.

Publisher's note: Elsevier takes a neutral position with respect to territorial disputes or jurisdictional claims in its published content, including in maps and institutional affiliations.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system, without permission in writing from the publisher. Details on how to seek permission, further information about the Publisher's permissions policies and our arrangements with organizations such as the Copyright Clearance Center and the Copyright Licensing Agency, can be found at our website: www.elsevier.com/permissions.

This book and the individual contributions contained in it are protected under copyright by the Publisher (other than as may be noted herein).

Notices

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our understanding, changes in research methods, professional practices, or medical treatment may become necessary.

Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds, or experiments described herein. In using such information or methods they should be mindful of their own safety and the safety of others, including parties for whom they have a professional responsibility.

To the fullest extent of the law, neither the Publisher nor the authors, contributors, or editors, assume any liability for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions, or ideas contained in the material herein.

ISBN: 978-0-323-95235-4

For information on all Academic Press publications visit our website at
<https://www.elsevier.com/books-and-journals>

Publisher: Stacy Masucci
Acquisitions Editor: Kattie Washington
Editorial Project Manager: Pratishtha Gupta
Production Project Manager: Omer Mukthar
Cover Designer: Mark Rogers

Typeset by TNQ Technologies



Dedication

This book is dedicated to those individuals who work diligently to protect human health and maintain the quality of our environment in the presence of dangerous substances. We express our deep admiration and sincere thanks for their persistent efforts.

To the scientists and researchers, whose steadfast commitment to unravelling the complexities of toxicology and risk assessment serves as the foundation of our knowledge, leading us toward well-informed decision-making and proactive interventions.

To the policymakers and regulators, whose diligent work in formulating and enforcing rules and regulations plays a crucial role in reducing the dangers presented by dangerous substances, guaranteeing the safeguarding of public health and the long-term viability of our ecosystems.

To the brave frontline workers, whose altruistic dedication to tackling the difficulties of chemical exposure frequently entails high personal cost, yet whose resolute commitment to public health and safety stays unshakable in the midst of adversities.

To the enduring communities impacted by chemical perils, whose fortitude and unity act as a guiding light of optimism and motivation, compelling us to further our endeavors in the quest for environmental fairness and impartiality for every individual.

And to the Earth, our collective abode, whose limitless splendor and abundant resources support all of us and whose fragile equilibrium we must respect and safeguard for the well-being of present and future generations.

This dedication pays homage to the resilient determination and steadfast dedication of every person who contributes to the joint effort of protecting our well-being and the environment. We deeply appreciate and value your commitment and selflessness. Your efforts have not only been recognized but also treasured, and your valuable contributions have become an integral part of our collective pursuit of a safer, healthier, and more sustainable world.

Contents

Contributors	xi		
About the editors	xv		
Foreword	xvii		
Preface	xix		
Acknowledgments	xxi		
Part I			
Pesticides, fertilizers, and insecticides			
1. Toxicity of pesticides: Health and environment risk of using Dichlordiphenyltrichloroethane	3	6. Neonicotinoids: A potential insecticide of the decade	73
<i>R.D. Kaushik and Vishakha Pundir</i>		<i>Sunita Khatkar and Santosh Kumar Dubey</i>	
2. Ecological risk assessment of atrazine in relation to its toxicity, hazard and management	15	7. Environmental contamination and toxicology of benzene-hexachloride (BHC)	85
<i>Randeep Kumar, Chandini, Ravindra Kumar and Om Prakash</i>		<i>Malvika Chawla</i>	
3. Impact of carbendazim on our eco- logical system and its management strategies	29	8. An expository note on notorious methyl parathion engendering risk evaluation and its redressal	105
<i>Sushila Arya, Ravendra Kumar and Om Prakash</i>		<i>Manila Kashni, Ritu Arora and Rajeev Jain</i>	
4. Health risk assessment and toxicity management of organochlorine pesticide: With the reference to Aldrin	43	9. Chlordane: Exposure, biohazard, current research, and precautions	119
<i>Nitish Kumar, Krishna Swarup Gupta and Rakesh Kumar Soni</i>		<i>Deepali Trivedi, Kumud Tanwar, Ashok Kumar Kakodia and Muskan Jain</i>	
5. Azinphos-methyl: Probabilistic health and environmental threats	57	10. Toxicological effect, bioaccumulative potential, and risk assessment of endosulfan	137
<i>Kumud Tanwar, Muskan Jain and Harshita Sachdeva</i>		<i>Kunarika Bhanot and Apourv Pant</i>	
		11. Naphthalene: Risk assessment and environmental health hazard	157
		<i>Upasana Bhardwaj and Raj Nath Yadava</i>	
		12. Pyrethroids: Uses, toxicological profile, and its fate in environment	177
		<i>Himani Gautam, Shubhra Singh and Gaganpreet Singh Brar</i>	

Part II

Automotive

13. Asbestos: Magic mineral or fatal menace? 195

M. Lakshmy

14. Ethylene Glycol: Industrial application and risk assessment 205

Satyendra Kumar Rajput, Rohit Bhardwaj, Swati Madan and Rahul Singh

15. Kerosene: Risk assessment, environmental and health hazard 219

Ashok Kumar Kakodia, Sunaina Chobdar, Shubham Awasthi and Ravi Kant

16. Potential hazard analysis, bioremediation, and non-bioremediation of trichloroethylene 235

Priyanka Tyagi

17. PAH (polycyclic aromatic hydrocarbons): Risk assessment and health impacts 253

Gagan Matta, Gaurav Pant, D.P. Uniyal and Gulshan K. Dhingra

Part III

Paints and paint solvents

18. Acrylamide: Unveiling toxicity and carcinogenic risks 279

Surekha Kannaujia and Radhey Shyam

19. Effects and mechanism of acrylonitrile use related toxicity 287

Swati Singh, Kumud Tanwar and Muskan Jain

20. The epitome of toxic dichloromethane (methylene chloride): An approach to understand hazards and safety 305

Om Singh and Vinod Kumar Singh

21. Methyl methacrylate: Utilization, evaluation of potential adverse effects, and toxicity to human health and the environment 315

Ankur Malik

22. A review on interaction of diethyl ether with human health and its effects on the environment 329

Shilpi Arora and Shipra Gautam

23. Toluene diisocyanate: Analytical safety assessment 339

Om Singh and Vinod Kumar Singh

24. A review on the toxicology of white spirit 349

Shalini Singh and Satyendra Kumar Rajput

Part IV

Chemical manufacturing solvents

25. Pyridine: Exposure, risk management, and impact on life and environment 363

Nazia Tarannum and Deepak Kumar

26. Risk assessment of Xylene and its impact on environment and human health 375

Gurpreet Saggu and Avinash Kumar

27. Toluene toxicity: Outline, management, and prognosis 391

Satyendra Kumar Rajput, Shalini Singh and Rohit Bhardwaj

28. Human health and environmental perspectives on exposure to benzene: A review 405

Esha Vatsa and Vipul Bhatt

29. Carbon disulfide toxicological overview 427

Mayank Kumar Malik and Vipin Kumar

30. Chloroform: Risk assessment, environmental, and health hazard 439
Shipra Gautam and Shilpi Arora
31. Exploring Hexane's impact: Toxicological insights, challenges, and forward-looking perspectives 453
Pretam Kumar and Sushil K. Pandey
- Part V
Dyes 467
32. Toxic potential of azo dyes: A broader understanding 469
Richa Saini and Kumud Choudhary
33. Assessing toxicity of *p*-chloroaniline: Current research and future perspectives 483
Ramesh Chandra and Sundeep Kumar
- Part VI
Cleaning agents
34. Health and safety measures associated with ammonium hydroxide exposure 495
Keshari Nandan, Amrish and Ankit Singh
35. Sulfamic acid: A risk to both the environment and human health 505
Ankit Singh, Abhay Kumar Choubey and Keshari Nandan
- Part VII
Pharmaceuticals
36. Barium sulfate: Human effects assessment and toxicological profile 517
Rupali Sharma and Shabnam Thakur
37. Aqua chloral: Assessing risks emanating from its noxiousness 533
Manila Kashni and Mitu Bhalla
38. Risk assessment and management studies of uracil mustard 543
Swapna Kumar Srivastava
39. Selenium sulfide toxicology profile: Sources of contaminations, distribution, and monitoring methods 557
Anushree Dave, Ashok Kumar Kakodia and Shiv Lal
40. Melphalan: Uses, side effects, current research, and precautions 571
Neha Kapoor, Anishma Metray, Rakeshwar Bandichhor and Srestha Dutta Choudhury
41. Mercuric oxide: Significance in chemistry, ongoing research, and safety evaluation 581
Anishma Metray, Rakeshwar Bandichhor and Neha Kapoor
42. Nicotine and salts: Sedative, stimulants, and toxicological effects 593
Sushila Arya, Ravendra Kumar and Om Prakash
43. Understanding silver nitrate: Characteristics, applications, hazard evaluation, and health implications 607
Shruti Sodhi, Rakeshwar Bandichhor and Neha Kapoor
44. Epinephrine: Clinical uses, interaction, health risk, and future prospective 617
Shivani Tyagi and Jyoti Choudhary
45. The influence of alkylating agent on environment: Cyclophosphamide 629
Satyendra Kumar Rajput and Shalini Singh

46. Arsenic trioxide: Therapeutic uses, environmental impact, and risk management 645
Kapim Kumar Bagga and Malvika Chawla
47. Toxicology of daunomycin: A logical approach to risk assessment and management 655
Neeraj Kumar and Prakash Chander Thapliyal
48. Toxicological aspects of hazardous vanadium oxide (V₂O₅): Direction on human health, environment issue, and future research 663
Sabeeha Parveen, Ramesh Chandra and Sundeep Kumar
49. Fate of nitroglycerin in human body and environment 673
Mayank Kumar Malik, Vipin Kumar and C.S. Mathela
- Part VIII**
Radioactive products
50. Nuclear reactor fuel: Uranium toxicological mechanism and emerging health risks 685
Pooja and Alka Harit
51. Need to remove radio cesium poisoning 699
Jaspal Singh, Mayank Kumar Malik and Meenu Teotia
52. Health and environmental risk of alpha emitter radium 713
Devendra Kumar Verma, Rashmi Rameshwari and Jagram Meena
53. Indium: Pollution potential, applications, adverse effects, and control measures 723
Jasvinder Kaur and Rajdeep Malik
54. Health effects and toxicity mechanism of thorium: Knowledge gaps and research prospects 729
Devesh Bhatt, Randeep Kumar, Ravendra Kumar and Om Prakash
- Part IX**
Miscellaneous
55. Potential of lignocellulolytic actinomycete isolates in the degradation of rice straw 743
Monika Chauhan, Sunil Kumar, M. Maqbool Rather and Puran Chandra
56. Environmental toxicants and hazardous chemicals: Paramount threat to mental health 755
Priyanka Soni, Rajat Singh and Arun Kumar
57. Exposure to indoor household air pollution and its impact 765
Farooq Ahmad Ganie, Nasir ud Wani and Masaratul Gani
58. A symphony of decay: Unraveling the chemical tapestry threatening heritage across the globe 775
Nikhil Kumar, Vijayata and Shilpi Sharma
59. Possible health effects of radiation exposure on unborn babies 785
Meenu Arora, Naaz Arora and Sanna Arora
60. Antibiotic resistance: Pathophysiology, implications of overuse, and strategies for recovery 795
Vineeta Dhyani, Ashish Dhyani and Ritika Joshi
- Index 813

Contributors

- Amrish**, Department of Chemistry, Meerut College, Meerut, Uttar Pradesh, India
- Meenu Arora**, Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar, Punjab, India
- Naaz Arora**, Apollo Cradle, Amritsar, Punjab, India
- Ritu Arora**, Department of Chemistry, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Shilpi Arora**, Department of Pharmaceutical Sciences, Himachal Institute of Pharmacy, Paonta Sahib, Himachal Pradesh, India
- Sanna Arora**, John Radcliffe Hospital, Oxford, United Kingdom
- Sushila Arya**, Department of Chemistry, College of Basic Sciences and Humanities, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India; Department of Agriculture, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India
- Shubham Awasthi**, GEC Banswara, Banswara, Rajasthan, India
- Kapim Kumar Bagga**, Reckitt Benckiser (Singapore) Pte Ltd, Singapore
- Rakeshwar Bandichhor**, Integrated Product Development, Innovation Plaza, Dr. Reddy's Laboratories Ltd, Hyderabad, Telangana, India
- Mitu Bhalla**, Department of Chemistry, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India; Child Psychologist, Doon International School, Mohali, Punjab, India
- Kunarika Bhanot**, Department of Chemistry, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Upasana Bhardwaj**, Pharmaceuticals, ASU, Gurugram, Haryana, India
- Rohit Bhardwaj**, Department of Pharmaceutical Sciences, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Devesh Bhatt**, Department of Chemistry, College of Basic Sciences and Humanities, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India
- Vipul Bhatt**, Gurukul Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Gaganpreet Singh Brar**, PI Industries Limited, Udaipur, Rajasthan, India
- Chandini**, Department of Agronomy, Bihar Agricultural University, Bhagalpur, Bihar, India
- Ramesh Chandra**, Department of Chemistry, University of Lucknow, Lucknow, Uttar Pradesh, India; Department of Chemistry, Indian Institute of Technology Kanpur, Kanpur, Uttar Pradesh, India
- Puran Chandra**, ICAR-NBPGR, Delhi, New Delhi, India
- Monika Chauhan**, Forest Research Institute, Dehradun, Uttarakhand, India
- Malvika Chawla**, Academic Editing, Jwalapur, Uttarakhand, India; Big4Bio, A Division of BigBio Communications, San Francisco, CA, United States
- Sunaina Chobdar**, GGTU, Banswara, Rajasthan, India
- Abhay Kumar Choubey**, Department of Sciences and Humanities, Rajiv Gandhi Institute of Petroleum Technology, Amethi, Uttar Pradesh, India
- Jyoti Choudhary**, Department of Biotechnology, Chinmaya Degree College, Haridwar, Uttarakhand, India
- Kumud Choudhary**, Department of Physics, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Srestha Dutta Choudhury**, Department of Chemistry, Hindu College, University of Delhi, Delhi, New Delhi, India
- Anushree Dave**, Govind Guru Tribal University, Banswara, Rajasthan, India
- Gulshan K. Dhingra**, Sri Dev Suman University, Rishikesh, Uttarakhand, India
- Vineeta Dhyani**, All India Institute of Medical Sciences, Delhi, New Delhi, India

- Ashish Dhyani**, Patanjali Research Institute, Haridwar, Uttarakhand, India
- Santosh Kumar Dubey**, Department of Chemistry, Institute of Integrated and Honors Studies, Kurukshetra University, Kurukshetra, Haryana, India
- Masaratul Gani**, Department of Pathology, GMC, Srinagar, Jammu & Kashmir, India
- Farooq Ahmad Ganie**, Department of Cardiovascular and Thoracic Surgery, SKIMS, Srinagar, Jammu & Kashmir, India
- Himani Gautam**, Dhanuka Agritech Research and Technology Centre (DART), Palwal, Haryana, India
- Shipra Gautam**, Department of Pharmaceutical Sciences, Himachal Institute of Pharmacy, Paonta Sahib, Himachal Pradesh, India
- Krishna Swarup Gupta**, Department of Chemistry, University of Rajasthan, Jaipur, Rajasthan, India
- Alka Harit**, Department of Chemistry, Harsh Vidya Mandir (P.G.) College, Haridwar, Uttarakhand, India
- Muskan Jain**, Department of Chemistry, Kanoria PG Mahila Mahavidyalaya, Jaipur, Rajasthan, India
- Rajeev Jain**, Dr B R Ambedkar Administrative Building, Pondicherry University, Puducherry, Puducherry, India
- Ritika Joshi**, Patanjali Research Institute, Haridwar, Uttarakhand, India
- Ashok Kumar Kakodia**, Department of Chemistry, Government College, Raigarh, Alwar, Rajasthan, India
- Surekha Kannaujia**, Department of Chemistry, DBS(PG) College, Dehradun, Uttarakhand, India
- Ravi Kant**, Parrish Pharmaceutical, Haridwar, Uttarakhand, India
- Neha Kapoor**, Department of Chemistry, Hindu College, University of Delhi, Delhi, New Delhi, India
- Manila Kashni**, Department of Chemistry, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Jasvinder Kaur**, Department of Chemistry, School of Sciences, IFTM University, Moradabad, Uttar Pradesh, India
- R.D. Kaushik**, Department of Chemistry, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Sunita Khatkar**, Department of Chemistry, Institute of Integrated and Honors Studies, Kurukshetra University, Kurukshetra, Haryana, India
- Pretam Kumar**, Department of Chemistry, University of Jammu, Jammu, Jammu & Kashmir, India
- Neeraj Kumar**, Department of Inorganic and Physical Chemistry, Indian Institute of Science, Bengaluru, Karnataka, India
- Nikhil Kumar**, Department of Chemistry, Chaudhary Charan Singh University, Meerut, Uttar Pradesh, India
- Nitish Kumar**, Graduate Institute of Biomedical Engineering, National Chung Hsing University, Taichung, Taiwan
- Randeep Kumar**, Department of Soil Science and Agricultural Chemistry, Bihar Agricultural University, Bhagalpur, Bihar, India
- Avinash Kumar**, Department of Zoology of Environmental Science, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Deepak Kumar**, Department of Chemistry, Chaudhary Charan Singh University, Meerut, Uttar Pradesh, India
- Ravendra Kumar**, Department of Chemistry, College of Basic Sciences and Humanities, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India
- Sundeep Kumar**, Department of Applied Chemistry, FET, MJP Rohilkhand University, Bareilly, Uttar Pradesh, India
- Sunil Kumar**, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Vipin Kumar**, Department of Pharmaceutical Sciences, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Arun Kumar**, Department of Psychology, Gurukul Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Ravindra Kumar**, Department of Chemistry, College of Basic Sciences and Humanities, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India
- M. Lakshmy**, Department of Chemistry, MSM College, Alappuzha, Kerala, India
- Shiv Lal**, Rajasthan Technical University, Kota, Rajasthan, India
- Swati Madan**, Amity Institute of Pharmacy, Amity University, Noida, Uttar Pradesh, India
- Ankur Malik**, CINBIO - Centro de Investigación en Nanomateriais e Biomedicina, University of Vigo, Vigo, Spain
- Mayank Kumar Malik**, Department of Chemistry, Faculty of Sciences, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India

- Rajdeep Malik**, Department of Chemistry, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- C.S. Mathela**, Department of Chemistry, Kumaun University, Nainital, Uttarakhand, India
- Gagan Matta**, Hydrology and Science Communication Research Lab, Department of Zoology and Environmental Science, Gurukul Kangri (Deemed University), Haridwar, Uttarakhand, India
- Jagram Meena**, Department of Chemistry, Gurukul Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Anishma Metray**, Department of Chemistry, Hindu College, University of Delhi, Delhi, New Delhi, India
- Keshari Nandan**, Department of Chemistry, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Sushil K. Pandey**, Department of Chemistry, University of Jammu, Jammu, Jammu & Kashmir, India
- Gaurav Pant**, Hydrology and Science Communication Research Lab, Department of Zoology and Environmental Science, Gurukul Kangri (Deemed University), Haridwar, Uttarakhand, India
- Apourv Pant**, Indian Council of Medical Research, Bengaluru, Karnataka, India
- Sabeeha Parveen**, Department of Chemistry, Indian Institute of Technology Kanpur, Kanpur, Uttar Pradesh, India
- Pooja**, Department of Applied Science and Humanities, Roorkee, Institute of Technology, Roorkee, Uttarakhand, India
- Om Prakash**, Department of Chemistry, College of Basic Sciences and Humanities, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India
- Vishakha Pundir**, Department of Chemistry, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Satyendra Kumar Rajput**, Department of Pharmaceutical Sciences, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Rashmi Rameshwari**, Department of Biotechnology, FET, Manav Rachna International Institute of Research and Studies, Faridabad, Haryana, India
- M. Maqbool Rather**, Forest Biology & Tree Improvement, Faculty of Forestry, SKUAST-Kashmir, Srinagar, Jammu & Kashmir, India
- Harshita Sachdeva**, University of Rajasthan, Jaipur, Rajasthan, India
- Gurpreet Saggi**, Chitkara University Institute of Engineering and Technology, Chitkara University, Rajpura, Punjab, India
- Richa Saini**, Department of Physics, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Rupali Sharma**, Amity Institute of Pharmacy, Amity University Haryana, Gurugram, Haryana, India
- Shilpi Sharma**, Department of Toxicology, Chaudhary Charan Singh University, Meerut, Uttar Pradesh, India
- Radhey Shyam**, Department of Chemistry, DBS(PG)College, Dehradun, Uttarakhand, India
- Ankit Singh**, Department of Sciences and Humanities, Rajiv Gandhi Institute of Petroleum Technology, Amethi, Uttar Pradesh, India
- Jaspal Singh**, Department of Chemistry, Faculty of Sciences, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Om Singh**, Department of Chemistry, COER University Roorkee, Uttarakhand, India
- Shalini Singh**, Department of Pharmaceutical Sciences, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Swati Singh**, Department of Chemistry, Kanoria Mahila Mahavidyalaya, Jaipur, Rajasthan, India
- Rajat Singh**, Department of Psychology, Gurukul Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Shubhra Singh**, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh, India
- Vinod Kumar Singh**, Department of Chemistry, Vishveshwarya Group of Institutions, Greater Noida, Uttar Pradesh, India
- Rahul Singh**, Department of Pharmaceutical Sciences, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Shruti Sodhi**, Department of Chemistry, Hindu College, University of Delhi, Delhi, New Delhi, India
- Priyanka Soni**, Department of Psychology, Gurukul Kangri (Deemed to be University), Haridwar, Uttarakhand, India
- Rakesh Kumar Soni**, Department of Chemistry, C.C.S. University, Meerut, Uttar Pradesh, India
- Swapna Kumar Srivastava**, School of Biotechnology, IFTM University, Moradabad, Uttar Pradesh, India

Kumud Tanwar, Department of Chemistry, Kanoria PG Mahila Mahavidyalaya, Jaipur, Rajasthan, India

Nazia Tarannum, Department of Chemistry, Chaudhary Charan Singh University, Meerut, Uttar Pradesh, India

Meenu Teotia, Department of Chemistry, C. C. S University Meerut, Meerut, Uttar Pradesh, India

Shabnam Thakur, Amity Institute of Pharmacy, Amity University Haryana, Gurugram, Haryana, India

Prakash Chander Thapliyal, Advanced Concrete, Steel and Composites Group, CSIR-Central Building Research Institute, Roorkee, Uttarakhand, India

Deepali Trivedi, Kanoria PG Mahila Mahavidyalaya, Jaipur, Rajasthan, India

Priyanka Tyagi, Dhanauri PG College, Haridwar, Uttarakhand, India

Shivani Tyagi, Quantum University, Roorkee, Uttarakhand, India

Nasir ud Wani, Consultant Department of Cardiovascular and Thoracic Surgery, SSH, Srinagar, Jammu & Kashmir, India

D.P. Uniyal, Uttarakhand State Council for Science & Technology, Dehradun, Uttarakhand, India

Esha Vatsa, School of Pharmaceutical Sciences, Jigyasa University, Dehradun, Uttarakhand, India

Devendra Kumar Verma, Department of Chemistry, Sri Venkateswara College, University of Delhi (South Campus), Delhi, New Delhi, India

Vijayata, Department of Chemistry, Shri K. K. Jain Degree College Khatauli, Muzaffarnagar, Uttar Pradesh, India

Raj Nath Yadava, Purnea University, Purnia, Bihar, India

Risk assessment and management studies of uracil mustard

Swapna Kumar Srivastava

School of Biotechnology, IFTM University, Moradabad, Uttar Pradesh, India

38.1 Introduction

Uracil mustard, commonly referred to as Uramustine, belongs to the category of alkylating agents (as shown in Fig. 38.1) and is extensively utilized in chemotherapy (Ghorani-Azam & Balali-Mood, 2015, p. 74). It is derived from uracil, a pyrimidine nucleobase, and chemically combined with nitrogen mustard. This compound is particularly effective against cancer cells that actively incorporate uracil into their nucleic acid synthesis processes during rapid cell division cycles. The alkylation of uracil within nucleic acids inhibits deoxyribonucleic acid (DNA) synthesis, ultimately leading to the apoptosis of these affected cells (Weber & Weber, 2015). It is commonly employed in the treatment of lymphatic malignancies, such as non-Hodgkin's lymphoma.

The compound is recognized by various names including 5-aminouracil mustard, uracil mustard, aminouracil mustard, Uramustina, uracil nitrogen mustard, Uramustine, and Uramustinum. Uracil mustard offers several advantages over other similar agents, including achieving a similar therapeutic effect with a lower dosage, maintaining uniform tolerability, and providing a more straightforward treatment regimen. With long-term therapy, it may be carried out with continued benefit.

This book chapter on uracil mustard is essential for comprehensively understanding its significance in cancer chemotherapy. By elucidating its mechanism of action as an alkylating agent targeting nuclear DNA and disrupting replication, it provides crucial insights into its therapeutic potential against rapidly dividing cancer cells. The chapter highlights its extensive clinical applications in treating various cancers such as lymphomas, leukemia, and solid tumors, underlining its pivotal role in cancer treatment. Additionally, it emphasizes the importance of caution due to potential adverse reactions, prompting careful administration and monitoring by healthcare professionals. Moreover, by discussing the synthesis of derivatives with minimized side effects and the optimization of therapeutic efficacy through combination therapy, the chapter offers valuable perspectives on ongoing efforts to enhance uracil mustard's utility in clinical practice. Overall, this chapter serves as a comprehensive guide for healthcare practitioners, researchers, and students, bridging the gap between scientific understanding and practical application in the fight against cancer.

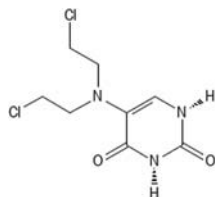


FIGURE 38.1 Structure of uracil mustard. Swapna Kumar Srivastava.