

**A BIBLIOGRAPHY OF ATRAZINE
AND ITS SIMPLE DEGRADATION PRODUCTS
IN THE ENVIRONMENT**

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U.S. GEOLOGICAL SURVEY

Open-File Report 89-613



St. Paul, Minnesota

1989

DEPARTMENT OF THE INTERIOR

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A BIBLIOGRAPHY OF ATRAZINE AND ITS SIMPLE DEGRADATION PRODUCTS IN THE ENVIRONMENT

By Paul D. Capel

ABSTRACT

Citations from the scientific literature on the environmental behavior and occurrence of atrazine and its simple degradation products were obtained from three computerized bibliographic databases: Chemical Abstracts Service, Selected Water Resources Abstracts, and Agricola. More than 2,500 citations were categorized by environmental process, occurrence, analysis, toxicity or physical/chemical property.

INTRODUCTION

Agricultural chemical contamination of surface and ground water is a topic of current concern. Agricultural chemicals have been observed in all components of the hydrologic cycle, establishing a need for research into their environmental fate and transport.

Atrazine (2-chloro, 4-ethyl-amino, 6-isopropyl-amino-s-triazine) provides an excellent environmental surrogate of other herbicides. It has the appropriate set of physical and chemical properties to allow its movement within and between all environmental compartments (air, rain, soil, surface water, biota, ground water, and so forth). It also has a sufficiently wide range of environmental half-lives to allow for its potential movement and subsequent observation in these compartments. Atrazine is also the most common organic contaminant in ground water in the mid-continent of North America (Chen and Druliner 1987, Detroy and others 1988, Klaseus and others 1988) and is the second most popular herbicide in use (Gianessi and Puffer 1988). Therefore, a growing number of studies, both within and outside of the U.S. Geological Survey's Water Resources Division, focus on the environmental behavior of this triazine herbicide (Burkart and others 1988).

To help facilitate the current and future research on nonpoint source contamination by agricultural chemicals, an extensive search of the scientific literature was performed for atrazine and its simple degradation products by means of computerized library databases (table 1). More than 5,000 citations in the scientific literature on these chemicals were found in computerized searches of three bibliographic databases: Chemical Abstracts, Selected Water Resources Abstracts, and Agricola. About half of the citations were eliminated from this bibliography as having limited usefulness to environmental studies based on examination of the citation's abstract and title or title only (whichever was available). The eliminated citations were directed strictly toward the agricultural usefulness of atrazine.

¹ Use of trade names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

The remainder of the citations were organized into categories (table 2). The first major category (Environmental Processes) includes the physical, chemical, and biological processes that control the transport (movement within an environmental compartment), transfer (movement between environmental compartments), and transformation (change in the chemical structure) of atrazine and its simple degradation products. The second major category (Environmental Observations) includes citations of observations of atrazine and its simple degradation products in the major environmental compartments. The third major category (Miscellaneous) includes other topics such as analytical methods, physical/chemical properties, toxicity, and the degradation products.

Each citation is composed of (1) a bibliographic reference, (2) language of the article, (3) keywords assigned to the citation in this bibliography, and (4) the data base reference number. Reference numbers for citations from the Chemical Abstract Service begin with CA; those from the Agricola data base begin with CAIN, CAT, OWRT, or IND, and those from the Selected Water Resources Abstracts data base do not have a reference number listed.

This is not an exhaustive bibliography of atrazine and its simple degradation products, but it contains the works which will be most accessible to the researchers. The citations are those which were available from the computerized library systems at the end of 1988.

Table 1.-- The chemicals referenced in this bibliography

[IUPAC, International Union of Pure and Applied Chemists; CAS, Chemical Abstracts Service]

Common Name	IUPAC Name	Molecular Formula	CAS Registry Number
Atrazine	2-chloro, 4-ethyl-amino, 6-isopropyl-amino-s-triazine	$C_8H_{14}N_5Cl$	1912-24-9
De-ethyl atrazine	2-chloro, 4-amino, 6-isopropyl-amino-s-triazine	$C_6H_{10}N_5Cl$	6190-65-4
De-isopropyl atrazine	2-chloro, 4-ethyl-amino, 6-amino-s-triazine	$C_5H_8N_5Cl$	1007-28-9
Di-dealkyl atrazine	2-chloro, 4-amino, 6-amino-s-triazine	$C_3H_4N_5Cl$	3397-62-4
Hydroxy atrazine	2-hydroxy, 4-ethyl-amino, 6-isopropyl-amino-s-triazine	$C_8H_{15}N_5O$	2163-68-0
De-ethyl hydroxy atrazine	2-hydroxy, 4-amino, 6-isopropyl-amino-s-triazine	$C_6H_{11}N_5O$	19988-24-0
De-isopropyl hydroxy atrazine	2-hydroxy, 4-ethyl-amino, 6-amino-s-triazine	$C_5H_9N_5O$	7313-54-4
Di-dealkyl hydroxy atrazine	2-hydroxy, 4-amino, 6-amino-s-triazine	$C_3H_5N_5O$	645-92-1

Table 2.--The categories used in this bibliography

I. Environmental Processes

A. Transformation Processes

Biodegradation/Biotransformation
Hydrolysis/Chemical Reactions
Photolysis

B. Transfer Processes

Volatilization
Uptake by Biota
Sorption/Partitioning
Associations with Humic Material
Associations with Plant Material
Associations with Surfactants
Sorption to Resins
Sorption to Sediments
Sorption to Soil

C. Transport Processes

Leaching
Runoff
Field Residuals

II. Environmental Observations

Atmospheric Observations
Drinking Water Observations
Ground Water Observations
Surface Water Observations
Waste Water Observations and Treatment

III. Miscellaneous

Analytical Methods/Quantification
Degradation Products
Miscellaneous Environmental
Physical/Chemical Properties
Toxicity

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ENVIRONMENTAL PROCESSES

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Biodegradation/Biotransformation

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