NSF-RANN Trace Contaminants Abstracts

SEPTEMBER 1976

MASTER

TOXIC MATERIALS INFORMATION CENTER
Environmental Resources Center
Information Center Complex
Information Division

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION FOR THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

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NSF-RANN TRACE CONTAMINANTS ABSTRACTS

Emily D. Copenhaver, Editor
Deborah S. Harnden, Associate Editor

Prepared for
NATIONAL SCIENCE FOUNDATION RESEARCH APPLIED TO NATIONAL NEEDS
CHEMICAL THREATS TO MAN AND THE ENVIRONMENT PROGRAM

by

TOXIC MATERIALS INFORMATION CENTER
ENVIRONMENTAL RESOURCE CENTER
INFORMATION CENTER COMPLEX
INFORMATION DIVISION

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TRACE CONTAMINANTS NEWS

PROGRAM CHANGES

On July 1, 1976, the Environmental Aspects of Trace Contaminants Program became the Chemical Threats to Man and the Environment Program. The new program, which has been expanded to encompass organic compounds and human ecosystems, focuses on the identification and quantification of hazardous compounds and assessment of the impact of the spread of these compounds on the environment and human populations. The specific areas of interest of the program are organic chemicals of commerce, metals and organometallic compounds, airborne contaminants, and environmental assay methodology. The objectives of the program are: to develop methodologies for hazard prediction of organic chemicals; to determine the transport, effects, and fates of critical organic compounds which pose threats to human populations and environments in high exposure areas; to investigate the human health effects of organic compound exposures; to assess the economic, legal and sociopolitical implications of hazardous levels of specific organic compounds in the environment; to identify and assess the effects of metals and organometallic compounds on biological life and on ecosystem structure and function; to identify, characterize and quantify contaminants produced from atmospheric precursors of anthropogenic and natural origin; to determine gas-phase kinetics and mechanisms of contaminant evolution, persistence, and conversion; to develop advanced instrumentation and analytical methodology for the collection, identification, and quantification of organic compounds present in a variety of environmental media. Although the program has a broader scope and a new name, the journal will still be entitled NSF-RANN TRACE CONTAMINANTS ABSTRACTS.

NEW GRANTS AND RENEWALS

Renewals

The Toxic Materials Information Center, Environmental Resource Center, Information Center Complex, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830. Emily Copenhaver (615-483-3611; Ext. 3-6823), principal investigator: Information Support Services for Trace Contaminants Programs. \$135,000 for 12 months; began January 1, 1976.

PERSONNEL CHANGES IN WASHINGTON OFFICE

On August 2, 1976, Mrs. Carter K. Schuth joined the National Science Foundation as Program Manager. She came to the Foundation from the Environmental Protection Agency's Office of Toxic Substances.

MEETINGS OF INTEREST

International Conference on Photochemical Oxidant Pollution and Its Control, September 12-17, Raleigh, N.C. Write: Dr. A. P. Altshuler, EPA, Research Triangle Park, N.C. 27711.

National Conference on Disposal of Residues on Land, September 13-15, St. Louis, Mo. Write: Diana Greenwald, Conference Coordinator, Information Transfer, Inc., 1160 Rockville Pike, Suite 202, Rockville, Md. 20852, 301-340-6006.

WPCF Annual Conference, October 3-8, Minneapolis, Minn. Write: Robert A. Canham, WPCF, 3900 Wisconsin Ave., N.W., Washington, D.C. 20016.

Symposium on Aquatic Toxicology and Hazard Evaluation, October 25-26, Holiday Inn-Holiday City, Memphis, Tenn. Write: Dr. Foster L. Mayer, Fish-Pesticide Research Laboratory, Rt. 1, Columbia, Mo. 65201.

37th Annual Meeting of the International Water Conference, October 26-28, William Penn Hotel, Pittsburgh, Pa. Write: Richard Lampel, IWC, 530 William Penn Place, Pittsburgh, Pa. 15219.

ACS 28th Southeastern Regional Meeting, October 26-29, Gatlinburg, Tenn. Write: W. A. Van Hook, Department of Chemistry, University of Tennessee, Knoxville, Tenn. 37916.

IUPAC International Symposium on Techniques for Retrieval of Chemical Information, November 9-10, London, England. Write: Dr. M. Williams, IUPAC, Bank Court Chambers, 2-3 Pound Way, Cowley Centre, Oxford OX4 3FY, United Kingdom.

Toxic Substances Seminar, December 9-10, Washington, D.C. Write: Nancy McNerney, Government Institutes, 4733 Bethesda Ave., Washington, D.C. 20014.

CALL FOR PAPERS

Papers are being solicited for a symposium entitled "Drinking Water Quality Enhancement Through Source Protection" to be held in conjunction with the National American Chemical Society Meeting in New Orleans, Louisiana, March 20-25, 1977. This symposium is sponsored by the Environmental Chemistry Division of the ACS. Prospective speakers must submit a statement of intent to the session chairman by September 1, 1976. The deadline for abstracts is November 1, 1976. Questions pertaining to the symposium should be brought to the attention of the session chairman, Dr. Robert B. Pojasek, JBF Scientific Corporation, 2 Jewel Drive, Wilmington, Massachusetts 01887, 617-657-4170.

TRACE CONTAMINANTS ABSTRACTS

<1>
Formation of Dimethylnitrosamine from
Dimethylamine and Nitrite

Hills, A.L.; Alexander, H.

Cornell University, Ithaca, NY

PHONE NO: (607) 255-3267 (Alexander)

Abstracts of the Annual Meeting of the American
Society for Microbiology, 75th Annual Meeting,
New York, NY, 27 April-2 May 1975, p. 211,
Abstract Q-42; 1975

ANALYSIS; DIMETHYLNITROSAMINE; DNNA; CARCINOGEN;
DIMETHYLAMINE; NITRITE; SEWAGE; LAKES; CANCER;
RADIATION; SOILS; NITROSO-NITROGEN; CHEMICAL
NITROSATION; NITRITE-NITROGEN; STERILIZATION;
MICROBIOLOGICAL FORMATION

Dimethylnitrosamine (DNNA), a potent carcinogen,
was not formed in significantly greater
quantities from dimethylamine and nitrite in
autoclaved sewage and lake water than in sewage
sterilized by exposure to 2 megareads of gamma
radiation or in lake water sterilized by
autoclaving. The level of DNNA formed in 3
autoclaved soils was not significantly greater
than that formed in radiation sterilized samples.
In a fourth soil, the concentration of DNNA was
greater once and essentially the same 3 times in
autoclaved samples as compared with sterile soil.
The maximum levels of DNNA formed were less than
0.1 ppm (as nitroso-nitrogen) in sewage and lake
water and 2.4 ppm in soil. Maximum rates for
chemical nitrosation were found to occur at pH
5.0-5.5 and pH 3.5-4.5 for soil and sewage,
respectively. The soil value differs markedly
from the optimum pH values reported for the
reaction in aqueous buffers (3.8) and in human
gastric juice (2.5). Yields of DNNA as
nitroso-nitrogen never exceeded 2.5% of the added
nitrite-nitrogen in any of the experiments. On
the basis of these observations, the probability
of significant formation of DNNA in soils and
waters will be discussed.

<2>
Microbial Formation of Dimethylselenide

Dolan, J.B.; Alexander, H.

Cornell University, Ithaca, NY

PHONE NO: (607) 255-3267 (Alexander)

Abstracts of the Annual Meeting of the American
Society for Microbiology, 75th Annual Meeting,
New York, NY, 27 April - 2 May 1975, p. 188
Abstract B-21; 1975

ANALYSIS; FORMATION; DIMETHYLSSELENIUM; EVOLUTION;
SELENIUM SOILS; SOILS; SELENIUM; MICROBIAL
FORMATION; INORGANIC SELENIUM; ORGANIC SELENIUM;
VOLATILE PRODUCTS; GAS CHROMATOGRAPHY-MASS
SPECTROMETRY; AVAILABLE CARBON SOURCE; PLANT
TISSUES; DIMETHYLSELENIUM COMPOUNDS;
SELENIUM-NITROGEN; SELENOCYSTINE; ANAEROBIOSES;
AEROBIOSES; MICROBIAL NITRIFICATION; SELENIUM;
SELENATE; ELEMENTAL SELENIUM; SUBSTRATE; BACTERIAL

The evolution of dimethylselenide (DNSe) from
high and low selenium soils amended with
inorganic and organic Se is affected by total Se

content and form of Se added. Identification of
the volatile product as DNSe was made by
chromatography-mass spectrometry. Maximum rates
of DNSe production occurred when the soil was
amended with an available carbon source. The
stimulation of DNSe production from soils amended
with plant tissues of varying Se content
apparently resulted from effects of organic
matter addition and not the Se contained therein.
After 40 days, 80, 37, and 7% of the Se added to
soil as trimethylselenonium chloride,
selenomethionine, and selenocystine was recovered
as DNSe. DNSe was generated more slowly from
inorganic and organic Se compounds in soils under
anaerobiosis than in the presence of air.
Microbial methylation of selenium appears to be
widespread in occurrence. Feeding cell
suspensions of a soil COFFINBACTERIUM generated
DNSe from selenite, selenate, and elemental Se.
Selenite was the best and elemental Se the
poorest substrate for the reaction by the
bacterium and in soil.

TAXONOMY: COFFINBACTERIUM

<3>
Stability of N-Nitrosamines in Samples of Natural
Environments

Cate, B.L., III; Alexander, H.

Cornell University, Ithaca, N.Y.

PHONE NO: (607) 255-3267 (Alexander)

Abstracts of the Annual Meeting of the American
Society for Microbiology, 75th Annual Meeting,
New York, NY, 27 April-2 May 1975, p. 187,
Abstract B-21; 1975

ANALYSIS; STABILITY; N-NITROSAMINES; CARCINOGENS;
TERATOGENS; SECONDARY AMINES; NITRITE; WATER;
SOILS; N-NITROSDIMETHYLAMINE; DNNA;
DISAPPEARANCE; DECOMPOSITION; THERMALITY;
NITROSO-NITROGEN; MICROORGANISMS; AEROBIC
ORGANISMS

N-Nitrosamines, a class of carcinogenic and
teratogenic compounds, may be formed in natural
environments from secondary amines and nitrite.
Our early work with waters and soil samples
receiving about 25 ppm N-nitrosodimethylamine
(DNNA) nitroso-N showed a lag of nearly 30 days
prior to the slow disappearance from soil and ac-
cumulation in 100 days in lake water. In
flooded soil, an initial loss of about 10% of the
added DNNA (ca. 20ppm) occurred in the first 2
weeks of incubation. No disappearance occurred
during the next 7 weeks. This stability may be
attributed to the inability of the microorganisms
to attack the molecule. Repeated attempts to
isolate microorganisms capable of using DNNA as a
C or N source failed. Soil isolates of the
genera BACILLUS, CLOSTRIDIUM, ARCHAEOBACTER, and
PSEUDOMONAS were found to be unable to degrade
DNNA. DNNA was toxic at a concentration of 10
ppm nitroso-N to 3 of 7 of the aerobic organisms
and at 1000 ppm nitroso-N to 6 of 7 of the test
organisms.

TAXONOMY: BACILLUS; CLOSTRIDIUM; ARCHAEOBACTER;
PSEUDOMONAS

44)
Environmental Transport Modeling of Pollutants in
Water and Soil

Anderson, R.E.; Begovich, C.L.; Jackson, D.J.

Computer and Environmental Sciences Division,
Oak Ridge National Laboratory, Oak Ridge, TN
37830

PHONE NO: (615) 483-4611, ext. 3-4502

Presented at the Symposium on Nonbiological
Transport and Transformation of Pollutants on
Land and Water, Washington, D.C., May 11-13,
1976; 1976, 44p

MODELING; TRANSPORT MODELS; WATER; SOIL; FIRST
ORDER EFFECT; TRANSPORT PARTICULATES; HEAVY
METALS; TIME SCALE; HYDROLOGIC CYCLE; GULF FLOW;
PARTICULATE FRACTION; SUSPENDED SEDIMENT; LEAD;
CADMIUM; ZINC; COPPER; LEAD SMELTER; POLLUTANT
TRANSPORT; ECOSYSTEM; AERIAL FLOWWAYS;
TERRESTRIAL PATHWAYS; WEATHERING PROCESS; SURFACE
FLOW; SOLUTE; SOIL PORE; EVAPOTRANSPIRATION;
LEACHING; SOLUBILITY; PARTICLE SIZE DISTRIBUTION;
WATERBURY; AIRCRAFT; DEPOSITION; CONTAMINANT
PLAS; CONTAMINANT EXCHANGE; SOIL CHEMISTRY

A suite of models is discussed which can be
applied to calculation of first order effects in
transport of several types of pollutants in water
and soil. The materials considered include
solids in the form of particulates and soluble
forms of the heavy metals. The time scale that
is currently being emphasized is discussed, along
with the physical size of the area covered by
these calculations. The role of the hydrologic
cycle is introduced along with the importance of
bulk flow and particulate transport as suspended
sediment. The build-up of lead, cadmium, zinc,
and copper in the soil near a lead smelter over a
six-year period is presented.

45)
Gas Chromatographic Analysis in Air Pollution
Problems, I.S.

Department of Chemistry, University of South
Florida, Tampa, FL 33610

PHONE NO: (813) 974-2365

Text of Tech. Rep. (ed.), Chromatographic
Analysis of the Environment, Marcel Dekker, NY,
NY, (1974), 736 p.; 1974

FIELD; ANALYSIS; GAS CHROM. TOGRAPHY;
APPLICATION; DETECTION; COLUMN; SAMPLE
MODIFICATION; DETECTION; PARTICULATE ANALYSIS;
GAS ANALYSIS; DETECTOR; METHOD; 95400
DETECTION; COST; COMPLEXITY; SAMPLE;
SEPARATION ELEMENT; SELECTIVITY; CARRIER GAS;
SAMPLE GENERATING SYSTEM; DIFFUSION CELL;
GASTHEAT CARRIER; SIGNAL; LEAK; NOISE; SAMPLE
SIZE; POINT-SAMPLING; MONITORING LEVELS; REINFORCE;
AIR QUALITY STANDARDS; AUTOMOBILE EXHAUST; LOW
BOILING HYDROCARBONS; POLYNUCLEAR HYDROCARBONS;
HALOGENATED HYDROCARBONS; ALDEHYDES; KETONES;
ALCOHOLS; NITROGEN OXIDES; CARBON SULFIDE;
PROPAGATE; SULFUR COMPOUNDS; ALKYL LEAD COMPOUNDS;
CFC; NITROGEN; OXYGEN; CARBON DIOXIDE; WATER
VAPOR; ARGON; COLD PARTICLES; REINFORCE;
PRECIPITATION; GAS CHROMATOGRAPHY-BASE
TECHNIQUE; SPECTROSCOPY; FLAME
IONIZATION; THERMAL CONDUCTIVITY; THERMAL
SPECTROMETRY; INFERRED GAS ANALYSIS; ELECTRON
CAPTURE DETECTOR; ACTIVE CARBON TRAP;
INSTRUMENTATION

Gas chromatography, combined with sample
modification and detection procedures is used for
analysis of air samples. The limited use of the
technique has been the result of high cost,
relative complexity of the systems and technical
problems with sampling and development of
suitable chromatographic columns. Accuracy of
the procedure is dependent on representative and
reproducible sample acquisition and the
selectivity and specificity of the separation
element and detector. A diagram of the gas
chromatographic system, calibration techniques
and standards, and the theory of column selection
are presented. Methods of analysis of major air
components (nitrogen, oxygen, carbon dioxide,
water vapor, argon), organic materials
(autoexhaust, low boiling hydrocarbons,
polynuclear hydrocarbons, halogenated
hydrocarbons, aldehydes, ketones, alcohols,
hydroperoxides, alkylpolynitrates), nitrogen
oxides, carbonyl sulfide and phosphine, sulfur
compounds, alkyl lead compounds, and CFC are
described. Sample collection procedures include
cold trapping, scrubbing, and preconcentration on
filters, inert substrates and columns. Analysis
of the gas chromatograph effluent may be inferred
detectors, hydrocarbon flame ionization
detectors, spectrophotometry, mass spectrometry,
ultraviolet spectrometry, thermal conductivity
detectors, electron capture detectors, liquid
colorimeter detectors and microcoulometric
detectors.

<7>
A Thermodynamic Model for Predicting the
Kinetics, Stability and Weathering of Common
Soil Minerals

A. D. Lindsay, U.S.

Department of Agronomy, Colorado State
University, Fort Collins, CO 80521; Pacific
Southwest Laboratory, Battelle Memorial
Institute, Richland, WA 99352

PHONE NO: (303) 491-6172

Soil Science Society of America, Proceedings, 34,
931-934; 1975

WEATHERING PROCESSES; SOIL MINERALS; EMPIRICAL
WEATHERING EXPERIMENTS; THERMODYNAMIC MODEL;
MINERAL TRANSFORMATIONS; SOILS; PRIMARY MINERAL
STABILITY; NA-GLASS; P-GLASS; PYROXENE; ANALCIME;
ANORTHITE; LOW ALBITE; MOSCOVITE; MICROCLINE;
QUARTZ; CLAY MINERALS; SOLUBLE SILICA; PH;
CHLORITE; HALLOYSITE; GIBBSITE; ILLITE;
BEIDELLITE; MONTMORILLONITE; DICHITE; KAOLINITE;
VOLCANIC ASH; MODELLING; THERMODYNAMIC MODELS;
STABILITY; MINERALS; PRIMARY MINERALS; SECONDARY
MINERALS; CLAYS; SOIL GEMS; MINERAL
SOLUBILITY; CHEMICAL EQUILIBRIA; STABILITY
DIAGRAMS; SOLUBILITY; MINERAL COMPOSITION;
MINERALS; CRYSTALLINITY; COEFFICIENT OF EXPANSION;
CRACKS; GRAIN SIZE; SURFACE AREA; CHEMICAL
COMPOSITION; CHEMICAL BONDS; THERMODYNAMIC DATA

Various workers have examined the weathering
products of soil minerals and have proposed
empirical weathering sequences. The present
paper outlines the development of a thermodynamic
model that predicts in a systematic way several
mineral transformations that can occur in soils.
According to this model, the stability of primary
minerals increases in the order: Na-glass,
P-glass, pyroxene, analcime, anorthite, low
albite, moscovite, microcline, and quartz. The
stability of secondary clay minerals depends on
soluble silica. At pH 6 with high silica
(approximately 10-3M) the order of increasing
stability is: chlorite, halloysite, gibbsite,
illite, dickite, beidellite, kaolinite, and
montmorillonite; at low silica (approximately
10-5M) the order is: chlorite, halloysite,
illite, beidellite, montmorillonite, dickite,
kaolinite, and gibbsite. The stability of both
primary and secondary minerals increases with pH.
The observed weathering of volcanic ash agrees
well with the predictions of this model. The
model makes use of important thermodynamic data
accumulated for soil minerals and helps to
pinpoint deficiencies in these data. The need to
examine the kinetics of mineral transformations
in soils in greater detail also becomes obvious
from this model.

<8>
Identification of Soil Lead Compounds from
Automotive Sources

Olson, R.B.; Skogerboe, S.F.

Department of Chemistry, Colorado State
University, Fort Collins, CO 80521

PHONE NO: (303) 491-6226 (Skogerboe)

Environmental Science & Technology, 9(3),
227-230; 1975

GRADIENT DENSITY; MAGNETIC SEPARATION;
PRECIPITATION; LEAD; LEAD COMPOUNDS;
AUTOMOTIVE SOURCES; SOIL; SOIL MATRICES; X-RAY

POWDER DIFFRACTION; SOIL SAMPLES; LEAD SULFATE;
PYROXENE; PARTICULATES; LEAD BICARBONATE;
AMMONIUM CHLORIDE COMPLEXES; ATMOSPHERIC
TRANSFERT; FALLOUT; FALLOUT; DECOMPOSITION;
SOIL FERTILITY; LEAD OXIDE; SEPARATION;
PRECIPITATION

Gradient density and magnetic separation
procedures are described for the preconcentration
of lead compounds from automotive sources in
soil. These procedures have been used to remove
the bulk of the soil matrix from the lead
compounds, thereby increasing the applicability
and reliability of X-ray powder diffraction as a
means of compound identification. The primary
lead compounds in eight different
lead-contaminated soil samples have been
identified through the use of the combined
separation and diffraction procedures. Lead
sulfate has been determined to be the principal
constituent in the soils examined. An
evaluation of possible reactions that could
account for the presence of lead sulfate as the
major entity is presented in conjunction with
supporting circumstantial evidence from the
literature.

<9>
Distribution of Atmospheric Mercury Species Near
Ground

Johnsco, D.L.; Brasen, S.F.

Department of Chemistry, University of South
Florida, Tampa, FL 33620

PHONE NO: (813) 974-2365 (Brasen)

Environmental Science and Technology, 9(12),
1003-1009; 1975

ANALYSIS; ATMOSPHERIC SAMPLES; PARTICULATE
MERCURY; VOLATILE MERCURY; DIURNAL STUDIES;
ATMOSPHERIC MERCURY SPECIATION; METHYLMERCURY;
MERCURY; DIMETHYLMERCURY; WIND TRANSPORT;
SPECIATION DATA; DIURNAL STUDY; AQUATIC SYSTEMS

A recently developed technique makes possible the
routine analysis of atmospheric samples for
"particulate" and "volatile" mercury. The
"volatile" fraction can be analyzed for several
chemical species. This work presents the results
of some Tampa Bay area analyses and diurnal
studies of atmospheric mercury speciation. The
mercury in air in the area investigated was
primarily "volatile" (greater than 90%) and was
composed of significant proportions of
mercury(II)-type compounds,
methylmercury(II)-type compounds, and elemental
mercury. Dimethylmercury was rarely observed.
Results were quite variable suggesting a variety
of sources and irregular wind transport
processes. The data indicate that background
mercury concentrations and the percentage
distribution of mercury species in air in a local
area may be established by mercury samplings
from the ground or from adjacent bodies of water.

610

611

Measurement of Sulfuric Acid Aerosol, Sulfur Dioxide, and the Total Sulfate Content of the Ambient Air

Thomas, E.L.; Bhattacharya, V.; Lundquist, G.L.; Jett, R.B.

Chemistry Department, Coates Chemical Laboratory, Baton Rouge, LA 70803

PMSE NO: (194) 388-1170 (West)

Analytical Chemistry, 44(4), 611-667; 1970, April

SULFURIC ACID; AEROSOLS; SULFITE OXIDIDE; SULFUR DIOXIDE; ANALYSIS; COLLECTION; PERIODIUMAMMONIUM SULFATE; SULFATES; TOPOCHEMICAL REACTION; PERIODIUMAMMONIUM SULFATE; SULFATION; SULFITE DIOXIDE; ACID AEROSOL; SULFONATES; ANALYSIS

Sulfuric acid, sulfur trioxide, and soluble sulfate salts can be determined after collection on tetraethylammonium bromide impregnated filters. The droplets of acid react topographically with the solid reagent to form the periodiiumammonium sulfate which can be pyrolyzed to produce stoichiometric amounts of sulfur dioxide. The SO₂ is readily determined as a measure of the acid aerosol. The critical feature is the stabilization of the sulfuric acid at the moment of collection whereby its reaction with existing pollutants such as Fe₂O₃, Al₂O₃, and Pb is inhibited. This reaction with co-pollutants during sampling has been an inherent source of error in all previous methods for determining ambient acid aerosol concentration. Total sulfate levels can be determined by a relatively easy modification of the procedure. The detection limit for sulfuric acid or its soluble salts is 0.1 µg as SO₄(2-) and the working range is 1 to 50 µg.

612

Determination of Chlorination Effects on Organic Constituents in Natural and Process Waters Using High-Pressure Liquid Chromatography

Delley, E.L.; Jones, G., Jr.; Thompson, J.E.

Oak Ridge National Laboratory, Oak Ridge, TN 37830

PMSE NO: (615) 483-661, ext. 3-104C

Presented at the First Chemical Congress of the North American Continent, held at Mexico City, Mexico, Nov. 30-Dec. 6, 1965; 1975

CHLORINATION; NATURAL WATERS; PROCESS COOLING WATERS; SPARGE EFFLUENTS; CHLORO-ORGANICS; HIGH-RESOLUTION LIQUID CHROMATOGRAPHY; CHLORINE; ANALYSIS; WATER; LIQUID CHROMATOGRAPHY; PROCESS WATERS; FRESH WATERS; NATIVE WATERS; ANTIFOULANT TREATMENT; COOLING SYSTEMS; ELECTRIC POWER GENERATING PLANTS; STERILIZATION; DISINFECTION; SPARGE APPARATUS PLANTS

Chlorination is routinely used as an antifoulant treatment in cooling systems for electric power generating plants, sterilization of drinking water, and disinfection of effluents from sewage treatment plants. Recently evidence has been presented showing that chlorine-containing organic compounds are formed during the chlorination of such waters with dilute concentrations of chlorine. This paper presents corroborative results from the examination of several waters of environmental concern.

Numerous chloro-organics at microgram-per-liter or less concentrations were detected in and separated from several chlorinated fresh and marine waters as well as chlorinated effluents from sanitary sewage treatment plants. The various water samples were chlorinated with milligram-per-liter concentrations of NaCl-tagged chlorine, and the resulting chloro-organic compounds were separated using high-pressure, high-resolution anion exchange chromatography. The reaction yields and types of chloro-organics are discussed with respect to (1) physical parameters such as light, temperature, and reaction time, and (2) chemical parameters such as chlorinating agent, chlorine concentration, ammonia concentration, inorganic and organic constituent concentrations and composition, ammonia concentration, inorganic and organic constituent concentrations and composition, and salinity. The yield of chlorine bound to stable chloro-organic compounds was estimated to be 0.5% of the chlorine dosage under typical reaction conditions for cooling waters of the Kingston Steam Plant (Harris Bar Lake) and 1% for cooling waters of the Allen Steam Plant (Mississippi River). Typical disinfection chlorination results in total yields of about 1% for chlorinated sewage treatment plant effluents.

GEOGRAPHICAL DESCRIPTION: US (3), Tennessee, Boone County, Tennessee River, Harris Bar Lake, Kingston Steam Plant; Mississippi, Mississippi River, Allen Steam Plant

613

Interactions of Cadmium and Selenium in Rat Plasma in Vivo and in Vitro

Gastewicz, T.A.; Smith, J.C.

Department of Pharmacology and Toxicology, University of Rochester School of Medicine and Dentistry, Rochester, NY 14642

PMSE NO: (716) 275-4111

Biochimica et Biophysica Acta, 417, 113-124; 1974

SELENIUM; CADMIUM; PLASMA PROTEINS; SUBCUTANEOUS ADMINISTRATION; RATS; GEL PERMEATION CHROMATOGRAPHY; PLASMA; PYROLYSIS; METABOLISM; ANALYSIS; SULFIDE; TISSUE DISTRIBUTION

Se 75 and Cd 109 tracers were used to study the binding of Se and Cd to plasma proteins at various SeCd(2-) doses and times up to 24 h after the simultaneous subcutaneous administration of SeCd(2-) and CdCl₂ to adult male rats. The simultaneous injection of CdCl₂ and SeCd(2-) markedly increased both Se and Cd plasma levels over that in control animals. Gel permeation chromatography of plasma indicated that all times up to 24 h Cd and Se were bound in an atomic ratio of approximately 1:1 in 110,000 and 130,000 dalton fractions. From 4 to 24 h, Cd and Se appeared in the 410,000 dalton fraction, also with an atomic ratio of approximately 1:1. The 110,000 dalton molecules appeared to have a maximal binding capacity of the Cd-Se complex at a concentration of approximately 100 µg/ml of plasma while the 130,000 and 410,000 dalton molecules show a higher binding capacity. Studies in vitro revealed that SeCd(2-) does not interact directly with Cd and plasma proteins. It is stabilized by erythrocytes to a form that interacts in an atomic ratio of 1:1 with Cd to form a protein-bound complex of 110,000 daltons.

(13)

A Study of Hearth Carbonizer Gas Composition and Energy Content at the Kingsford Company, Springfield, Oregon

Coppez, J.C.; Birdmore, R.F.

Department of Physics, University of Oregon, Eugene, OR 97403

PHUSE NO: (503) 694-6797

A report prepared for the Eugene Oregon Water and Electric Board, 17 p. plus appendix; 1975

COMPOSITION: ENERGY CONTENT; OFF-GAS; HEARTH (CARBONIZER); GAS; HYDROGEN RETRACTION; CARBON MONOXIDE; WATER; CONDENSIBLE HYDROCARBONS; PARTICULATE MATTER; AFTER-COMBUSTION CHAMBERS; WAGGED FUEL; CHARCOAL; HYDROGEN; WOOD WASTE; GAS SPECTROSCOPY; GAS CHROMATOGRAPHY; WATER

The Kingsford Company plant in Springfield, Oregon manufactures charcoal briquettes from wood waste. Wood waste is fed to a hearth carbonizer where most of the volatile components are driven off, producing a char that is largely carbon. Heat for this destructive distillation is generated by adding a limited amount of air to the carbonizer, allowing some combustion of the wood waste. The gas that leaves the carbonizer is combustible. At present it is burned in an after-combustion chamber (ACC) to control emissions, but it is evident from the temperatures achieved in the ACC that it contains significant sources of energy. The gas is dirty, containing large amounts of particulate and condensable hydrocarbons (tar) as well as the gaseous products of air-inefficient combustion. This study was performed to provide some information about the chemical composition and energy content of this off-gas in order to help evaluate possible commercial uses for the gas. The energy density in the dry gaseous fraction was found to be 90 BTU/scf. The gas contains H₂, CO, and C₂, which supply most of the energy, and an inert fraction of 70%. Total energy in the off-gas mixture including gases, water, condensable hydrocarbons, particulate matter, and sensible heat is 117 BTU/scf. Total energy flow into one of the two after-combustion chambers at this plant is 41 x 10⁶ BTU/hr. (Copies of this report are available from the author).

GEOGRAPHICAL DESCRIPTION: 75 (W), Oregon, Springfield, Kingsford Company Plant

(14)

Chlorine-Containing Stable Organics: New Compounds of Environmental Concern

Geiss, C.W.; Holey, S.L.

Oak Ridge National Laboratory, Oak Ridge, TN 37830

PHUSE NO: (615) 893-8641, ext. 3-6617

Part of Proceedings of the 15th Congress of the International Association of Limnology, held at Winnipeg, Manitoba, August 22-29, 1978; 1978

AQUATIC POLLUTION; CHLORO-ORGANICS; CHLORINATION; NATURAL WATERS; HIGH-RESOLUTION; LIQUID CHROMATOGRAPHY; TOXICITY; CHLORINE; ANALYSIS; BIOCIDES; IICHA; ABILITY-EXCHANGE CHROMATOGRAPHY; FISH; HATCHING SUCCESS; ZOOPLANKTON; 4-CHLORORESORCINOL

Although chlorine has been routinely used as a biocide, effects of reaction products of chlorine in natural waters upon the biota are poorly understood. Using a recently developed method of high resolution anion-exchange chromatography, 17 chlorine-containing stable organic compounds have been identified and quantified in secondary treatment effluents. Two of these compounds (4-chlororesorcinol and 4-chlororesorcinol) were used in initial bioassay studies. Testing of fish centered on a sensitive link in the life history (hatchability of eggs). Both chemicals significantly lowered hatching success at the lowest concentration used (0.001 ppm). Although survivorship of zebrafish was affected only at higher concentrations (greater than or equal to 0.1 ppm) of 4-chlororesorcinol, an inverse relationship was seen between the concentrations of both compounds and the rate of maturation. These data demonstrate the importance of chlorine reaction products in aquatic ecosystems. The significance of these results and future research needs will be discussed.

(15)

The Geochemical Cycle of Arsenic in Lake Washington and Its Relation to Other Elements

Glodetz, R.A.

Department of Oceanography, University of Washington, Seattle, WA 98195

PHUSE NO: (206) 542-5535

Oceanology & Oceanography, 20(3), 447-461; 1978, May

ARSENIC; SURFACE SEDIMENTS; ATMOSPHERIC INPUT; ARSENIC-FISH TISSUE; COPPER SUPPLIES; BACTERIAL; INORGANIC REACTION; LAKE WATERS; CONDENSABLE MATTER; IRON; MANGANESE; COPPER; ARSENIC PUDGET; OUTFLUING WATER; ARSENIC; PAIR ARSENATE; ARSENITE; DIMETHYLARSINIC ACID; ANALYSIS; HEAVY METALS; FISH HYPOPHOSPHITE

Abnormally high arsenic concentrations (greater than 100 ppm dry wt) in the surface sediments of Lake Washington are attributed to atmospheric input of partially soluble arsenic dust from a copper smelter. As an upland and removal of dissolved As from the lake water by bacteria or an inorganic reaction. The suspended matter in the deeper lake water contains 5% iron, 4% manganese, and 150 ppm arsenic. Cores dated by Pb 210 indicate that As levels began to increase in the sediments when the smelter began operation in 1950. An arsenic budget for the lake shows equal supplies from the atmosphere and from rivers, and removal by outflowing water (45%) and by accumulation in the sediments (55%). A similar cycle was observed for antimony which is released by the smelter in much smaller amounts than arsenic. About two-thirds of the As in rain and lake water was in the form of arsenate; however, in the interstitial water 55% of the dissolved As was present as arsenite and a few percent as dimethylarsinic acid.

GEOGRAPHICAL DESCRIPTION: 48 (W); Washington, Tacoma, Seattle, Lake Washington, Cedar River, Snohomish River, Mercer Island

<16>

<16>

Chlorination of Cooling Water: A Source of Chlorine-Containing Organic Compounds with Possible Environmental Significance

Jolley, R.L.; Ghers, C.W.; Pitt, W.W., Jr.

Oak Ridge National Laboratory, Oak Ridge, TN 37830

PHONE NO: (615) 483-8611, Ext. 3-1946

Part of Proceedings of the Fourth National Symposium on Radioecology, Held at Corvallis, Oregon, May 17-18, 1975; 1975

CHLORINATION PROCESS; COOLING WATERS; CHLORO-ORGANICS; WATER POLLUTION; CHLORINE 36; AQUATIC ECOLOGY; ANALYSIS; HIGH-RESOLUTION LIQUID CHROMATOGRAPHY

Chlorination of cooling waters may be a source of environmentally significant pollutants. Many water-soluble chlorine-containing organic compounds of low volatility were found in a sample of cooling water chlorinated to a 2-mg/liter chlorine concentration in the laboratory. The compounds were separated and detected using a coupled foci-tracer--high-resolution liquid chromatographic technique developed at the Oak Ridge National Laboratory for determination of chlorinated organics in process effluents. For a chlorination contact time of 75 min at 25 degrees C, the yield of chlorine in the form of chloro-organics amounted to 0.78% of the chlorine dosage. It is estimated that the yield is about 0.5% under typical reaction conditions in the electric power plant cooling system chosen for study. Because chlorine is commonly used to remove slime films from the cooling systems of electric power plants, as a means of maintaining high operational efficiency, it is estimated that several hundred tons of chlorinated organics are produced annually in the nation by this antifoulant process. The chromatographic elution positions of some of the separated constituents correspond to those of compounds separated and partially identified from chlorinated sewage treatment plant effluents. The results of this study indicate the formation of chloro-organics during the chlorination of cooling waters should be thoroughly examined particularly with respect to their identification and determination of possible toxicological properties.

<17>

Soluble Organic Constituents in Sewage Treatment Plant Effluents as Determined by a Multicomponent Analytical Technique

Jolley, R.L.; Pitt, W.W., Jr.; Rainey, W.T., Jr.

Oak Ridge National Laboratory, Oak Ridge, TN 37830

PHONE NO: (615) 483-8611, Ext. 3-1940

Part of Proceedings of the 169th National Meeting of the American Chemical Society, Division of Environmental Chemistry, Held at Philadelphia, PA, 75(1), 221-224; 1975

SEWAGE PLANT EFFLUENTS; WATER POLLUTANTS; ANALYSIS; HIGH-RESOLUTION LIQUID CHROMATOGRAPHY; POLLUTANT IDENTIFICATION; ORGANIC POLLUTANTS; SOLUBLE ORGANIC CONSTITUENTS; SEWAGE TREATMENT PLANT; SEWAGE TREATMENT; SECONDARY EFFLUENT; PRIMARY EFFLUENT; HIGH-RESOLUTION ANION EXCHANGE CHROMATOGRAPHY; HIGH-RESOLUTION CATION EXCHANGE CHROMATOGRAPHY; UV-SPECTROMETRY; GAS CHROMATOGRAPHY; MASS SPECTROMETRY; TRIMETHYLSILYL

DERIVATIVES; MASS SPECTRA

A multicomponent analytical technique developed at Oak Ridge National Laboratory for separation and identification of organics in complex, dilute aqueous solutions has been used to identify 55 soluble organic constituents in the primary effluent from a municipal sewage treatment plant and 16 in the secondary effluent. In addition, 703 unknown constituents in the primary effluent and 11 in the secondary effluent have been characterized with respect to gas-chromatographic and mass-spectrometric properties. The multicomponent analytical identification procedure uses sequentially high-resolution anion exchange chromatography, high-resolution cation exchange chromatography, UV-spectrometry, gas-chromatography, and mass spectrometry. Twelve aldonic and deoxyaldonic acids previously unreported in sewage effluents were identified. The mass spectra of the trimethylsilyl derivatives of two of these, quinic acid and 2,5-dideoxypentonic acid, are presented. These mass spectra have not been reported previously in the literature.

<18>

Separation and Analysis of Refractory Pollutants in Water by High-Resolution Liquid Chromatography

Pitt, W.W., Jr.; Jolley, R.L.; Katz, S.

Oak Ridge National Laboratory, Oak Ridge, TN 37830

PHONE NO: (615) 483-8611, ext. 3-6676

Presented at the First Chemical Congress of the North American Continent, Held at Mexico City, Mexico, Nov. 30-Dec. 5, 1975; 1975

POLLUTED WATERS; REFRACTORY ORGANIC POLLUTANTS; ANALYSIS; HIGH-RESOLUTION LIQUID CHROMATOGRAPHY; LIQUID CHROMATOGRAPHY; SEWAGE EFFLUENTS; NATURAL WATERS; COAL LIQUEFACTION; AQUEOUS WASTES; SEPARATION; WATER; GAS-CHROMATOGRAPHIC PROPERTIES; MASS-SPECTROMETRIC PROPERTIES; SULFATOCERIC ACID; CARBOHYDRATE ANALYSIS; UV-SPECTROMETRY; GAS CHROMATOGRAPHY; MASS SPECTROMETRY; ANALYSIS

High-resolution liquid chromatography has been applied to the problem of analyzing for refractory organic compounds present at microgram-per-liter levels in various polluted waters. Two different chromatographic systems, which were previously developed for the analysis of the molecular biochemical constituents in human body fluids, have been oxidizable with sulfatoceric acid, and the other for carbohydrate analysis. Various aqueous samples, sewage treatment plant effluents, coal liquefaction plant liquors, natural waters, and drinking water supplies, have been collected, concentrated up to 10,000-fold, and then chromatographed. The chromatographic fractions were then subjected to a multiple analytical identification procedure using in sequence UV-spectrometry, gas chromatography, and mass spectrometry. Many of the separated compounds were subsequently identified; for example, 56 organics were identified and quantified at the ug/liter level in the effluent of a primary sewage treatment plant. In addition, numerous unknown constituents have been characterized with respect to gas-chromatographic and mass-spectrometric properties.

<19>
Methylmercury Poisoning

Weiss, B.; Eberly, F.A.

Environmental Health Sciences Center, Department
of Radiations Biology and Biophysics, University
of Rochester School of Medicine and Dentistry,
Rochester, NY 14642

PHONE NO: (716) 275-3791

Toxicology, 12(3), 311-313; 1975

NEUTROPHILIC; NEUTROPHIL; NEUTROPHILIC
DISTURBANCES; BEHAVIORAL DISTURBANCES; SENSORY
MALFUNCTIONS; PCTC PARASITIC; SYMPTOMS;
SPAIN DAMAGE; CONGENITAL MALFUNCTIONS;
FUNGICIDES; EXPOSURE; ATOMIC ABSORPTION ANALYSIS;
HAIR; BLOOD-MERCURY CONCENTRATION; TREATMENT;
IMMUNOLOGIC MERCURY; MICROORGANISMS; ANALYSIS;
REVIEW

Methylmercury poisoning is most clearly evidenced
by neurological and behavioral disturbances.
Sensory malfunctions include paresthesias,
astereogenesis, and constrictions of the visual
fields. Motor manifestations range from
impairment of fine co-ordination to gross ataxia.
Population exposure has been the result of the
use of methylmercury treated wheat seed as food
and the discharge of mercury into waters where
fish are a large dietary component.
Methylmercury freely crosses the placenta and is
toxic to the developing fetal brain. Diagnosis
of methylmercury poisoning is primarily by
establishment of exposure combined with the
appearance of neurological disturbances. No
satisfactory treatment has yet been developed.
Methylmercury poisoning can be prevented by
avoiding contamination of food supplies.

<20>
Body Temperature Change of Bluegill Sunfish
Subjected to Thermal Shock

Stauffer, J.F.; Dickson, R.L.; Heath, G. Lane,
G.W.; Cairns, J., Jr.

Department of Biology and Center for
Environmental Studies, Virginia Polytechnic
Institute and State University, Blacksburg, VA
24061

PHONE NO: (703) 951-6464

The Progressive Fish-Culturist, 37(2), 90-92;
1975, April

HEATED EFFLUENTS; FISH; FISH DISTRIBUTION;
RESIDENCY TIME; THERMAL FLUXES; AMBIENT
TEMPERATURE; DISCHARGE TEMPERATURE; BODY
TEMPERATURE; THERMAL SHOCK; BLUEGILL SUNFISH;
ANALYSIS; WEIGHT; BODY THICKNESS

When bluegill sunfish are subjected to thermal
shock, there is no significant correlation
between length, weight and condition factors and
the time required to reach equilibrium with the
environmental temperature. Hence, heating rates
are not solely dependent on weight and body

thickness of the fish. The time difference
required for live and dead fish to reach
temperature equilibrium with the environment
suggests that blood flow rate and heat transfer
through the gills may be important factors in
equilibration. Body temperature adjustments are
achieved more quickly when environmental
temperatures are above rather than below
acclimation temperature. This study indicates
that it may be inaccurate to base the residency
time of fish in the plume on the relationship
between the internal body temperature and the
ambient or discharge temperature of the water.

GEOGRAPHICAL DESCRIPTION: US (2), Virginia, Glen
Dra, New River, Appalachian Power Company

<21>
Industrial Treatment of Heavy Metals to Protect
Aquatic Systems in the New Lead Belt Area

Jennett, J.C.; Wixson, S.G.

University Missouri-Rolla, Rolla, MO

PHONE NO: (315) 423-2554

Presented at the 30th Annual Purdue Industrial
Waste Conference, Lafayette, IN, May 6-8, 1975,
19 p.; 1975

BIOPROCESSING; PLANT LIFE; ANIMAL LIFE; LEAD;
HEAVY METALS; INDUSTRIAL TREATMENT; AQUATIC
SYSTEMS; MINING; MILLING; SMELTING; ZINC; COPPER;
SILVER; PHYSICAL-CHEMICAL EFFECTS; LEAD-ZINC
MINING; CLAY; FERTILITY; AESTHETIC
CHARACTERISTICS; TRANSPORT; BIOLOGICAL HAZES;
LIVING FILTERS; NUTRIENTS; ROCK FLOES; TAILINGS;
MINERALS; SEDIMENT; VELOCITY PROFILES;
SEDIMENTATION CONDITIONS; ALGAL BLOOMS; BENTHIC
DIVERSITY; TAILINGS PILES; ALGAE; BENTHIC
DIVERSITY INDICES; MEASUREMENT SYSTEMS; WASTE
TREATMENT SYSTEMS; SINGLE TAILINGS POND;
INSUFFICIENCY; CREEP POND; SEDIMENTATION; ACID
NEUTRALIZATION; HEAVY METAL PRECIPITATES;
SEDIMENTATION OF METAL PRECIPITATES; ICG TSH
PREVENTION; PRECIPITATES; STABILIZATION; OXIDIZABLE
CONSTITUENTS; EQUALIZATION; EFFLUENT AND EFFLUENT
QUANTITY; QUALITY FLUCTUATIONS; FLOW BALANCING

As a result of the increase in turbidity and
suspended solids and total dissolved solids in
the effluent from lead smelting operations in the
"New Lead Belt" district of Southeastern
Missouri, mine-mill waste treatment systems have
been developed. Single tailing ponds have been
found to be inadequate for protecting stream
quality. Two waste treatment systems which allow
for removal of tailings by sedimentation, acid
neutralization, formation of heavy metal
precipitates, sedimentation of metal
precipitates, long term retention of settled
tailings and precipitates, stabilization of
oxidizable constituents, equalization of influent
and effluent quantity and quality fluctuations
and storm water storage and flow balancing are
presented. The first system recycles the mill
water and treats the mine water in a series of
fine sedimentation lagoons. The second system,
which may be used where mill recycling is not
practical is a lagoon-meander system in which
algae are used to remove heavy metals and to
reduce trace nutrient levels. The effectiveness
of the waste treatment systems are measured by
the return of benthic diversity indices to
pre-mining levels.

GEOGRAPHICAL DESCRIPTION: US, Missouri, Clark
County, Logan Creek, Sinking Creek, Black
River, Webb Creek, Clearwater Lake

<22>
Behavioral Implications of Fetal and Early
Postnatal Exposure to Chemical Pollutants

Weiss, B.; Spyker, J.R.

Dept. of Radiation Biology & Biophysics,
University of Rochester Medical Center,
Rochester, NY; Dept. of Anatomy, University of
Virginia Medical School, Charlottesville, VA

PHONE NO: (716) 275-3791

Pediatrics, 53(5), pt. 2, 6p.: 1974, May

NEURAL CELL DENSITY; CENTRAL NERVOUS SYSTEM;
BEHAVIORAL PERFORMANCE MEASURE; BEHAVIORAL
IMPLICATIONS; MOTOR REACTIONS; APPETITE
REGULATION; VISUAL DISCRIMINATION; FETAL
EXPOSURE; NEUROGENESIS; LEAD; REVIEW

This essay, an introduction to a conference on
the fetus and child, is an overview of the
behavioral implications of exposure to chemical
pollutants, more specifically methylmercury and
lead. There is substantial evidence that the
central nervous system undergoes a continuous
loss of cells throughout postnatal life, that a
large proportion of cells die during
neurogenesis, and that numerous structural and
chemical changes take place both in the
developing and the aging brain. The brain
possesses an enormous reserve capacity. Still, a
process, as exposure to chemical pollutants, that
reduces this reserve capacity may, at sometime
late in life, because of additional losses
imposed by a degenerative process, make the brain
incapable of coping with any additional loads.
Subtle deviations in behavior patterns, such as
slowing of motor reactions, impaired regulation
of appetite and reduced visual discrimination, at
various stages of postnatal development are
likely to remain undetected by a physician. It is
suggested that a more thorough, critical
assessment of the impact of new chemicals on the
human central nervous system, specifically the
delayed and pre-natal effects, be studied.

<23>
The Effect of Soil Lead Sorption Capacity on the
Uptake of Lead by Corn

Miller, J.E.; Passer, J.J.; Koeppe, D.E.

Department of Agronomy; University of Illinois,
Urbana, IL 61801

PHONE NO: (217) 333-4276 (Koeppe)

Cornus. Soil Plant Anal., 6(4), 349-358; 1975

LEAD; CORN; SOIL; LEAD-AMENDED SOIL; LEAD UPTAKE;
SOIL pH; CATION EXCHANGE CAPACITY;
PHOSPHORUS; AUTOMOTIVE SOURCES; INDUSTRIAL
SOURCES; TRACE METALS; ANALYSIS; PLANT TEST

Lead uptake by four-week-old corn shoots grown in
lead-amended soils was found to be dependent upon
the level of Pb in the soil relative to the
soil's capacity to sorb Pb. At a given level of
added Pb, lead uptake by plants was found to
decrease with an increase in soil pH, cation
exchange capacity, and available phosphorus.

<24>
Introduction to Insect Pest Management

Hercalf, R.L.; Luckmann, R.H.

University of Illinois, Urbana, IL

PHONE NO: (217) 333-3649

Environmental Science and Technology,
Wiley-Interscience, New York, NY 10016, 567p.:
1975

INSECTS; PESTICIDES; PEST MANAGEMENT; ANALYSIS;
REVIEW

This review discusses the biological, chemical,
and control factors associated with pest
management. Examples of adaptable, successful
and economically feasible methods of insect
management which avoid adverse environmental
effects are presented.

<25>
Advances in Environmental Science & Technology,
Volume 5

Pitts, J.N., Jr.; Hercalf, R.L.; Lloyd, A.C. (eds)

University of California, Riverside, CA;
University of Illinois, Urbana, IL

PHONE NO: (714) 787-6584

Advances in Environmental Science & Technology,
Volume 5, Wiley-Interscience, New York, NY
10016, 371 p.: 1975

COMBUSTION-GENERATED AIR POLLUTION; TECHNOLOGICAL
ADVANCES; THERMAL CONTAMINATION; ANALYSIS; REVIEW

An analysis of the effects and technological
advances for the control of combustion-generated
air pollution in the urban environment and water
pollution due to thermal contamination are
presented. The pollution-ridden Japanese
environment is compared with the relatively
pollution-free environment of Australia.

<26>
Insecticides for the Future, Needs and Prospects,
Volume 4

Hercalf, R.L.; McKelvey, J.J., Jr. (eds)

University of Illinois, Urbana, IL; The
Rockefeller Foundation

PHONE NO: (217) 333-3649

Advances in Environmental Science & Technology,
Volume 4, Wiley-Interscience, New York, NY
10016, 432p.: 1975

SELECTIVITY; BIODEGRADABLE INSECTICIDES; FOOD
PRODUCTION; HUMAN HEALTH; INSECTICIDES; REVIEW

A review of the development of selective,
biodegradable insecticides is presented. The
role of insecticides in food production and human
health, limitations of insecticides, and
prospects for improved insecticides are discussed.

<27>

Residues of Polychlorinated Biphenyl (PCB) Components in Broiler Chickens Receiving the Aroclors in Three Dietary Variations

Sensen, L.G.; Wilson, D.W.; Metcalf, R.L.; Balboa, R.F.

College Veterinary Medicine, University of Illinois, Urbana, IL 61801

PMDB NO: (217) 333-3649 (Metcalf)

J. Agric. Food Chem., 24(2), 256-261; 1976

RESIDUES; CHLORINATED ORGANICS; POLYCHLORINATED BIPHENYLS; CHICKENS; BROILERS; DIETARY VARIATIONS; FAT ACCUMULATION; METABOLIC STABILITY; TISSUE CONCENTRATIONS; METABOLITES; ANALYSIS; DIETARY COMPOSITIONS

Broiler chickens were fed three dietary variations, normal (23% protein, 4.5% fat), low protein (17% protein, 4.9% fat), high fat (23% protein, 8.4% fat), containing 20 ppm of the polychlorinated biphenyl mixtures Aroclor 1242, 1242 or Aroclor 1254 for an 8 week growth period. The time course of residue accumulation in fat and blood was determined. Accumulation in fat over the 8 week period reached a maximum of 98 ppm for Aroclor 1242 (low protein diet) and 161 ppm for Aroclor 1254 (normal diet). Aroclor 1254 total residues were consistently higher than Aroclor 1242 total residues in all diets. This is because the constituents of Aroclor 1254 have a higher metabolic stability and lipid solubility. Highest residue levels were found for both mixtures to be in fat followed by liver and kidney, spleen, muscle, brain, and blood. Differences between tissues in component composition of total residue were examined.

<28>

Long-Path Monitoring of Atmospheric Carbon Monoxide. 1975 Regional Air Pollution Study, Saint Louis, Missouri

Ku, S.L.; Hinkley, E.D.

Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, MA 02173

PMDB NO: (617) 862-5500, Ext. 5358

NSF/DAWG/11/G1-37603, 140 p.; 1976, April

LASER MONITORING SYSTEM; CARBON MONOXIDE; RESONANCE ABSORPTION; SEMICONDUCTOR DIODE LASER; CLOSED-CYCLE CRYOGENIC CELL; CRYOGENIC PARABOLOID; PHOTO RETROREFLECTOR; ATMOSPHERIC TURBULENCE; WIDE-RANGE TUNABLE DIODE LASER; ANALYSIS; ATMOSPHERIC CHEMISTRY

A sensitive (5 ppt) long-path laser scattering system for CO has been developed and operated in the field. It is based on the principle of

resonance absorption and employed a PbS 0.625μ 0.18 semiconductor diode laser mounted in a closed-cycle cryogenic cooler. A simple optical system consisting of off-axis paraboloid, remote retroreflector, and beam-splitter was used to transmit and receive the laser beam. Tests were conducted over a 0.61 km path in order to determine the average ambient CO concentration using a novel derivative technique which effectively eliminated the adverse effects of atmospheric turbulence and scattering. During these experiments it was possible to observe increases in CO level due to individual automobiles as well as the longer-term increases caused by commuter traffic. This diode laser technique can be extended to other pollutants by incorporating an additional laser for each gas or by using one of the new wide-range tunable diode lasers which can monitor different pollutant gases in succession. We have assembled the present system into a mobile van for participation in the first Regional Air Pollution Study of the U.S. Environmental Protection Agency in St. Louis Missouri; and the initial experiments confirmed our calibration procedure and extended the monitoring pathlength to 2 km.

<29>

Determination of Chlorine Containing Organics in Chlorinated Sewage Effluents by Coupled 36Cl Tracer High Resolution Chromatography

Jolley, E.L.

Oak Ridge National Laboratory, Oak Ridge, TN 37830

PMDB NO: (675) 813-8617, Ext. 3-1940

Environ. Letters, 7(8), 321-340; 1976

METHOD DEVELOPMENT; CHLORINATION; SEWAGE; SEWAGE TREATMENT PLANTS; RADIOACTIVE TRACER; HIGH RESOLUTION CHROMATOGRAPHY; CHLORO-ORGANIC CONSTITUENTS; SANITATION; EFFLUENTS; 36Cl; ANALYSIS

A method was developed to study the effects of chlorination on sewage and the effluents from sewage treatment plants. This method combines radioactivity tracer (36Cl) chlorination with high resolution chromatography. The need for such methodology follows from the lack of data about chlorination effects and from the concern that chlorination will yield environmentally harmful substances. Utilizing this experimental technique, over 40 chlorine containing organic constituents were detected in the effluent from the primary stage of a domestic sanitary sewage treatment plant.

<N>

<N>

Trace Element Emissions of Coal-Fired Power Plants: A Study of the Chalk Point Electric Generating Station

Gladney, E.S.

Department of Chemistry, University of Maryland, College Park, MD

Dissertation submitted to the Faculty of the Graduate School of the University of Maryland, Doctor of Philosophy, Analytical Chemistry, 369 p.; Xerox University Microfilms, 75-15, 77a; 1974

ANALYSIS: TRACE METALS: COAL; BOTTOM SLAG; ECONOMIZER ASH; FLY ASH; SUSPENDED PARTICULATES; COAL-FIRE POWER PLANTS; FILTER SAMPLES; CASCADE-IMPACTOR SAMPLES; AMBIENT AEROSOL; INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS; SODIUM; POTASSIUM; RACEMIC; CALCIUM; STRONTIUM; BARIUM; ZINC; GALLIUM; ARSENIC; SELENIUM; ANTIMONY; LANTHANUM; CERIUM; SAMARIUM; EUROPIUM; YTERBIUM; LUTETIUM; TUNGSTEN; NIOBIUM; TANTALUM; RUTHENIUM; SILICON; NICKEL; ZIRCONIUM; IRIDIUM; INSTRUMENTAL PHOTON ACTIVATION ANALYSIS; ORGANIC PARTICULATES; ELECTROSTATIC PRECIPITATION; VOLATILE ELEMENTS; FLY ASH; IN-STACK PARTICLES; PARTICLE SIZE DISTRIBUTIONS

Samples of coal, bottom slag, economizer ash, fly ash, and in-stack suspended particulates were collected inside the Chalk Point power plant. Filter and cascade-impactor samples of the ambient aerosol in the vicinity of the power plant were also collected. These samples were analyzed by instrumental neutron activation analysis for 20 elements (Na, K, Mg, Ca, Sr, Fe, Cr, I, Al, Si, V, Cr, Mn, Fe, Co, Zn, Ga, As, Se, Sb, La, Ce, Sm, Eu, Tb, Tm, Yb, Ba) and by instrumental photon activation analysis for 7 elements (Sb, Si, Ti, V, As, Sr, Pb) in an effort to determine if coal-fired power plants are the source of a certain group of highly enriched trace elements observed on urban air particulates. Trace element distributions as a function of particle size were determined for both the in-stack suspended particulates and the ambient aerosol. The only elements which were strongly enriched (with respect to Al in the coal) on suspended particulates beyond the electrostatic precipitator are Mg, As, Se, Sb, and Pb. Most of the Sr and Rb, much of the I, and perhaps non-negligible fractions of other volatile elements in the coal left the plant in the vapor phase. The power plant was found to increase the total particulate loading in the atmosphere around the plant. The composition of the emissions for most elements was quite similar to that of the rural aerosol. The power plant did not act as a strong source for the highly enriched trace elements: Sb, As, Zn, Se, In, V, and Pb. The particle size distributions for these elements on the in-stack particles and on the ambient aerosol were found to be completely different, suggesting that the power plant was not the source for the highly enriched species.

GEOGRAPHICAL DESCRIPTION: US(2), Maryland, Prince Georges' County, Patuxent River, Swanson Creek, Chalk Point Generating Station

<11>

Measurement of Small Nitrous Oxide Concentrations by Gas Chromatography

Delwiche, C.C.; Polston, D.E.

Department of Land, Air, and Water Resources, University of California, Davis, CA 95616

TRAB: NO: (1976) 752-2133 (Polston)

Soil Sci. Soc. Am. J., 40(2), 328-327; 1976

ANALYSIS: GAS CHROMATOGRAPHY; HELIUM IONIZATION DETECTOR; STAINLESS STEEL COLUMNS; PORAPAK Q; CRYOGENIC CONCENTRATION; SOIL GASES; FERTILIZATION; IRRIGATION; SOIL PROFILES; DENITRIFYING ORGANISMS; DENITRIFICATION; ANALYSIS

A method is described for determining N_2O in small concentrations using a gas chromatograph with a He ionization detector and a stainless steel column packed with "Porapak Q". Nitrous oxide was determined directly at concentrations of 0.1 ppm or greater. By cryogenic concentration, levels in the 1 ppb range or less were detected. Soil gases contained from 0.36 to 9,000 ppm N_2O depending upon previous history of N fertilization and irrigation. Highest concentrations occurred in the top 10-20 cm of the soil profile. Liquid cultures of denitrifying organisms also showed N_2O concentrations varying over a wide range as a function of culture conditions.

<12>

Surface Predominance of Trace Elements in Airborne Particles

Intec, J.W.; Ich, A.; Hatcher, D.F.C.; Evans, C.A.; Williams, F.

School of Chemical Sciences, University of Illinois, Urbana, IL 61801; Materials Research Laboratory, University of Illinois, Urbana, IL 61801

TRAB: NO: (1976) 891-5409 (Hatcher)

Science, 191(4229), 852-854; 1976, February

TRACE METALS; AIRBORNE PARTICLES; COAL FLY ASH; BULK ANALYSIS; PARTICLE SURFACE CONCENTRATION; BERYLLIUM; CARBON; CALCIUM; CHROMIUM; POTASSIUM; LITHIUM; MANGANESE; SODIUM; PHOSPHOROUS; LEAD; SULFUR; VANADIUM; ZINC; THALLIUM; CONDENSATION POWER PLANTS; ION MICROSCOPIC MASS SPECTROMETRY; ALUMINUM; IRON; SILICON; TITANIUM; LITHIUM; ANALYSIS

A number of silver and trace elements including Be, C, Ca, Cr, Fe, Li, Mn, Na, P, Pb, S, Ti, V, and Zn present in coal fly ash are found to be preferentially concentrated on the particle surfaces. Environmentally effective concentrations of these elements are thus much higher than indicated by conventional bulk analyses.

<32>

The Application of Immunological Techniques to the Detection of Organic Contaminants of Environmental Concern

Williams, C.B.; Ikeno, H.F.; Levinson, S.A.; Dandliker, R.B.

ISI Corporation, P. O. Box 80017, San Diego, CA 92134; Scripps Clinic and Research Foundation, 360 Prospect St., La Jolla, CA 92037

PHONE NO: (714) 545-7171, Ext. 356

Presented at the 70th Annual Conference on Trace Substances in Environmental Health, Columbia, MO, 6-10 June, 1976, 10 p.; 1976

IMMUNOLOGICAL TECHNIQUES; ORGANIC CONTAMINANTS; SENSITIVITY; SELECTIVITY; ANTIBODY; ANTIGENS; HAPTENS; DIQUAT; WEEDICIDES; DITHYLISTILBESTROL; CARCINOGENS; HEXACHLOROPHENE; FLUORESCENT DERIVATIVES; FLUORESCENCE INTENSITY; FLUORESCENCE POLARIZATION; CYTOSOL RECEPTOR SITES; ANALYSIS

The high degree of specificity and sensitivity of antibody for the causative antigen or hapten is the phenomenon which allows immunological techniques to be applied to the analysis of samples for the presence of trace quantities of organic contaminants. Assays have been developed for three organic environmental contaminants presently of concern, and are described in detail. These compounds are diquat, a herbicide which has been implicated in a number of human fatalities, dithylistilbestrol, a synthetic hormone used for fattening beef cattle and now known to be a carcinogen, and hexachlorophene, a disinfectant related to some infant deaths. Techniques for the preparation of the required fluorescent derivatives of these compounds, together with their antibodies, is discussed in detail. In particular, a novel free radical technique for the synthesis of the conjugates using high energy ionizing radiation is presented. Three different parameters have been investigated as indicators of the presence of the contaminants, namely fluorescence intensity, fluorescence polarization, and in the case of dithylistilbestrol, the use of cytosol receptor sites. The assays can be conducted rapidly and with sensitivities in the picogram/ml range. It is anticipated that this sensitivity can be improved to the picogram/ml range with the preparation of improved antibody.

<33>

Chlorine-containing Organic Constituents in Chlorinated Effluents

Jolley, J.L.

Chemical Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN 37830

PHONE NO: (615) 883-8611, Ext. 3-1940

Journal of the Water Pollution Control Federation, 67(3), 601-618; 1975, March

CHLORINE; UNSTATED CHLORINATION; UNSTATED TREATMENT PLANTS; CHLORINATION PROCESS; PRIMARY EFFLUENTS; SECONDARY EFFLUENTS; SCL; CHLORINE-CONTAINING COMPOUNDS; RADIOISOTOPIC METHOD; FLUORESCENCE; SLOUGH DETECTION; ANION-EXCHANGE

CHLORINATION YIELD; ANALYSIS; CHLORINE-ORGANICS

Stable chlorine-containing organic constituents are present after effluents have been chlorinated at chlorine levels of 1 to 2 mg/l chlorine residual. Anion-exchange chromatographic elution positions were established for these constituents, and several were tentatively identified and quantified at the microgram/liter level. The chlorination yield, the portion of the chlorine dosage associated with stable chlorine-containing organic compounds at the end of the chlorination reaction period, was about one percent for a typical chlorinated secondary effluent, was approximately constant with respect to chlorine dosage, but increased with increasing reaction time and was approximately the same for both primary and secondary effluents. Essentially equivalent results were obtained with either chlorine gas or hypochlorite solution as chlorinating agent. Available chlorine in the effluent is primarily consumed in oxidation reactions.

<35>

Evidence for Primordial Superheavy Elements

Gentry, P.V.; Cahill, T.A.; Fletcher, R.P.; Fausone, R.C.; Hedeker, L.P.; Nelson, J.W.; Floccini, F.C.

Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, TN 37830; Department of Physics and Crocker Nuclear Laboratory, University of California, Davis, CA 95616; Florida State University, Tallahassee, FL 32306

PHONE NO: (916) 752-2220 (Cahill)

Physical Review Letters, 37(1), 11-15; 1976, July

GIANT HALOS; THREE DIMENSIONAL STRUCTURES; SPONTANEOUS/INDUCED HALOS; NON-INDUCED X-RAY ANALYSIS; LOW ENERGY PHOTON BEAMS; L TRANSITIONS; F TRANSITIONS; PHOTONS; THOMAS VAN DE GRAAFF ACCELERATOR; SCL-1 X-RAY DETECTOR; X-RAY STRUCTURE; GAMMA-RAY STRUCTURE; ELEMENT 126; ELEMENT 116; ELEMENT 127; ELEMENT 128; PRIMORDIAL SUPERHEAVY ELEMENTS

Microscopic crystalline monazite inclusions showing giant halo formation in biotite mica have been analyzed by the method of proton-induced X-ray emission. The observed X-ray energy spectra are best explained by the presence of a number of superheavy elements. Systematic differences between the giant halo inclusions and the uranium/thorium inclusions are found in the region of 22 to 31 keV. Evidence for the presence of element 126 is highly confident. The experimentally found energy spectra closely resemble the theoretically predicted spectra. There is also evidence suggesting the presence of elements 116 or 127, 127 being the most probable and 126.

<36>
Nitrifying Populations and the Destruction of NO₂ Sorbed by Soil

Chiores, W.C.; Alexander, M.

Cornell University, Ithaca, NY 14853

PHONE NO: (607)256-3267 (Alexander)

Abstracts of the Annual Meeting of the American Society of Microbiology, 76, 17C, Abst. 84; 1976

SIGNIFICANCE: NITROGEN FIXATION; NO₂ DESTRUCTION; NITROGEN DIOXIDE; NITRITE; NITRIFYING BACTERIA; NITRATE OXIDATION RATES; SOIL MOISTURE; NITROGEN; CLOSTRIDIA; SOILS; NITRIFICATION; NITRIFYING; ANALYSIS

Nitrifying microorganisms participate in the destruction of NO₂ sorbed by soil by oxidizing the nitrite formed as a sorption product. The nitrite oxidation rate increases and shifts away from linearity as soil moisture increases to field capacity. At constant soil moisture levels, the rate of nitrite oxidation in samples preexposed to NO₂ is greater than in samples not preexposed, suggesting adaptation and/or growth of a nitrifying population. However, inhibition of nitrite oxidation by 1mM but not 0.01mM chlorate suggests that, if autotrophs are involved, a resting rather than a growing population carries out the oxidation. "NITROGEN" numbers in the soil rise only after at least half of the nitrite initially formed from NO₂ is oxidized, but the population increase does not produce a corresponding increase in nitrite oxidation rate. Heating the soil to 42-45 C for 6 h reduces "NITROGEN" numbers and retards but does not eliminate nitrite oxidation. No increase in "NITROGEN" numbers is observed during nitrite oxidation in the heated soil. These results and estimates of nitrite turnover per autotrophic cell suggest that "NITROGEN" is not a major contributor to nitrite oxidation in this soil, but heterotrophic nitrifiers may be involved in this mechanism for the destruction of NO₂.

TAXONOMY: NITROBACTER

<37>

Resistance of RHIZOBIUM to Thiram, Sargol and Phytol

Odeyemi, O.; Alexander, M.

Cornell University, Ithaca, NY 14853

PHONE NO: (607)256-3267 (Alexander)

Abstracts of the Annual Meeting of the American Society of Microbiology, 76, 171, abst. 86.; 1976

IMPACT: SPERMATOPHYTES; PHYTOPLASMA; NITROGEN FIXATION; NITROGEN DIOXIDE; NITRITE; NITRIFYING BACTERIA; NITRATE OXIDATION RATES; SOIL MOISTURE; NITROGEN; CLOSTRIDIA; SOILS; NITRIFICATION; NITRIFYING; ANALYSIS

Mutant strains of RHIZOBIUM HELIOTI, R. PHASEOLI, and a cowpea RHIZOBIUM resistant to 300

ppm thiram, 250 ppm sargol, and 1000 ppm phytol, respectively, were obtained by repeated sequential exposure of the organisms to increasing concentrations of each pesticide. Seeds of alfalfa treated with thiram, beans treated with sargol, and cowpea treated with phytol were inoculated with mutant and wild types of strains of R. HELIOTI, R. PHASEOLI, and cowpea RHIZOBIUM SP. In each instance, the sensitive and tolerant strains fixed similar amounts of nitrogen symbiotically in the absence of the fungicide. In the presence of the seed protectants, the fungicide-tolerant strains fixed more than twice as much nitrogen as the sensitive strains. The nitrogen content of fungicide-treated plants inoculated with sensitive rhizobia was similar to uninoculated legumes. The resistance of the three bacteria resulted from their ability to degrade the toxicants. The cowpea RHIZOBIUM converted phytol to four products, R. HELIOTI formed two products from thiram, and R. PHASEOLI released chloride from sargol. The results provide a new means of simultaneously allowing for N₂ fixation and seed protection of legumes.

TAXONOMY: RHIZOBIUM HELIOTI; RHIZOBIUM PHASEOLI; RHIZOBIUM SP.

<38>

Microbial Formation and Degradation of Dimethylamine

Tate, P.L.; Alexander, M.

Laboratory of Soil Microbiology, Department of Agronomy, Cornell University, NY 14853

PHONE NO: (607)256-3267 (Alexander)

Applied & Environmental Microbiology, 31(3), 799-803; 1976, March

DIMETHYLAMINE; TRIMETHYLAMINE; SOILS; pH; AMMONIFICATION; NITROGEN SOURCE; BACTERIA; C-N RATIO; NITRATE; NITRITE; PRODUCT ACCUMULATION; MICROBIAL POPULATION; DEGRADATION; ANALYSIS

Dimethylamine was formed from trimethylamine in soils of different pH values. The rate of disappearance of the secondary amine from soil was affected by pH and was markedly reduced under anaerobiosis. The accumulation of dimethylamine in cultures of NITROCOCCUS SP. provided with trimethylamine depended on the nitrogen sources available to the bacterium but was not greatly influenced by the C-N ratio of the medium. Dimethylamine and nitrite accumulated in large amounts at pH 6.0 to 9.0 in cultures containing the tertiary amine and nitrate, but dimethylsuccinimide was apparently not produced.

TAXONOMY: NITROCOCCUS SP.

<39>

Cometabolism of DDT and its Metabolites by
Microorganisms

Sabbas-Dac, B. A.; Alexander, P.

Laboratory of Soil Microbiology, Cornell
University, Ithaca, NY 14853

PHONE NO: (607) 255-3267 (Alexander)

Abstracts of the Annual Meeting of the American
Society for Microbiology, 76, 201, Abstr. Q62; 1976

MICROORGANISMS; TESTING CELLS;
BIS(p-CHLOROPHENYL) METHANE: p-CHLORO-PENTYLACETIC
ACID; p-CHLOROPHENYLGLYOXYLALDEHYDE;
1,1'-DICHLORO-2,2-BIS(p-CHLOROPHENYL) ETHANE
DIBENZOYL; DIBENZOYL;
1-(p-CHLOROPHENYL) ETHANOL; CROTONOLIN; CIT;
METABOLITES: 1-CHLOROPHENYLGLYOXYLALDEHYDE;
1,1-DICHLORO-2,2-BIS(p-CHLOROPHENYL) ETHANE;
1,1-DICHLORO-2,2-BIS(p-CHLOROPHENYL) ETHANOL;
BIS(p-CHLOROPHENYL) ACETIC ACID; GAS
CHROMATOGRAPHY-MASS SPECTROMETRY; MASS SPECTRA;
MICROBIAL METABOLISM; ANALYSIS

Testing cells of PSEUDOMONAS PUTIDA converted
bis(p-chlorophenyl) methane (DDT) to
p-chlorophenylacetic acid (PCFA),
p-chlorophenylglyoxaldehyde,
1,1'-dichloro-2,2-bis(p-chlorophenyl) ethane
(DDT), benzhydrol (BH),
1,1'-dichloro-2,2-bis(p-chlorophenyl) ethane (DDT),
and benzophenone (BP). DDT was converted by
resting cells to 1-(p-chlorophenyl) ethanol, EHP,
EH, and EP. None of the bacteria tested was able
to cometabolize DDT. Resting cells of
ASPERGILLUS NIGER converted DDT to a product
tentatively identified as
p-chlorophenylethylaldehyde. Strains of
PSEUDOMONAS and ALICATIBES converted DDT to
1,1-dichloro-2,2-bis(p-chlorophenyl) ethane,
1,1-dichloro-2,2-bis(p-chlorophenyl) ethylene,
BH, DDT, and DDP; bis(p-chlorophenyl)acetic
acid to EH, EHP, and EP; DDT to DDT and EHP;
and BH to DDT. Most of the products formed
during the cometabolism of DDT metabolites were
identified by combined gas chromatography-mass
spectrometry and by comparison of mass spectra
with those of the authentic compounds. The
isolation of these products of cometabolism of
DDT and its metabolites suggests the existence of
more than one pathway for the degradation of DDT
and its products.

TAXONOMY: PSEUDOMONAS PUTIDA; ASPERGILLUS NIGER;
ALICATIBES

<40>

Conversion of 1,1'-dichloro-2,2-bis(p-chlorophenyl)
ethane (DDT) to Water-Soluble Products by
Microorganisms

Jeonget, P. A.; Alexander, P.

Laboratory of Soil Microbiology, Department of
Agronomy, Cornell University, Ithaca, NY 14853

PHONE NO: (607) 255-3267 (Alexander)

J. Agric. Food. Chem., 24(1), 111-115; 1976,
January-February

BACTERIA; STRAINS; WATER SOLUBLE PRODUCTS; WATER
SOLUBLE PRODUCTS; DDT; INSECTICIDES; METABOLISM;
MODEL MICROBIAL SYSTEMS; AEROBIC INCUBATION;
AEROBIC INCUBATION; INORGANIC NUTRIENTS;

PHYSICAL DEGRADATION; ANALYSIS

Forty-three percent of the bacteria isolated from
sea water and marine sediments converted between
5 and 70% of the DDT supplied in vitro to
water-soluble products, and 35% transformed less
than 5% of the insecticide to water-soluble
metabolites. Several water-soluble compounds
generated from DDT by BACON ALTERNANS were
partially characterized and were found to be
different from known products of DDT metabolism.
However, the insecticide was not converted to
water-soluble products in soil marine ecosystems
supplemented with a large number of organic
compounds and incubated aerobically,
anaerobically, and with supplemental inorganic
nutrients.

GEOGRAPHICAL DESCRIPTION: US (NH), Connecticut,
Long Island Sound Skeneville, Saybrook,
Connecticut River, Westbrook, Back River, Selsey
Point, Sagamore Terrace

TAXONOMY: BACON ALTERNANS

<41>

Continuous Source Atomic Absorption Spectroscopy
with High Resolution and Wavelength Modulation

Zander, A. T.; O'Haver, T. C.; Bolmer, P. H.

Department of Chemistry, University of Maryland,
College Park, MD 20742; Department of Chemistry,
Villanova University, Villanova, PA 19085

PHONE NO: (301) 456-2619

Analytical Chemistry, 48(8), 1166-1175; 1976, July

CONTINUOUS SOURCE ATOMIC ABSORPTION SPECTROMETRY;
EFFECTIVE MONOCHROMATOR; WAVELENGTH MODULATION;
ZINC; LEAD; CADMIUM; NICKEL; IRON; MANGANESE;
DETERMINATION; COPPER; CALCIUM; ANALYSIS

A continuous source atomic absorption spectrometer
has been assembled using a commercially available
echelle monochromator which was modified for
wavelength modulation with a quartz refractor
plate. A 200-W Hg-Ne arc and a 150-W VIL-BU
Eiac lamp were used as the continuous sources.
Nine elements (Pb, Cd, Bi, Fe, Mn, Hg, Co, Cu,
Zn) were studied with the continuous source high
resolution wavelength modulated AA (CEW-BA)
system. The standard curves are linear over
sufficiently wide ranges to be analytically
useful. They compare well with standard curves
for background corrected (B2 lamp) AA
(AAIC(M2)) and with previous high resolution
AA. Sensitivities (characteristic
concentrations) were poorer only by a factor of
2-5 even though the system was not optimized
specifically for sensitivity. For the nine
elements studied, CEW-BA detection limits were
better in seven cases compared to AAIC(M2).
Compared to uncorrected line source AA, the
CEW-BA detection limits were less than a factor
of 10 poorer.

<62>
Spatial Variability of the Leaching
Characteristics of a Field Soil

Siggar, J.B.; Nielsen, D.E.

Department of Land, Air and Water Resources,
University of California, Davis, CA 95616

PHONE NO: (916) 752-0681

Water Resources Research, 12(1), 78-88; 1976,
February

LEACHING CHARACTERISTICS; FIELD SOIL; SPATIAL
VARIABILITY; SOILS; SOIL PROFILE; SCIENTIFIC
DISTRIBUTION; WATER SOLUBLE SALTS; WATER
INFILTRATION RATES; SEEPAGE WATER VELOCITY;
APPROXIMATE EFFICIENCY COEFFICIENT; ANALYSIS;
MODELING; CALCULATIONS; NITRATE; IRRIGATION WATER

Solute distributions within a soil profile during
the leaching of water-soluble salts applied to
the soil surface were measured at six depths to
18.8 cm within 20 subplots of a 750-ha field.
Estimates of the pore water velocity based upon
measures of solute displacement within each
subplot and the entire field were found to be
logarithmically normally distributed and in
agreement with volumetric measures of water
infiltration rates. Such agreement was only
possible because it was recognized that the
observed values were not normally distributed,
and their mean values were calculated
accordingly. The number of observations required
to yield an estimate of the mean pore water
velocity within a prescribed accuracy is shown to
depend upon the nature and extent of the spatial
variability of the field soil. For the field
examined, 100 observations would allow the mean
pore water velocity to be estimated within
greater or less than 50% of its true value. The
functional relation between field-measured values
of the apparent diffusion coefficient, also found
to be logarithmically normally distributed, and
pore water velocity is examined and interpreted
in terms of solute distributions likely to be
measured at specific sampling sites.

<63>

Denitrification Kinetics in Soil Systems: The
Significance of Good Fits of Data to Mathematical
Forms

Koch, D.B.; Vithayathil, P.; Whitlow, P.;
Shearer, G.; Chien, S.W.

Center for the Biology of Natural Systems,
Washington University, St. Louis, MO 63130

PHONE NO: (314) 863-0100

Soil Sci. Soc. Am. J., 40(2), 249-253; 1976

DENITRIFICATION; SOIL SYSTEMS; NITRATE; SOILS;
MICHAELIS-MENTEN KINETICS; GLUCOSE ADDITION;
MICHAELIS-MENTEN KINETICS; SATURATION PHENOMENA;
SOIL SOILS; ANALYSIS

The loss of NO₃⁻ added to two central Illinois
soils was determined in experiments in which the
soils were incubated under waterlogged

conditions. The loss was measured as a function
of substrate concentration in one experiment in
which samples were incubated for a single time
(24 hours) and as a function of time in a second
experiment in which the concentration of the
added NO₃⁻ was held constant (200 ppm NO₃⁻ -N).
The rate of loss of NO₃⁻ was about 5.5 times
higher in one of the soils than in the other.
This difference was largely overcome by the
addition of glucose (1% with respect to the soil)
which also greatly enhanced the rate of
denitrification in both soils. The experimental
points representing the rate of NO₃⁻ loss plotted
as a function of the concentration of added NO₃⁻,
were equally well fit by Michaelis-Menten and
exponential equations as well as by the solutions
to a pair of nonlinear differential equations
representing a system in which the product of one
reaction (e.g., the reductant generated by the
oxidation of carbon compounds) is a substrate in a
second sequence (e.g., the denitrification of
NO₃⁻). The significance of such fits is
discussed. The authors point out that while such
fits have certain uses, it is not possible to
infer from them the mechanism of the reaction.

<64>

Field Trials with 16-N, Kearney Field Station

Stout, P.A.

The Kearney Foundation of Soil Science,
University of California, Riverside, CA 92502

PHONE NO: (714) 787-5102

Addendum to the Annual Report to the National
Science Foundation, Nitrate in Effluents from
Irrigated Lands; 1975, July

NITRATE; EFFLUENTS; FIELD TRIALS; NITROGEN
FERTILIZER; IRRIGATED CROPS; FOOD PRODUCTION;
ENERGY CONSERVATION; WATER CONSERVATION; ISOTOPICT
TRACELESS; NITRATE; FERTILIZER PLACEMENT; APPLICATION
TIMING; IRRIGATION REGIMES; SOIL NITROGEN; PLANT
NITROGEN; FERTILIZER NITROGEN; CROP FERTILIZATION
MANAGEMENT; ANALYSIS

Fertilization for optimal yield is shown to be
compatible with environmental and economic
considerations. Conservation of irrigation water
and energy are positive benefits of nitrogen
fertilizers. Energy-use efficiency improved 750%
and water-use efficiency improved 1000%.
Minimization of fertilizer-nitrogen
use-efficiency in the field results in minimal
escape of nitrate to the environment. Schemes of
fertilizer placement, application timing and
irrigation regimes which will give the greatest
recovery of applied fertilizer-nitrogen are
developed with the aid of isotopic nitrogen. The
pattern of plant uptake of fertilizer-nitrogen
versus soil-nitrogen is well established by 11
days at which time 90% of the absorbed
plant-nitrogen comes from fertilizer-nitrogen.

<45>
Reaction of O(3P) Atoms with Toluene and
1-Methylcyclohexene

Gaffrey, J.S.; Atkinson, R.; Pitts, J.N., Jr.

Department of Chemistry and Statewide Air
Pollution Research Center, University of
California, Riverside, CA 92502

PHONE N): (714) 787-8588

J. Am. Chemical Society, 98(7), 1828-1832; 1976

OHXRE; TOLUENE; PENTACYCLOHEXENE; VOLATILE
ADDITION PRODUCTS; PHENOL; CRESOL; CARBON
MONOXIDE; METHANE; ETHANE; NONVOLATILE POLYMERIC
TAR; GAS PHASE AROMATIC HYDROCARBONS; CYCLIC
UNSATURATED HYDROCARBONS; C7H12O ISOMERS; AIR
CHEMISTRY; ANALYSIS

The products and mechanisms of the reaction of
O(3P) atoms with toluene and 1-methylcyclohexene
have been investigated at 50-800 Torr total
pressure over the temperature range 296-423K.
With toluene the volatile addition products
observed were phenol, o-, m-, and p-cresol, along
with CO, C₆H₆, C₇H₈, and a large amount of
nonvolatile polymeric tar. The reaction of O(3P)
atoms with 1-methylcyclohexene produced CO and
the C₇H₁₂O addition product isomers
1-methyl-1,2-epoxycyclohexane,
2-methylcyclohexanone, 1-methylcyclopentanecarbox-
aldehyde, methylcyclopentyl ketone,
2-methyl-5-hexenal, 1-hepten-6-one, and
2-methyl-2-hexenal. These products are discussed
in terms of a general mechanism for the gas phase
addition of O(3P) atoms to aromatic and cyclic
unsaturated hydrocarbons. The available evidence
suggests that the initial reaction step is that of
addition of an oxygen atom to the aromatic ring,
predominately in the ortho position, followed by
isomerization of phenolic compounds or ring
cleavage or contraction to form a variety of
highly reactive olefinic species which will
consume O(3P) atoms in secondary reactions,
ultimately producing a tar or polymer containing
few or no aromatic protons. The difference in
products between the cyclic olefins and aromatic
hydrocarbons arises because of the difference in
the rate constants for reaction of O(3P) atoms
with the reactant and with the reaction products.

<46>
Denitrification Measured Directly from Nitrogen
and Nitrous Oxide Gas Fluxes

Polston, D.E.; Fried, R.; Goldammer, D.A.

Department of Land, Air, and Water Resources,
University of California, Davis, CA 95616

PHONE NO: (916) 752-2113

Soil. Sci. Soc. Am. J., 40(2), 259-264; 1976

DENITRIFICATION; NITROGEN; NITROUS OXIDE; GAS
FLUXES; NITROGEN FERTILIZERS; SOILS; PLANT
UPTAKE; RESIDUAL SOIL NITROGEN; LEACHING; FIELD
PLOTS; SOIL-WATER PRESSURE HEAD; RYEGRASS;
TENSIMETERS; SOIL SOLUTION SAMPLES; GAS
SAMPLES; NITROGEN TRIOXIDE; SOIL DEPTH; TIME;
CONCENTRATION GRADIENT; DIFFUSION COEFFICIENTS;
SOIL ATMOSPHERE; NITROGEN TRANSPORT; NITROGEN
TRANSFORMATION; ANALYSIS; LABORATORY STUDIES;
FIELD STUDIES; OXYGEN; CARBON DIOXIDE; MICROBIAL
ACTIVITY; ANALYSIS

The amount of denitrification is generally the
unknown in attempts to evaluate the fate of N
fertilizers applied to soils. Substantial error
can result when denitrification is determined
from the difference between measurements of plant
uptake, residual soil N, leaching, and the amount
of N applied. An independent, direct measure of
denitrification potentially has merit by
containing only the error from direct measurement
and not a cumulative error from several
measurements. Nitrate at a rate of 300 kg of
N/ha and enriched with 20 and 10 atom percent
excess ¹⁵N was applied to laboratory columns and
a field plot, respectively. The columns were
maintained at soil-water pressure heads of -22
and -70 cm. The field plot was maintained at a
soil-water pressure head of approximately -10 cm
in the upper 10 cm of soil. The field plot was
cropped with perennial ryegrass (LOLIUM PERENNE).
The columns and field plot were instrumented with
tensimeters, soil solution samplers, and gas
samplers. The concentration and isotopic ratio
of N₂, N₂O and H₂O were measured as a function of
soil depth and time. The gaseous concentration
gradients and measured apparent diffusion
coefficients were used to calculate the fluxes of
¹⁵N₂ and ¹⁵N₂O gas from the soil. Residual soil
N, plant uptake, and leaching were measured in
order to calculate denitrification by difference.
For the laboratory columns, the amount of
denitrification determined directly compared
favorably with that determined by difference.
For the field plot, the disparity between
denitrification calculated directly and by
difference was attributable to the uncertainty in
the gaseous concentration gradient near the soil
surface and the spatial variability of the
apparent diffusion coefficient near water
saturation.

TAROCBY: LOLIUM PERENNE

GEOGRAPHICAL DESCRIPTION: T3, N14S07E1, Iron County, Crooked Creek Watershed

<49>
Organic Contaminants in Aqueous Coal Conversion Effluents: Environmental Consequences and Research Priorities

Berben, L.R.; Southworth, G.P.; Gehre, C.S.

Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN 37830

PHONE NO: (615) 483-8611, Ext. 3-6618

Presented at the 16th Annual Conference on Trace Substances in Environmental Health, Columbia, MO, 8-10 June, 1976, 10 p.; 1976

COAL CONVERSION TECHNOLOGY; CCAL; WASTEWATER; HEAVY METALS; AQUATIC ECOSYSTEMS; EFFLUENTS; HEAVY METAL TRANSPORT; HEAVY METAL PERSISTENCE; ORGANICS; PHENOLS; ARYLAMINES; ALIPHATIC HYDROCARBONS; POLYCYCLIC AROMATIC HYDROCARBONS; SULFUR-CONTAINING COMPOUNDS; COAL LIQUEFACTION EFFLUENTS; ANALYSIS

The anticipated implementation of an extensive coal conversion industry in the United States within several decades will result in production of substantial quantities of highly-contaminated wastewater. Many of the contaminants produced, if released into natural waters, could have deleterious effects on aquatic ecosystems, and ultimately, on human life. Research is required to determine potential acute and sub-acute effects of potentially hazardous effluent constituents, and to evaluate their transport and persistence in aquatic systems. To facilitate a rational assignment of future aquatic research priorities to answer these issues, we have initiated a systematic assessment of the environmental hazards of anticipated organic components of aqueous coal liquefaction effluents by the compilation of a critical literature review. Five major classes of organic compounds have been operationally defined: 1) phenols, 2) arylamines (organic bases), 3) aliphatic hydrocarbons, 4) mono- and polycyclic aromatic hydrocarbons (PAH), and 5) sulfur-containing compounds. We present here a summary assessment of each class on the basis of 1) concentrations anticipated in coal liquefaction effluents, 2) removal of waste-water treatment systems, 3) acute toxicity, 4) chronic toxic effects on aquatic organisms, and 5) environmental transport and persistence. Gaps in understanding and future research needs are identified.

<50>
The Potential Toxicity and Bioaccumulation in Aquatic Systems of Trace Elements Present in Aqueous Coal Conversion Effluents

Hildebrand, S.G.; Cashner, L.H.; Carter, J.A.

Oak Ridge National Laboratory, P. O. Box 1, Oak Ridge, TN 37830

PHONE NO: (615) 483-8611, Ext. 3-1010

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COAL; COAL CONVERSION TECHNOLOGY; AQUATIC ENVIRONMENTS; ENVIRONMENTAL IMPACTS; HEAVY METALS; CADMIUM; ALUMINUM; ARSENIC; SILVER; BARIUM; BERYLLIUM; BISMUTH; BROMINE; CADMIUM; CESIUM; COBALT; CHROMIUM; CERIUM; COPPER; DYSFROSIUM; EUROBIUM; IRON; GALLIUM; GERMANIUM; HAFNIUM; MERCURY; NIODIUM; IODINE; LANTHANUM; LITHIUM; LUTETIUM; MAGNESIUM; MANGANESE; MOLYBDENUM; NIOBIUM; NIOBIUM; NICKEL; LEAD; POLONIUM; PRASEODYMIUM; RADIUM; RUTHENIUM; AMERICIUM; SCANDIUM; SELLONIUM; SAMARIUM; TUNGSTEN; TITANIUM; THALLIUM; THORIUM; VANADIUM; YODINE; YTERBIUM; ZINC; ZIRCONIUM; ANALYSIS; TOXICITY; BIOACCUMULATION

Implementation of coal conversion technology on a large scale may result in releases of many elements to aquatic environments. To insure the orderly and safe development of coal conversion technology it is necessary to assess potential adverse impacts of trace element releases on aquatic ecosystems and human health. The results of analyses for 55 elements (Ag, Al, As, Au, B, Ba, Bi, Br, Cd, Ce, Co, Cr, Cs, Dy, Fe, Ga, Ge, Hf, Hg, In, Ir, La, Li, Lu, Mg, Mn, Mo, Ni, Pd, Pb, Pt, Pr, Ra, Re, Sb, Se, Sn, Sr, Ta, Te, Th, Ti, Tl, U, V, W, Yb, Zn, Zr) in aqueous effluents of a single experimental run of a coal conversion pilot plant are presented. A review of the literature on toxicity and bioaccumulation factors for aquatic biota of these elements is summarized.

<51>
The Use of Instrumental Nuclear Activation Methods in the Study of Particles from Major Air Pollution Sources

Gordon, G.E.; Zeller, K.H.; Gladney, E.S.; Greenberg, R.P.

Department of Chemistry, University of Maryland, College Park, MD 20742

PHONE NO: (301) 450-4422

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INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS; AIR POLLUTION SOURCES; ANALYSIS; COAL FIRED POWER PLANTS; POWER PLANTS; COAL; INCINERATORS; TRACE ELEMENTS; FLY ASH; OIL; LEAD; CADMIUM; BERYLLIUM; NICKEL; SILICON; CARBON; INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS

Nuclear methods have been used effectively in the study of particles emitted by a coal-fired power plant and a municipal incinerator. In the coal-fired plant there is appreciable fractionation of only five of the observed elements. By contrast, particles from the incinerator are highly enriched in several trace elements.

<52>
Trace Metal and Trace Organic Emission to the
Environment by Lead-Zinc Mining and Milling
Operations

Jennett, J.C.; Callier, R.J.; Pail, J.

Civil Engineering Department, Syracuse
University, Syracuse, NY; Environmental
Protection Agency, Kansas City, MO

PHONE NO: (315) 423-2554

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Substances in Environmental Health, Columbia, MO,
8-10 June, 1976, 15 p.; 1976

TRACE METALS; STREAMS; LEAD; ZINC; WATER-SHED
BODIES; ORGANIC EMISSIONS; ATOMIC ABSORPTION
SPECTROSCOPY; TREATMENT; EFFLUENTS; FUGITIVE
SOURCES; EFFLUENTS; ORGANICS; ANALYSIS

This paper reviews 5 years research on the trace
metal, organometallic, and trace organic levels
emitted by the world's largest lead-zinc mining
operations to the streams of Clark National
Forest but concentrates on smelter watershed
runoff and mine-mill trace organic emissions.
Metals were measured using atomic absorption
spectroscopy; trace organics were measured using
the American Society for Testing Materials
extraction procedures with chloroform and benzene
as the solvents; organometallics were estimated
by atomic emission spectroscopic examination of the
effluents. The results of these studies have shown
that trace metals were emitted in relatively
large quantities particularly during periods of
runoff; however treatment procedures developed in
the last 3 years have largely eliminated this
problem near mines and mills. Problems still
exist where fugitive sources blow onto soil and
then are washed into the streams and out of the
ecosystems where they are eventually trapped in
down stream reservoirs. Trace organic levels in
effluents are still higher than in the control
and receiving streams of the region. Effluents
range from 0.3 - 0.5 µg/l trace organics; control
streams ranged from 0.21 - 0.27 µg/l.
Organometallic levels were below measurable
levels in the solvent extractions studied. Two
waste treatment systems investigated appear to be
effective at removing the organics studied.

GEOGRAPHICAL DESCRIPTION: US, Missouri (SE),
Clark National Forest, Crooked Creek Watershed

Tread, the world's largest mining district. One
major research concern has been the possible
accumulation of heavy metals in this lake from
the combined drainage. Conventional dredging
methods as well as hand collection devices used
by search SCUBA divers were employed to collect
sediment samples. These, together with selected
samples of aquatic biota, were analyzed to
evaluate the extent of trace metal accumulation
after approximately eight years of mining
operation. Release of heavy metals from the
mining district occurs primarily in the form of
metal-rich solids from mine tailings and runoff
from soils contaminated by mining and smelting
activities. Transport of heavy metals may occur
also in a dissolved form. Possible mechanisms of
dissolution, exchange and eventual transport of
heavy metals from industrial sources, are
strongly influenced by humic acids from detritus
and other organic constituents of living
components of the environment. This biological
activity will increase the dissolution of heavy
metals solids, and also affect the geochemical
mobility of metals through complexing and
chelation. In Clearwater Lake, lead
concentrations in sediments ranged from less than
3 ppm at the points of stream entry to
concentrations in excess of 60 ppm in deep
quiescent waters adjacent to the dam. Zinc and
copper concentrations followed a similar trend,
ranging from 10-40 ppm and 5-30 ppm respectively.
Cadmium concentrations reached detectable levels
(0.3-0.5 µg/l) only in samples collected near the
dam. Total body lead content of bluegills, bass,
goggle-eyes, catfish, and minnows collected in
the lake ranged from undetectable levels to 16
ppm. The mucous membranes of skin and gills show
a particular affinity for heavy metals. Forage
lead concentrations in skin and scales ranged
from undetectable levels in catfish to 21 ppm in
bluegill. Gills from a variety of fish
demonstrated lead content of 5-18 ppm. Catfish
gills were generally found to contain less lead
than those of bluegill. Freshwater mussels had
total body lead concentrations of 25-30 ppm, most
of which was located in the shells. Soft
internal tissues (muscle, heart, kidneys,
gastrointestinal organs, and reproductive organs)
did not have detectable quantities of lead.
These data allow some interesting comparisons
with similar data collected from areas of much
higher heavy metal concentrations in the mining
district.

GEOGRAPHICAL DESCRIPTION: US, Missouri (SE),
Piedmont, Viburnum Tread, Clearwater Lake

<53>
Investigation of Clearwater Lake as a Potential
Sink for Heavy Metals from Lead Mining in
Southeast Missouri

Gale, E.L.; Bolter, E.; Wixson, B.G.

University of Missouri-Rolla, Rolla, MO

PHONE NO: (314) 387-8897 (Wixson)

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8-10 June, 1976, 22 p.; 1976

SURFACE BODIES; SURFACE WATER DRAINAGE; HEAVY
METALS; ACCUMULATION; LAKES; SEDIMENT SAMPLES;
MINE TAILINGS; SOILS; RUNOFF; MINING ACTIVITIES;
SMELTING ACTIVITIES; DISSOLUTION; HEAVY METAL
EXCHANGE; HEAVY METAL TRANSPORT; HUMIC ACIDS;
METAL COMPLEXES; CHELATION; GEOCHEMICAL MOBILITY;
SEDIMENTS; LEAD; ZINC; COPPER; BLUEGILLS;
CATFISH; BASS; MINNOWS; GOGGLE-EYES; SKIN; GILLS;
INTERNAL TISSUE; ANALYSIS

The geoecology of Southeast Missouri makes
Clearwater Lake near Piedmont the recipient of
most of the surface waters draining the Viburnum

<54>

Resistance of Nitrosamines to Microbial Attack

Lowe, P. L.; Alexander, M.

Dept. of Agronomy, Cornell University, Ithaca, NY
14853

PHONE NO: (607) 255-3267 (Alexander)

J. Environ. Qual., 5(2), 137-139; 1976

N-NITROSODIMETHYLAMINE; PICKED SOILS; MICROBIAL
ENRICHMENTS; PEG SEDIMENTS; SOILS; SEWAGE;
N-NITROSODIETHYLAMINE; N-NITROSODI-N-PROPYLAMINE;
AERobic CULTURES; BACTERIA; RESPIRATION; SOIL
COMMUNITIES; NITROGEN-NITROGEN BOND RESISTANCE;
PERSISTENCE; ANALYSIS

N-nitrosodimethylamine was not degraded in
flooded soil or in microbial enrichments from bog
sediments. Enrichment cultures inoculated with
soil and sewage did not yield microorganisms
capable of metabolizing N-nitrosodimethylamine,
N-nitrosodiethylamine, or
N-nitrosodi-n-propylamine. N-nitrosodimethylamine
was not metabolized by aerobic cultures of
bacteria, and it was not significantly inhibitory
to individual bacterial cultures or to
respiration of soil or sewage communities. The
data suggest that the nitrosamines persist in
samples of natural environments because of the
resistance of the nitrogen-nitrogen bond in
nitrosamines.

TAXONOMY: PSEUDOMONAS STUTZERI; PSEUDOMONAS
PPACI; BACILLUS MYCOTIDES; BACILLUS CEREUS;
BACILLUS SUBTILIS; BACTERIA; CLOSTRIDIUM
ACEETOETHYLICUM; CLOSTRIDIUM PASTEURIANUM

<55>

Uptake of Cadmium by Soybeans as Influenced by
Soil Cation Exchange Capacity, pH, and Available
Phosphorus

Miller, J. E.; Nassette, J. J.; Koeppe, E. E.

Department of Agronomy, Institute for
Environmental Studies, University of Illinois,
Urbana, IL 61801

PHONE NO: (217) 333-4370 (Koeppe)

J. Environ. Qual., 5(2), 157-160; 1976

CADMIUM; SOYBEANS; SOILS; CATION EXCHANGE
CAPACITY; pH; PHOSPHORUS; CADMIUM ACCUMULATION;
BRAY P1 REAGENT; MAGNESIUM CHLORIDE; EDTA; TISSUE
CONCENTRATIONS; SOIL EXTRACTANTS; CADMIUM
SOLUBILITY; HEAVY METALS; ANALYSIS; LOAM; CLAY

The accumulation of cadmium (Cd) and its effect
on vegetative growth of soybeans (GLYCINE MAX
(L.) Merr. var. Ansoy) in soils with a range in
cation exchange capacity (CEC), pH, and available
phosphorus (P) were investigated in greenhouse
experiments. Cadmium uptake decreased as soil pH
and CEC increased, while increasing available
soil P was related to increased Cd accumulation.
Cadmium extracted from the soil by Bray P1
reagent, Bray P2 reagent, 2N HgCl₂ and 0.1N EDTA
was significantly correlated with plant Cd
concentrations. The growth of the soybean shoots
was generally depressed when tissue
concentrations reached 1-2 micrograms Cd/g dry
weight. Cadmium uptake by soybeans was
correlated with the ratio of added Cd to the Cd
sorptive capacity of soil.

TAXONOMY: GLYCINE MAX(L.)

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