

中国环境科学研究院

Chinese Research Academy of Environmental Sciences

环境科学论文集

1990—1991

中国环境科学研究院学术委员会 编

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内 容 简 介

中国环境科学研究院是国家级大型综合性环境科研机构, 建院 10 多年来在承担国家环境科技攻关、大型综合性及超前性环境问题的研究中取得了一大批科研成果, 在国内外学术会议和刊物上共发表论文 600 多篇。

本论文集重点收集了环科院“七五”攻关和 1990—1991 年的科研工作所取得的成果, 内容涉及大气、水、环境生态、固体废弃物、环境分析测试、环境管理、环境情报等方面的学术报告。内容全面, 资料性较强。

可供环境保护、环境监测、气象、农林方面的科研、管理人员使用, 也可供大中专院校师生参考。

环 境 科 学 论 文 集

中国环境科学研究院学术委员会 编

责任编辑 吴淑岱 赵凌清

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编者话

中国环境科学研究院为国家环境立法、制订政策以及环境管理提供技术服务。建院 10 多年来在承担国家环境科技攻关、大型综合性、区域性及超前性环境问题的研究活动中，获得了一大批科研成果。为了交流与推广这些成果，我们已先后编印、出版了三本论文集。1985 年 12 月编印的论文集，主要是反映 1980—1984 年时期的论文，1988 年 12 月和 1990 年 5 月由中国环境科学出版社出版的论文集分别是反映 1985—1986 年、1987—1989 年的论文及“六五”攻关成果。

中国环境科学研究院广大科技人员 10 多年来，在国内外学术会议和刊物上共发表 600 多篇论文（包括专著）。

这本论文集重点收集了“七五”攻关和 1990—1991 年时期的科研工作所取得的结果。

参加审编本论文集的人员有：闵淑琴、刘玉敏、刘亿、路振山、金嘉满同志。

本论文集最后由刘鸿亮、王文兴同志审定。论文集难免有不足之处，我们热诚欢迎读者给予批评指正。

中国环境科学研究院学术委员会

1991 年 11 月

Editor's Note

Technically serving for the state environmental policies', laws' and regulations' making, as well as for environmental management, the scientists and the researchers in Chinese Research Academy of Environmental Sciences (CRAES) have undertaken a large number of projects for solving some regional, comprehensive or theoretical environmental problems in large scale in the state during the last ten years. Many scientific fruits have been achieved in the research activities and some of them published in three paper collections in order to be exchanged and popularized: the first collection was published in December 1985, in which mainly collected the papers issued between 1980—1984; the second and the third in December 1988 and May 1990 published by China Environmental Science Press reflecting the achievements in environmental science research during 1985—1986 and 1987—1989, individually.

This one is the fourth mainly showing the results obtained during 1990—1991, especially in the research activities of the national key projects in the Seventh Five-Year State Economic Development Plan.

Main editorial staff of the paper collection are Ms. Min Shuqin, Ms. Liu Yumin, Mr Liu Yi, Mr Lu Zhenshan and Ms. Jin Jiaman. Its final examination and approximate are made by Prof. Liu Hongliang and Prof. Wang Wenxing. Please oblige us with your valuable comments.

Academic Commission of CRAES

1991. 11

序

环境科学是综合了生态学、化学、物理学、地学、医学、气象学、工程学等各个领域的科学知识和技术，针对人类活动所引起的空气、水、土壤、生物环境的问题进行系统研究。揭示社会经济发展和环境保护协调发展的基本规律。

我国在 50 年代，对自然灾害、草场退化、土地沙漠化和盐碱化、泥石流等重大环境问题，建立了具有中国特色的研究机构，为环境科学技术的发展打下了初步的基础。70 年代初，在国家“全面规划，合理布局，综合利用，化害为利，依靠群众，大家动手，保护环境，造福人民”的环境保护方针指导下，以及国际上关注环境保护的强劲舆论推动下，我国环境保护事业获得迅速发展。环境科学技术亦很快地发展成为一门崭新的独立一级学科，形成了比较完整的环境科学体系，拥有为数众多的、专业齐全的环境科学技术队伍，具有现代化仪器设备和研究设施，已经取得具有实用价值和学术水平的环境科研成果达 2000 项，为国家环境保护做出了重要贡献。

中国环境科学研究院成立十多年来，开展了环境背景值，酸雨，水、气、土壤环境容量，环境质量评价，环境污染防治技术，环境管理，环境标准等方面课题研究。其主要学术成果有：

“六五”期间，研究发现了我国光化学烟雾污染的远距离传输特性；工业城市地区大气污染物高浓度团块输送及 SO_2 与气溶胶相互消长规律；城市热岛结构。

查明两广地区 40 万平方公里面积内酸性物质的干沉降现状，判明降水酸性主要来自云中过程。

提出并建立了我国大气、水环境容量理论体系，定量评价方法以及系列化模型和现场观测技术。

此外，国家环境管理在立法、制订技术政策上采用了中国环境科学研究院大量的科研数据。

“七五”期间，研究取得水、气环境容量的研究成果进行了广泛的推广与应用，为推行总量控制，建立中国排污许可证制度提供实用技术方法。

根据华南地区酸雨的形成、特征及经济损失的研究成果，提出了技术对策。

研究了我国主要湖泊水体富营养化的成因和发展规律，提出控制富营养化的技术措施。

提出了珠江三角洲地区经济-环境协调发展的水、土、大气环境容量的开发及对策。

提出了中、小城镇地区发展氧化塘处理污水——低投资、低运行费用的二级处理技术路线。

建成了国家、专业、地方三个层次的环境信息系统的框架结构。国家级环境信息系统，是由环境监测、水环境、大气环境及环境管理辅助决策等四个子系统构成。专业信息系统是由有毒有害化学品信息管理系统；污水处理的软件包和噪声控制系统组成。地

方环境信息系统，目前建成的有吉林市、秦皇岛市、黑龙江省、化工部等试点数据库。

上述成果在这本论文集中均有所反应，我期望论文集的出版能够促进中国环境科学研究院与环境科技界之间的交流。

刘 鸿 亮

1991年11月25日

Preface

Being composed of the knowledges and technologies in the fields of biology, chemistry, physics, geology, medicine, engineering, meteorology, and so on, environmental science and technology deal with the pollutions, destructions and impacts caused by human activities on air, water, soil, organisms and ecological systems to bring to light the basic and objective laws governing the coordinative development of social-economy and environmental protection. Established in 1950's, the research organization with Chinese characteristic have been working hard for solving and controlling some vital environmental problems, such as natural disasters, grassland degeneration, land sandinization and salinization, mud-rock flows, etc., laid a tentative foundation for the development of environmental science and technology.

The development of the Chinese environmental protection cause in the beginning of 1970's was very remarkable under the guidance of the state environmental protection policy—"Relying on people and concerned by everybody, develop technologies of overall planning, rational distribution; comprehensive utilization and changing the wastes into resources to protect the environment and bring benefit to mankind"—and pushed by the world environmental protection opinion. Now, environmental science and technology has been a new independent discipline at first grade with a comparatively integrated scientific system, a numerous research contingent of completed specialties and a great quantity of advanced instruments and facilities. 2000 more achievements in environmental research at high academic level and with high practical applicable value have been gained, which have made great contribution to the environmental protection in China.

Launching studies on environmental management, environmental standards, environmental quality and impact assessment, environmental pollution control techniques, environmental background values, environmental capacities (water, air, soil), acid rain, and so on, a great deal of achievements have been gained during the last ten years since the foundation of Chinese Research Academy of Environmental Sciences, such as, a) during the first five years, the discoveries of the formulation and long-distance transportation regulations of photo-chemical smog in China, the ball type transportation regulation of the high concentration air pollutants and the mutually increasing-decreasing regulation between SO_2 and aerosol in industrial urban regions, urban heat-island constructions; b) it has been found out that the acidity of the rain is mainly formulated in cloud-mist process in Guang Dong and Guand Xi region of a 400 000 km^2 area, based on the investigation of the acid dry precipitation; c) it is the first in China to give environmental capacities (water, air) a scientific definition—air environmental capacity is kinds of planning variable functions combining the parameters of natural regulations and social

interests; water environmental capacity seems to be the amount of pollutant loads to be held in waters under certain environmental targets; besides; d) a great amount of data produced in CRAES have been adopted in the state environmental management process, such as making strategies, legislations, technological policies and etc. ; during the last five years; a) completed the studies of practical applicable techniques and methods for controlling total amount of water pollutants based on the quantitative respond-relationship of water environmental capacity application and water pollution source management; b) working out a set of technological policies for acid rain control in the area of the south-east of China according to the studies on the formulation process, features and economic lost of the acid rain there; c) finished the research on contribution factors and deterioration regulation of lake eutrophication in China and gave their controlling measurements; d) working out an integrated planning according to the economy developments and environmental protection in Zhu Jiang Delta region based on the studies on exploring the environmental capacity (water, air and soil) and the pollution control strategies; e) discovering a secondary sewage treatment technique with low investment and low operation expensive for middle/ small towns—oxidation ponds; f) established a computerized state environmental information system (three levels; state, profession and locality) and the state one is composed of four subsystems; environmental monitoring, water environment, air environment and supplementary policy making in environmental management process; the profession one—three subsystems hazardous chemicals information management, waste water treatment and noise control; the last one—same pilot projects in the city of Ji Lin, Qin Huang Dao, Hei Long Jiang Province, the Ministry of Chemical Industry and so on.

More than 600 academic papers have been published in conferences or publications nationally and internationally during the last ten years. This collection only reflects some of them and is expected to play an initiative role to promote the academic exchange between Chinese Research Academy of Environmental Sciences and the circles of environmental sciences and technologies, home and abroad.

Liu Hongliang

President of CRAES

Nov. 25, 1991

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华南地区酸沉降区域源解析

王文兴 梁金友 陈延智

Analysis on Regional Sources of Acid Precipitation in the South of China

Wang Wenxing Liang Jinyou

Cheng Yanzhi

Abstract

IDNN model was applied to a set of data on acid rain. The species in acid rain were apportioned. The results show over 80% of acidity, 50% of sulfate and 60% of nitrate originated from the other regions to the north of the southern China.

前 言

在受体模式用来定量地求解酸沉降的来源方面, Currie^[1]、Dzubay^[2]等(1984)分别通过对模拟数据和实测数据的处理, 比较研究了受体模式的两大分支化学质量平衡法(CMB或SMB或CEB)和因子分析模式(FA)在源解析时的特点。结果表明经典的CMB法可得出较多的源型, 对未知源则束手无策; FA可求解未知源, 但解出的源的数量较少。

Herry^[3]通过对两组数据的处理, 指出因子模式应用于源解析存在着系统误差, 其因子解的不确定度太大。Rahn等^[4,5,6]在气溶胶的区域源解析领域作了开拓性的工作, 他们建立的“元素示踪技术”近些年来已得到人们的普遍承认。但由于这种技术经验性强, 工作量大, 未能得到广泛的应用。作者^[7]建立的区域源解析模式, 发展了Rahn等的元素示踪技术, 克服了人工选择示踪元素系列的经验性, 建立了称为IDNN的算法程序自动地筛选示踪元素系列。与传统的受体模式相比, IDNN模式没有CMB不能求解未知的缺陷, 却有FA所不具备的解的择一性。

本文采用IDNN模式处理实测酸雨样品的源解析, 解出了中国南部一些地区的区域示踪元素系列, 得到了1986年2—3月观测期间两广地区春季降水酸度的88%、硫酸盐的50%、硝酸盐的60%来于两广以北地区的重要结论。