

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT INITIATION

Date: 1/5/81

Project Title: Kinetic Model for Ozonation of Toxic Water Contaminants

Project No: E-20-W03

Project Director: F. Michael Saunders; Joseph P. Gould

Sponsor: U. S. Department of the Interior
Office of Water Research & Technology

~~8/30/82~~
9 3/31/83

Agreement Period: From 10/1/80 Until 9/30/81

Type Agreement: Annual Cooperative Program Grant No. 14-34-0001-1111;A-095-GA

Amount: \$ 9,500* OWRT
7,305 GIT (E-20-373)
\$16,805

Reports Required: Annual Reports; Conference Report

Sponsor Contact Person (s):

Technical Matters

U. S. Department of the Interior
Office of Water Research & Tech.
Assistant Director - Research
Washington, D.C. 20240
202/343-5345

SEC. ACQUISITION #3

Contractual Matters

(thru OCA)

U. S. Department of the Interior
Office of Water Research & Tech.
Chief, Contracts & Grants Center
Washington, D.C. 20240
202/343-6992

*FY'81 funds only. Additional time and money forthcoming with FY'82 funding.

Defense Priority Rating: None

Assigned to: Civil Engineering (School/Laboratory)

*B-10-611
E-20-1501
1102
1804*

COPIES TO:

- Project Director
- Division Chief (EES)
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- Project Code (GTRI)
- Other C. E. Smith

SPONSORED PROJECT TERMINATION SHEET

Date September 22, 1983

Project Title: Kinetic Model For Ozonation of Toxic Water Contaminants

Project No: E-20-W03

Project Director: Dr.s' F.M. Saunders, J.P. Gould & E.P. Minchew

Sponsor: U.S. Department of Interior : Office of Water Policy.

Effective Termination Date: 9/30/83

Clearance of Accounting Charges: 9/30/83

Grant/Contract Closeout Actions Remaining:

NONE

- Final Invoice and Closing Documents
- Final Fiscal Report
- Final Report of Inventions
- Govt. Property Inventory & Related Certificate
- Classified Material Certificate
- Other _____

Closing will be handled through continuation project E-20-E03.

Assigned to: Civil Engr. (School/Laboratory)

COPIES TO:

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 Computer Input
 Project File
 Other Ina Newton

Dr.s' Sanders, J.P. Gould
 E.P. Minchew

ANNUAL REPORT -- ANNUAL COOPERATIVE PROGRAM OR MATCHING FUND PROGRAM PROJECT

OWRT PROJECT NO. <u>A-095-GA</u> AGREEMENT NO. <u>14-34-0001-1111</u> FCCSET RESEARCH CATEGORY: <u>5D</u>	<u>PROJECT TITLE:</u> Kinetic Model for Ozonation of Toxic Water Contaminants
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NAME AND LOCATION OF UNIVERSITY WHERE PROJECT IS BEING CARRIED OUT:

Georgia Institute of Technology
Atlanta, Georgia 30332

<u>PROJECT BEGAN --</u> MONTH: <u>10</u> ; YEAR: <u>1980</u>	<u>TO BE COMPLETED --</u> MONTH: <u>9</u> ; YEAR: <u>1982</u>
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<u>PRINCIPAL INVESTIGATORS</u>	<u>DEGREE</u>	<u>DISCIPLINE</u>
F. Michael Saunders	Ph.D.	Environmental Engineering
Joseph P. Gould	Ph.D.	Environmental Engineering

<u>STUDENT ASSISTANTS^{1/}</u>	<u>DEGREE HELD (IF ANY)</u>	<u>DISCIPLINE OR ACADEMIC BACKGROUND</u>
Edward P. Minchew	MSSE	Environmental Engineering

- (A) Research Project Accomplishments. Research during the past fiscal year has been directed towards identification of analytical procedures for the determination of ozone, phenolic compounds and degradation products of ozone and phenolic compounds. A number of procedures have been investigated for applicability to specific experiments, reproducibility of results and linearity of calibrations. Efforts have been co-ordinated with other research groups in our laboratory for production of organic-free water and identification of compounds produced during the ozonation process.

A procedure reported by Horgne' and Bader (1981) for the determination of aqueous ozone through bleaching of the blue dye, indigo trisulfonate, has been adapted to the present research. In the development of this process, it was determined that measurement of ozone by the standard iodometric technique is unreliable, and is highly dependent upon the speed with which the titration is performed. Furthermore, monitoring ozone degradation via absorbance of ultra-violet radiation over a period of several minutes was found to be unacceptable. Absorbance of ultraviolet radiation resulted in an accelerated rate of degradation of aqueous ozone when compared to a similar solution not exposed to the radiation.

Gas-liquid chromatography of distilled water indicated only minor contamination. However, subsequent ozonation resulted in a large number of chromatographic peaks and indicated the necessity for ultra-pure water in this investigation. Low-level organic water is presently being used with satisfactory results.

Chromatographic procedures for the analysis of phenolic compounds have been analyzed with a high degree of reproducibility and linearity. In addition, it was discovered that the three dihydroxybenzenes, catechol, hydroquinone and resorcinol, could be detected quantitatively by gas chromatography. These three compounds have typically been measured using high pressure liquid chromatography. However, use of gas chromatography - mass spectroscopy allows for specific identification of these compounds. Methods of isolation of these compounds from aqueous solution are presently being investigated.

- (B) Application of Research Results. This project was initiated as a result of a research project conducted for the Georgia Department of Natural Resources - Environmental Protection Division. The earlier project was in response to a need identified by the state agency and was focused on the enhancement of dye biodegradability using preozonation. The research being performed on this project would therefore be supportive of the treatment interests of the carpet and textile industry of the region as well as all industries discharging potentially toxic materials to the environment.

- (C) Publications. The following publications have been developed in conjunction with project research:

1. Ozone Enhancement of Dye Biodegradability, Saunders, F. M., Southerland, C. R., and Sorrell, J. F., Final Project Report to GA Environmental Protection Division - EPA Contract #76335, Report No. SCEGIT 79-183, School of Civil Engineering, Georgia Institute of Technology, Atlanta, GA, December 1980.

2. "The Effect of Solute Competition on Ozonolysis of Industrial Dyes", Saunders, F. M., Gould, J. P., and Southerland, C. R., submitted to Water Research, October 1981.

(D) Project Status. The project is a two-year project and is scheduled to continue in progress in fiscal year 1982.

(E) Work Remaining and Progress Contemplated During Next Year. Reaction kinetics and product formation resulting from reaction of dissolved ozone and single solutes will be evaluated and compared with other results published in the literature. These studies will be implemented using a CMF reactor with provision for withdrawal of small amounts for monitoring dissolved ozone levels in the reactor. Effluent from the reactor will be collected and immediately quenched to be analyzed for organics. Target compounds will be selected based on varying levels of surface activity.

The effect of surface activity will then be studied using multi-component systems and gaseous ozone. Analysis of reaction rate kinetics and products formed will be compared with results obtained from the single-solute, dissolved ozone reactions. As before, provisions will be made to allow for instantaneous determination of dissolved ozone, and collected effluent will be immediately quenched and analyzed for organic constituents.

Based on the results obtained from the two studies, a comprehensive model will be developed to describe the ozonation process, including gas-transfer and surface competition effects.