SPECTRUM
Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

Water Management Technologies
1510 SW 13th Street
Ft. Lauderdale, FL 33312

A final test of your upgraded OXY-PLUS as applied to SCAVENGER 2000 floating marine platform that you designed to rejuvenate polluted bodies of water by reducing the levels of microbial contaminants was conducted Monday March 26, 2001. A sample of surface water from Twin Lakes in Fort Lauderdale was brought to the vessel. A sample was taken before treatment. The remaining lake water was placed in an open container and treated with your system. An additional sample was removed after three minutes of treatment and another removed after five minutes. The three samples were taken to the Nova Southeastern University Oceanographic Center for analysis.

A direct microscopic examination was conducted at one of the NSU microbiology laboratories. Bacterial analyses were performed. The following are results from the direct examination:

1) The pretreatment sample had a distinctive green color. Microscopic examination revealed the presence of more than a dozen species of algae and protozoa. The algae observed were highly mobile with three to four organisms present in each field. Forty fecal coliform bacteria per 100 ml and a total bacterial count of 360 bacteria per 1 ml were determined.

2) The sample that was treated for three minutes had lost most of the green color. Microscopic examination showed no active moving algal organisms. There appeared to be a 50% reduction in algal cells. Fecal coliform bacteria were not detectable. The total bacteria count was reduced to 160 per 1 ml.

3) The five minute minute treated sample was also clear with no color and showed no mobile algal organisms. No fecal organisms were detected and the total bacterial count was reduced to 140 per 1 ml.

Monday afternoon at approximately 1:00 PM the vessel made its way to a polluted site in a Fort Lauderdale live aboard canal area. The water temperature was 77 degrees F. And the measured flow rate of water through the vessel was 30,400 liters per minute.

Two untreated samples were taken. Two additional samples were taken, 1) immediately after treatment and 2) after one pass of thirty meters and return through pass.

Microscopic analyses by Dr. Andrew Rogerson of Nova Southeastern University was performed without his knowledge of sample origin (blind study):

Both untreated sample showed a variety of species of algae and protozoa. Motile algal cells and chains of diatoms were observed. Several types of dinoflagellate algae were observed swimming in the samples.

The sample taken immediately after treatment showed at least a 50% reduction in motile algae and deterioration of diatoms. One swimming dinoflagellate was seen.

The sample taken after one pass back and forth showed a reduction of about 75%. No swimming or living algae was observed. Many ruptured cells were seen.

The samples will be cultured to determine more quantitative results which may take a week to ten days.

The results indicate that the OXY--PLUS treatment system on your vessel is quite effective for treatment of contaminated of surface waters. Significant reduction of algae and fecal and total bacterial counts occurred and the kill is increased by multiple passes in the same area. Please contact me if you have additional questions.

Regards,

Donald S. McCorquodale, Jr., Ph.D.
President/Microbiologist - Spectrum Laboratories, Inc.
Affiliated Faculty - Oceanography – Nova Southeastern University.

NOVA SOUTHEASTERN UNIVERSITY
Oceanographic Center

NSU

Dr D. McCorquodale
Spectrum Laboratories
Fort Lauderdale, Florida 33309

Re: testing of treated and untreated water

Dear Dr. McCorquodale,

I have performed light microscopical analyses of the four samples you provided (2 controls and 2 treatments). Please note that the results below are not quantitative, rather they are subjective assessments based on observations of living versus dead algal cells.

The two control samples were rich in both motile algae (i.e. flagellates) and non-motile algae (e.g. diatoms). The first treated sample (collected immediately after treatment) showed a greater than 50% reduction in motile cells. In other words, this implies that about 50 % of all algae were killed. Diatoms, being non-motile, were difficult to score as living or dead however many showed evidence of some cell damage (i.e. cell lysis). The second treatment (taken after several passes) showed greater algal damage and it is estimated that around 75% of the algae were killed. Again, this assessment was based mainly on the effect on motile algae.

I stress that these results are tentative and are solely based on subjective observations. However, they are encouraging and definite cell damage was evident in the treated samples. In the meantime, I am culturing the four samples in the laboratory to see if the control samples respond (i.e. grow) faster than the treated samples. If growth is more pronounced in the controls, it will help to substantiate the above observations.

Sincerely yours,

A Rogerson

Andrew Rogerson Ph.D
Professor Marine Microbiology and Director of Graduate Programs

8000 North Ocean Drive • Dania Beach, Florida 33004-3078 • (954) 262-3600
Fax (954) 262-4098

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1510 SW 13th Street
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This letter is a follow-up to the initial report of the results of samples taken from your OXY-Plus SCAVENGER 2000 floating marine platform on Monday afternoon March 26, 2001.

Two untreated samples were taken. Two additional samples were taken, 1) immediately after treatment and 2) after one pass of thirty meters and return through pass.

Microscopic analyses by Dr. Andrew Rogerson of Nova Southeastern University was performed on cultures set up for each of the four samples. These cultures contained nutrients and were incubated under normal environmental conditions for eight days.

Both untreated samples showed a variety of species of algae. These samples were rated as " **** " or 100% growth.

The sample taken immediately after treatment showed between a " ** " and " *** " growth. This indicates between a 25% and 50% reduction.

The sample taken after one pass back and forth showed a " * " growth. This indicates a 75% reduction.

The growth results substantiate the initial observations that indicate that the OXY--PLUS treatment system on your vessel is quite effective for treatment of contaminated of surface waters.

Regards,

Donald S. McCorquodale, Jr., Ph.D.
President/Microbiologist - Spectrum Laboratories, Inc.
Affiliated Faculty - Oceanography - Nova Southeastern University .

Principal Investigator

Biographical Sketch

Name: Donald McCorquodale Position title: Affiliate Faculty NSU

Education/Training

Institution	Degree	Year	Field of study
Florida Atlantic University	B.S.	1969	Biology (minor Chem)
Florida Atlantic University	M.S.	1971	Microbiology
Nova Southeastern University	Ph.D.	1987	Microbiology

Research and Professional Experience

1987-2000 Affiliate Faculty, Nova Southeastern University, Oceanographic Center, Florida. Conducts research and teaches a graduate course in Water Pollution Monitoring.

1973-2000 President, Spectrum Laboratories, Inc., Fort Lauderdale, Florida
Dr. McCorquodale founded Spectrum Laboratories, Inc. in 1973 and has developed a broad-based analytical laboratory to handle a variety of analytical and consulting problems. He serves and president and senior microbiologist with combined management and technical duties. He is consultant to various drainage districts and the Life Science progam of the National Aeronautics and Space Administration. His company is currently developing methods for indicators of fecal pollution in marine waters including coliphage and toxicity testing.

Selected Professional Activities

- 1967 - 1969 – Microbiology section chief for Quincore Laboratories, Deerfield Beach, Florida. Supervising and conducting microbiological testing of germicidal products.
- 1969 - 1971 – Principal investigator (microbiologist) on a fellowship from the Equine Research Foundation.
- Between 1971 and 1974 – Staff member in the Department of Biological Science at FAU, Boca Raton, Florida.
- 1971 - 1973 – Project microbiologist for U.S. EPA research grant entitled 'Biological Control of Aquatic Vegetation'.
- 1973 - 1995 Taught membrane filter techniques' for Florida Water and Pollution Control Operators Association.
- 1998 - 2000 – Serves on the Technology Advisory Group of Harmful Algal Bloom Task Force.
- 1998 - 2000 - Member of the Mayor of Fort Lauderdale, Florida's Blue Ribbon Committee on Water Quality.

Principal Investigator

Biographical Sketch

Name: Andrew Rogerson Position title: Professor and Director of Graduate Programs

Education/Training

Institution	Degree	Year	Field of study
Paisley College of Technology, Scotland	BSc (honors)	1975	Biology
University of Stirling, Scotland	PhD	1979	Microbial Ecology

Research and Professional Experience

1979-1982	Postdoctoral Research Fellow, University of Toronto, Canada
1981-1982	Assistant Professor, University of Toronto, Canada
1982-1984	Visiting Research Fellow, Atlantic Research Lab NRCC, Canada
1984-1986	Research Associate, Atlantic Research Lab NRCC, Canada
1986-1988	Higher Scientific Officer, CCAP, England
1988-1989	Research Associate, UCSB, California, U.S.A.
1989-1992	Lecturer grade B, University of London, England
1992-1996	Senior Lecturer, University of London, England
1996-1998	Associate Professor, South Dakota School of Mines & Technology, U.S.A
1998-1999	Associate Professor, Oceanographic Center of NSU, Florida, U.S.A.
1999-2000	Professor and Director, Oceanographic Center of NSU, Florida, U.S.A.

Selected Professional Activities

1990-2000	supervised 6 PhD students (5 completed, one ongoing) and 3 MS students (ongoing)
1997-2000	Member of Editorial Board of Journal of Eukaryotic Microbiology
1993-1996	External Examiner for PhD candidates at University of Glasgow, Scotland and University of Lancaster, England
1991	External Examiner for Biology Program, University of Strathclyde, Scotland
1990-1996	Head of SEM and TEM facility, University Marine Biological Station Millport, Scotland
1990-2000	Invited Keynote Speaker: Taxonomy Workshop, Australia; Congress of Protozoology, Sardinia, Italy

Grants and Contracts

1981-2000	18 awards as PI or coPI. Dollar amounts ranging from $1,500 to $400,000 (total value, $1,030,000)

Selected Recent Publications (95 in total)

1) Rogerson, A., Hannah, F., Hauer, G. and Cowie, P. 2000. Numbers of naked amoebae inhabiting intertidal zone of two geographically separate sandy beaches. J. Mar. biol. Ass. U.K. in press.
2) Rogerson, A and Hauer, G. 2000. Naked amoebae of the Salton Sea, California. Hydrobiologia. in press.
3) Rogerson, A. and Gwaltney, C. 2000. The numerical importance of naked amoebae in the planktonic waters of a mangrove stand in Southern Florida. J. Euk. Microbiol. in press.
4) Armstrong, E., Rogerson, A. and Leftley, J.W. 2000. First recording of *Nitzchia alba* from UK coastal waters with notes on its growth potential. J. Mar. biol Ass. U.K. in press.
5) Armstrong, E., Rogerson, A. and Leftley, J.W. 2000. The abundance of heterotrophic protozoa associated with macroalgae. Estuar. Coast. Shelf Sci. 50: 415–424.
6) Armstrong, E., Rogerson, A. and Leftley, J.W. 2000. Utilization of macroalgal carbon by marine protists. Aquatic Microbial Ecol. 21: 49-57.
7) Bulter, H. and Rogerson, A. 2000. Naked amoebae from benthic sediments in the Clyde Sea area, Scotland. Ophelia, in press.
8) Rogerson, A. and Patterson, D.J. 2000. The naked ramicristate amoebae (gymnamoebae). In: Illustrated Guide to the Protozoa, edition 2. Allan Press, Kansas, in press.
9) Patterson, D.J., Simpson, A.G., and Rogerson, A. 2000. Amoebae of uncertain affinities. In: Illustrated Guide to the Protozoa, edition 2. Allen Press, Kansas, in press.
10) Patterson, D.J., Rogerson, A. and Vors, N. 2000. The heterolobosea. In: Illustrated Guide to the Protozoa, edition 2. Allen Press, Kansas, in press.
11) Hobson. P.R., Lampitt, R.S., Rogerson, A., Watson, J., Fang, X. and Krantz, E.P. 2000. True three-dimensional spatial coordinates of individual plankton determined using underwater hologrammetry. Limnol. Oceanogr. in press.
12) Sims, G.P., Rogerson, A. and Aitken, R. 1999. Primary and secondary structure of the small-subunit ribosomal RNA of the naked, marine amoeba *Vannella anglica*: phylogenetic implications. J. Mol. Evol. 48: 740-749.
13) Rogerson, A. and Detwiler, A. 1999. Abundance of airborne heterotrophic protists in Rapid City, South Dakota. Atmospheric Res. 51: 35-44.
14) Pinn, E.H., Nickell, L.A., Rogerson, A. and Atkinson, R.J.A. 1999. Comparison of the mouthpart setal fringes of seven species of mud-shrimp (Crustacea:Decapoda:Thalassinidea). J. Nat. Hist. 33: 1461-1485.
15) Pinn, E.H., Nickell, L.A., Rogerson, A. and Atkinson, R.J.A. 1999. Comparison of the gut morphology and gut microflora of seven species of mud-shrimp (Crustacea: Decapoda: Thalassinidea). Mar. Biol. 133: 103-114.
16) Rogerson, A., Hannah, F. and Anderson, O.R. 1998. A redescription of *Rhabdamoeba marina* DUNKERLY 1921, an inconspicuous marine amoeba from benthic sediments. Invertebrate Biology 117: 261-270.
17) Rogerson, A., Williams, A.G. and Wilson, P.C. 1998. Utilization of macroalgal carbohydrates by the marine amoeba *Trichosphaerium sieboldi*. J. Mar. biol. Assoc. U.K. 78: 733-744.

Affiliations

American Society for Microbiology
American Chemical Society (Chair-elect of the South Florida Branch)
American Water Works Association
International Oceanographic Society
American Society for Testing and Materials
American Association for the Advancement of Science

Selected Recent Publications (relevant to proposal)

1) McCorquodale, D.S. 1988. Coliphage as an indicator of fecal pollution in marine waters: Assay, validation and application. 136 pp., Diss. Abst. Int., pt. B-Sci & Eng., vol. 48.
2) McCorquodale, D.S. 1987. An assessment of indicator bacteria and bacteriophage in surface waters and sediments of Biscayne Bay. 89 pp., Metro Dade Technical Report, DERM.
3) McCorquodale, D.S. 1987. An assessment of indicator bacteria and bacteriophage in surface waters and sediments of Biscayne Bay – Phase II. 22 pp., Metro Dade Technical Report, DERM.
4) McCorquodale, D.S. 1987. An assessment of indicator bacteria and bacteriophage in surface waters and sediments of Biscayne Bay – Pahse II, IIa, IIb. 56 pp., Metro Dade Technical Report, DERM.
5) McCorquodale, D.S., and Burney, C.M. 1993. Biscayne Bay sewage pollution indicators final report, contract No. C-3242, 82 pp. South Florida Management District.
6) McCorquodale, D.S. 1996. Indicators for determining the sources and extent of fecal contamination in coastal waters: an annotated bibliography. Technical Report 96-06, 56 pp., Broward County Department of Natural Resource Protection.