Samuel P. Massie Chair of Excellence In Environmental Disciplines

---

Final Report (1994-2010)

Work Performed Under
Grant No: DE-FG02-94EW11430

By
Principal Investigator: Dr. Adeyinka A. Adeyiga
Professor of Chemical Engineering
School of Engineering & Technology
Hampton University, Hampton, VA

Submitted to
DOE/NNSA Program Manager
Department of Energy Headquarters
1000 Independence Avenue
Washington, DC

December 2014

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. the views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Table of Contents

Hampton University 1994-2010 Year Report

I. Overview

A. Massie Program Specialty Overview

The establishment of the DOE-EM Dr. Samuel P. Massie Chair of Excellence provides an excellent opportunity for Hampton University to be involved in key environmental issues in the 21st Century. The Hampton University Massie Program focuses on:

1. Coal gasification with respect to pollution prevention and reduction
2. Solid waste treatment through bioremediation technology
3. Industrial wastewater treatment

B. 2010 Fiscal Year Overview

A good percentage of the year was spent on synthesizing ion catalysts suitable for use in slurry bubble column reaction. Construction of an autoclave continuous stirred tank reactor is almost complete and ready for testing any time from now.

C. Past Accomplishments Overview

At the initial stage of the development of this program, work was conducted in the area of formic acid recovery from waste streams. The last two years have been spent on the removal of priority metal ions such as cadmium, chromium, copper, lead, mercury, nickel, silver, thallium, zinc, etc., from industrial and municipal wastewater by using natural wastes. The process uses tree leaves to adsorb the metal ions in the wastewater. The ultimate goal is to develop inexpensive, highly available, effective metal ion adsorbents from natural wastes as an alternative to existing commercial adsorbents, and also to explain the possible adsorption mechanism that is taking place.

This technology uses natural wastes to eliminate other wastes. Obviously, there are several advantages: (1) the negative impact on environment is eliminated, (2) the complicated regeneration step is not needed, and (3) the procedure saves money and energy.

Twelve different types of leaves have been tested with lead, zinc, and nickel. The results showed that the highest removal rate was 96% for lead (Pb^{++}), 61.7% for nickel (Ni^{++}), and 71.3% for zinc (Zn^{++}). Activated carbon, by comparison, has a removal rate of 93.9% for lead, 68.5% for nickel, and 72.1% for zinc. The leaves tested so far appear to be good adsorbents for removal of the metal ions in question from wastewater. The study mechanism showed that the leaf tannin is an active ingredient in the adsorption of metal ions. The metal ion displaced the protons of two adjacent phenolic hydroxyl groups to form a chelate. The ion-exchange mechanism controlled the adsorption process. Three publications have resulted from these activities.

The research involving the recovery of formic acid from industrial waste stream was the greatest past accomplishment.

II. Initiatives for the Coming Fiscal Year (October 2011 - September 2012)

A. Chair Program Overall Focus Changes

The work on Wastewater treatment using metal ions removal will continue and extend into organics. Additional work in the area of attrition resistant ion-based Fischer-Tropsch catalysts leading to Slurry

Bubble Column testing will be added to the program. Work on newly DOE-funded CO_2 separation by phase-enhanced absorption will be added. The Environmental Justice initiatives under the Black Mayors Association will be an integral part of the Massie Program. However, the overall focus will remain the same.

B. New Research Initiatives

The research work in the area of wastewater treatment will continue extending into organics. For the immediate future, Hampton plans to expand investigations into the following areas:

- Removal of arsenic from wastewater by natural wastes.
- Removal of organic contaminations from wastewater by natural wastes.
- Removal of organic chemicals from wastewater by surfactant technology.
- Development of Attrition Resistant Iron-Based Fischer-Tropsch Catalysts
- Development of Attrition Resistant Iron-Based Fischer-Tropsch Catalysts for Slurry Bubble Column
- Attrition-Resistant Fischer-Tropsch Catalysts Based on FCC Supports

The Program will strategize involvement of more US companies with similar research interests.

C. New Academic Initiatives

The Principal Investigator and the Chair along with the school Dean will work to strengthen the ongoing relationship between School of Engineering & Technology, and the Department of Chemistry, Biology and Environment and Marine Science.

D. Facility/Equipment Acquisition

In preparation for the addition of the Massie Chair of Excellence, a state-of-the-art environmental laboratory has been developed.

E. Staffing Changes

F. Outreach Initiatives

Under the Black Mayors Association Environmental Justice issue, Hampton University will form partnerships with the City of Portsmouth and the City of Chesapeake, the only two cities with black mayors in the Tidewater of Virginia (Mayor James Holley and Mayor William Ward). Over the years, several areas of the City of Portsmouth have had dilemmas with lead contamination. The Program with the Cities will focus attention on the need to more actively ensure equitable environmental protection for all, and to empower those most often disenfranchised from the decision making process – the blacks. The Massie Fellow program will involve high school students and teachers.

III. Sustainability Plans After Grant

The center will recruit top-notch scientists and engineers who will coordinate first-class research activities. The involvement of this caliber of researchers will give the Program more opportunity to compete on larger grants. This in turn will enhance forming more partnerships with corporations that have similar interests. It is the goal of the University to establish a viable center that will address various

environmental issues going into the 21st Century. An able Engineer/Scientist who will devote 100% of his/her time looking for resources to sustain the center activities beyond year five will head the Program center.

IV. Accomplishments

A. Research-related Accomplishments

1. Research Descriptions/Significant Results

a) New Program Research

None.

b) On-going Program Research

During Fiscal Year 1999-2000 the following research was conducted:

Removal of Metal Ions from Wastewater Using Tree Leaves.
The research focuses on the removal of priority metal ions, such as lead, nickel, and zinc, from wastewater by using tree leaves. Twelve different kinds of leaves have been tested at room temperature. The experiments were carried out with 2 g of 40-50 mesh leaves in 200 ml synthetic wastewater containing about 50 mg/l metal ions. The initial pH of the synthetic wastewater was about 5. The experiments showed that the highest removal rate was 96% for lead (Pb^{++}), 61.7% for nickel (Ni^{++}), and 71.3% for zinc (Zn^{++}). Compared to activated carbon, removal was 93.9% for lead, 68.5% for nickel, and 72.1% for zinc. The leaves tested so far appear to be good adsorbents for removal of the metal ions in question from wastewater. The study mechanism showed that the leaf tannin is an active ingredient in the adsorption of metal ions. The metal ion displaced the protons of two adjacent phenolic hydroxyl groups to form a chelate. The ion-exchange mechanism controlled the adsorption process.

Catalysts Synthesis for CSTR reaction

Development of Nanomaterial membrane for gas separation

Kinetic model of gas liquid decomposition extraction

c) Completed Program Research

The Recovery of Formic Acid from Industrial Waste Streams (1997)
This research involved extraction of formic acid from the reaction of sodium formate with carbon dioxide: $HCOONa(w) + CO_2(g) + H_2O(w) \rightleftarrows Am(o)$ $NaHCO_3(s,w) + HCOOHAm(o)$. The reaction was operated at room temperature. Sodium formate (aqueous solution) was amine. The reaction can be divided into two steps:

$$HCOONa(w) + CO_2(g) + H_2O(w) \rightleftharpoons aHCO_3(s,w) + HCOOH(w)$$
$$HCOOH(w) + Am(o) \rightleftharpoons HCOOHAm(o)$$

In the first step, sodium bicarbonate and formic acid were formed. Produced formic acid was immediately extracted into an organic phase by tertiary amine as expressed in step two. When proper diluents were

used, solid sodium bicarbonate occurred in an aqueous phase. The experimental investigation showed that temperature, pressure, and concentration of sodium formate affected extraction equilibrium. But, diluents and their ratio with tertiary amine affected extraction equilibrium significantly. It was found that the solvation of formed complex HCOOHAm(o) in diluents has a great influence on the extraction of formic acid by tertiary amine. The high polarity of the diluent and the low solvophobic property of the diluent with tertiary amine are beneficial to the extraction of formic acid.

Other program research prior to the 1999 fiscal year include:

1. Simultaneous Removal of Hydrogen Sulfide and Ammonia in Coal Gasification Process: Drs K. Jothimurugesan and Adeyinka A. Adeyiga. Funded by the Department of Energy.
2. Syngas Conversion Over Co-Ni-HZSM-5 Catalysts. Drs. K. Jothimurugesan and Adeyinka A. Adeyiga. Funded by the National Science Foundation.
3. Development of Advanced Hot-Gas Desulfurization Sorbents. Drs K. Jothimurugesan and Adeyinka A. Adeyiga. Funded by the Department of Energy
4. Investigation of Combined SO2/NOx Removal by Ceria Sorbents A. Akyurtlu and J. Akyurtlu. Funded by the Department of Energy.

Investigation of No_x Removal from Small Engine Exhaust: Sorbents A. Akyurtlu and J. Akyurtlu. Funded by the NASA.

2. Proposals Submitted and Grants Received

Customer	Proposal/ Grant Title	Partner(s)	Dollar Amt	Period of Performance	Awarded/Declined /Pending
1. DOE-NNSA	Chair of Excellent Program		$2.57million	1994-Date.	Awarded
2.NNSA	NNSA- Fleet Study	NC A$T/SSU	$68000	2007/200	Awarded
3.DOE	Attrition-Resistant Fischer-Tropsch Catalyst Based on FCC Supports	LSU, Clemson SUD-CHEMIE, Inc.	$218,000	2006-2010	Awarded
4.DOE	Center Of Excellence for Energy Policy	LSU, Clemson SUD-CHEMIE, Inc.	$1,067,312	2005-2010	
5. DOE	Attrition-Resistant Fischer-Tropsch Catalyst Based on FCC Supports	LSU, Clemson SUD-CHEMIE, Inc.	$135,642	2008-2010	
6.DOE	Carbon Dioxide Separation by Phase-Enhanced Absorption		$20,000	2002-2003	Awarded
7. DOE	Attrition-Resistant Iron-Based Fischer-Tropsch Catalysts for SBCRs	SUD-CHEMIE Inc.	$220,000	2001-2005	Awarded
8.DOE	Carbon Dioxide separation by phase enhanced gas-liquid absorption		$28,000	2002-2004	Awarded
9.DOE	Combination removal of toxic metal ions and organic chemicals from wastewater with natural wastes		$20,000		Declined
10.DOE	Phase enhanced gas-liquid absorption for green house gas separation		$200,000		Declined
11.DOE	Attrition-Resistant Iron-Based Catalysts for Fischer-Tropsch Reaction	UCI	$217,000	1999-2003	Awarded
11.DOE	Removal of toxic metal ions from wastewater with natural wastes		$200,000	1999-2000	Declined
12.DOE	Attrition Resistant Iron-Based Fischer-Tropsch Catalysts for Slurry Reactor Applications	SUD-CHEMIE Inc.	$220,000	2004-2007	

3. Publications

Journal/Book	Title/Chapter	Chair-related Author(s)	Year
Applied Catalysis A: General, 372 (2010) 184-190	Study of attrition of Fe-based of Fe-based catalyst supported over Spent FCC catalysts and their Fisher-Tropsch activity in a fixed Bed reactor	Sivakumar Vasireddy, Andrew Compos, E. Miamee, Adeyinka A., Rena Armstrong, Joe D. Allison and James J. Spivey.	2010
Industrial and Engineering Chemical Research	Attrition Resistance and Catalytic Performance of Spray-Dried Iron Fischer Tropsch Catalysts in a Stirred Tank Slurry Reactor	D. B Bukur, V. Carreto-Vazquez, L. Nowicki, and Adeyinka A. Adeyiga,	2004
Industrial and Engineering Chemistry Research	Removal of Metal Ions From Wastewater With Roadside Treed Leaves	Liang Hu, Adeyinka A. Adeyiga, Tina Greer, Leke Adeyiga	2002
Journal of Catalysis	Effect of Activation Method on Fe FTS Catalysts: Investigation at the Site Level Using SSITKA	Kandis Sudsakorn, James G. Goodwin, Jr., and Adeyinka A. Adeyiga	2002
Industrial and Engineering Chemistry Research	Kinetic Model of Gas-Liquid-Liquid Decomposition Extraction	Liang Hu, and A. Adeyiga	2002
Industrial and Engineering Chemistry Research	Preparation of attrition resistant spray-dried Fe Fischer-Tropsch catalysts using precipitated SiO_2	Sudsakorn, Goodwin, Jothimurugesan, Adeyiga	2001
Industrial and Engineering Chemistry Research	Preparation of Attrition Resistant Spray-Dried Fe Fischer-Tropsch Catalysts using Precipitated SiO_2	Kandis Sudsakorn, James G. Goodwin, Jr., K. Jothimurugesan, and Adeyinka A. Adeyiga	2001
Chemical Engineering Communication	Adsorption of Pb++, Zn++, Ni++ on leaves – equilibrium, kinetics, and mechanism	Liang Hu, A. Adeyiga, T. Greer, A. Adeyiga and Efat Miamee	2001

Chemical Engineering Communication	Removal of metal ions from wastewater with road side tree leaves	Liang Hu, A. Adeyiga, A. Adeyiga and Efat Miamee	2000
Accepted by Industrial and Engineering Chemistry Research	Metal removal from industrial and municipal wastewater by natural wastes	Liang Hu, Adeyinka A. Adeyiga, Tina Greer, Shuming Zheng, Leke Adeyiga	1999
Industrial and Engineering Chemistry Research	Analysis of the decomposition-extraction process	Liang Hu, Adeyinka A. Adeyiga, Shuming Zheng, G. Hanidu, Alfonso Pujol, Jr.	1998
Industrial and Engineering Chemistry Research	Extraction of Formic Acid from Sodium Formate	Hu, Liang, and Adeyiga, A.A.	1997

4. Conferences/Presentations

Conference	Title	Author(s)	Year
NNSA-MSI Program Meeting Baton Rouge LA Feb.1-3, 2010	Attrition Resistant Fisher-Tropsch Catalysts Based on FCC Supports" Supports	Adeyiga, A. Adeyiga, Efat Miamee, James J. Spivey Sivakumar Vasireddy	2010
ACS Symposium (2010) San Francisco	Spent FCC materials supported Fe Catalysts: Study of attrition and their Fisher-Tropsch activity in a fixed Bed reactor	Sivakumar Vasireddy, Andrew Campos, E. Miamee, Adeyinka Adeyiga, Joe D. Allison and James J. Spivey.	2010
Gordon Research Conference Venturi, CA. January12-16-2009	Attrition of Fe Based Catalyst FCC Supports	Sivakumar Vasireddy, Andrew Compos, Adeyinka A. Adeyiga, James J. Spivey	2009
Pittsburg, PA. June 10-11, 2008	Attrition Resistant Fischer- Tropsch Catalysts Based on FCC Supports	Campos ,J. J. Spivey, A. Adeyiga, J.G. Goodwin, Jr.	2008

NNSA MSI Program Meeting Washington DC, October 25-26 2007	"Attrition Resistant Fisher-Tropsch Catalysts Based on FCC Supports" Supports	Adeyinka A. Adeyiga	2007
Pittsburg PA. June 5-6, 2007	Attrition Resistant Fischer- Tropsch Catalysts Based on FCC Supports.	Campos ,J. J. Spivey, A. Adeyiga, J.G. Goodwin, Jr.	2007
National Nuclear Security Administration Meeting. Orangeburg, SC October 24-25, 2006	Development of Attrition- Resistant Iron-based Fischer- Tropsch Catalysts".	Adeyinka A. Adeyiga	2006
ACS National Meeting, New York, NY	Spray Dried Iron Catalysts for Slurry Phase Fischer-Tropsch Synthesis.	Dragomir Bukur, Wen-Ping Ma, Victor Vazquez and A. Adeyiga	2003
URC-HBCU and University and other Minority Institutions, Programs Review Meeting, Pittsburgh, PA	Attrition-Resistant Iron-Based Catalyst for F-T SBCRS	Adeyinka A. Adeyiga, Liang Hu, and Efat Miamee	2002
UCR-HBCU Contractors Review Conference, Pittsburgh, PA	Development of Attrition-Resistant Iron-Based Fischer-Tropsch Catalysts	Adeyinka A. Adeyiga	2001
URC-HBCU and University and other Minority Institutions Annual Symposium, Pittsburgh, PA	Removal of phenols from wastewater by surfactant separation	Liang Hu, A. Adeyiga and Efat Miamee	2000
AIChE Spring National Meeting, Atlanta, GA	Adsorption of Pb++, Zn++, and Ni++ on leaves	Liang Hu, A. Adeyiga and Efat Miamee	2000
AIChE Annual Meeting	Kinetic model of decomposition extraction process	Liang Hu, Brian R. Chen, Shuming Zheng, and Adeyinka A. Adeyiga	1998
AIChE Annual Meeting	Adsorption of metal ion on tree leaves	Liang Hu, Adeyinka A. Adeyiga, and Shuming Zheng	1998
U.S. Department of Energy, Federal Energy Technology Center	Feasibility investigation of the adsorption of metal ions on leaves	Liang Hu, and Adeyinka A. Adeyiga	1998

AIChE Annual Meeting, Chicago, IL	Equilibrium of Extraction of Formic Acid from Sodium Formate	Liang Hu, and Adeyinka A. Adeyiga	1996
3rd International Symposium and Exhibition: Gas Cleaning at High Temperatures, Karlsruhe, Germany	Hot Coal Gas Desulfurization with Zinc Based Sorbents	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1996
3rd International Symposium and Exhibition: Gas Cleaning at High Temperatures, Karlsruhe, Germany	Catalytic Decomposition of Ammonia in Coal Gas	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1996
High Temperatures Gas Cleaning, (Eds. E. Schmidt, T. Pilz and A. Dittler)	Hot Coal Gas Desulfurization with Zinc-Based Sorbents	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1996
Proceedings of the Advanced Coal-Fired Power Systems '96, Review Meeting, Morgantown Energy Technology Center, Morgantown, West Virginia	Advanced Hot-Gas Desulfurization Sorbents	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1996
Thirteenth Annual International Pittsburgh Coal Conference:, Pittsburgh, PA	Removal of Hydrogen Sulfide From Hot-Coal Gas Streams	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1996
Fourth Annual Historically Black Colleges and Universities/Private Sector-Energy Research and Development Technology Transfer Symposium, Greensboro, NC	Catalytic Decomposition of Ammonia in Coal Gasification Processes	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1996
Fourth Annual Historically Black Colleges and Universities/Private Sector-Energy Research and Development Technology Transfer Symposium, Greensboro, NC	Regenerable Sorbents for Desulfurization Sorbents	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1996

Proceedings of the Advanced Coal-Fired Power Systems, Morgantown Energy Technology Center, Morgantown, WV	Development of Advanced Hot-Gas Desulfurization Sorbents	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1995
Twelfth Annual International Pittsburgh Coal Conference Proceedings	Simultaneous Removal of H_2S and NH_3 from Hot Coal Gas	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1995
Annual AIChE Meeting, Miami Beach, FL	Development of Advanced Hot-Gas Desulfurization Sorbents	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1995
Twelfth Annual Inter-national Pittsburgh Coal Conference, Pittsburgh, PA	Simultaneous Removal of H_2S and NH_3 in Hot Coal Gas	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1995
Proceedings of the Advanced Coal-Fired Power Systems, Morgantown Energy Technology Center, Morgantown, WV	Development of Advanced Hot-Gas Desulfurization Sorbents	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1995
Third Annual Historically Black Colleges and Universities/Private Sector Energy Research and Development Technology Transfer Symposium, Atlanta, GA	Development of Advanced Hot-Gas Desulfurization Sorbents	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1995
Second Annual Historically Black Colleges and Universities/Private Sector Energy Research and Development Technology Transfer Symposium	Simultaneous Removal of H_2S and NH_3 in Coal Gasification Process	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1994
Proceedings, Coal-Fired Power Systems 94 - Advances in IGCC and PFBC Review Meeting, Morgantown Energy Technology Center, Morgantown, WV	Simultaneous Removal of H_2S and NH_3 in Coal Gasification Process	Jothimurugesan, K., Adeyiga, A. A., and Gangwal, S. K.	1994

5. Teaming/Collaborative Efforts

The Massie Chair Program is currently collaborating with the Working Group for Environmental Science and Technology (WEST) on campus. The WEST group has representatives from the following departments:

Chemistry, Biology, Physics, Marine and Environmental Science and Engineering.

The Environmental Justice initiatives are in collaboration with the City of Portsmouth and City of Chesapeake.

B. Academic-related Accomplishments

1. Undergraduate Program

a) Course Development

None.

b) Courses Offered

Course Number	Course Title	Students Taking Course
CME 523	Industrial Pollution	60

c) Degrees Offered

B.S., Chemical Engineering.

d) Students Trained/Graduated/Employed

Names	Degree	Major	Date of Graduation	Employer/ Graduate School
1. Elana Clemons	B.S.	Chemical Engineering	May 1998	Industry
2. Shelly Hutson	B.S.	Chemical Engineering	May 1998	Newport News Shipbuilding
3. Keesha Lewis	B.S.	Biology	May 1998	Hampton University
4. Estelle Rutledge	B.S.	Chemical Engineering	May 1999	University of Arkansas Medical School
5. Jeffrey Carpenter	B.S.	Chemical Engineering	May 1999	Industry
6. Maame Poku	B.S.	Chemical Engineering	May 2000	Graduate School Carnegie Mellon University
7. Judith Cothorn	B.S.	Chemical Engineering	May 2000	Industry
8. Natalie Reaves	B.S.	Chemical Engineering	May 2000	Industry
9. Jamal Burgess	B.S.	Electrical Engineering	May 2001	Graduate School

10. Tisha Williams	B.S.	Chemical Engineering	May 2001	Industry
11. Catherine Miano	B.S.	Architecture	May 2000	Industry
12. Etang Williams	B.S.	Chemical Engineering	May 2001	Frito-Lay Inc.
13. Burnita Johnson	B.S.	Chemical Engineering	May 2002	Industry
14. Robert Crosby	B.S.	Chemical Engineering	May 2002	Navy
15. Heather Shaw	B.S.	Chemical Engineering	May 2002	Industry
16. Calvin Coston, Jr.	B.S.	Electrical Engineering	May 2004	Industry
17. GholamAli Miamee	B.S.	Computer Science	Dec. 2002	Graduate School
18. Brandee Barnes	B.S.	Chemical Engineering	May 2002	Graduate School
19. Marcus Williams	B.S.	Chemical Engineering	May 2003	Industry
20. Keoyona Bradley	B.S.	Chemical Engineering	May 2003	Industry
21. Tracey Hicks	B.S.	Chemical Engineering	May 2003	Industry
22. Victor Roberts	B.S.	Chemical Engineering	May 2005	Industry
23. Kimberly Parham	B.S.	Chemical Engineering	May 2006	Industry
24. Brandon Buie	B.S.	Computer Engineering	May 2008	Industry
25. Josslyn Stinson	B.S	Accounting	May 2009	Industry
26. Daniel Thomas	B.S.	Electrical Engineering	May 2009	Industry
27. Devona Thomas	B.S.	Electrical Engineering	May 2010	
28. Keara Harris	B.S	Electrical Engineering	May 2010	
29. Sarah Lewis	B.S	Biology	May 2011	
30. Monique Simpson	B.S	Math	May 2011	

2. Graduate Program

a) Course Development

None.

b) Courses Offered

None.

c) Degrees Offered

None.

3. Collaborative/Joint Efforts

The program collaborates with the chemistry, biology and marine science departments in producing environmental graduates.

C. Facilities and Equipment

None.

D. Staffing

1. New Staff

None.

2. Current Personnel

Names	Position	Degree	Specialty
1. Dr. Adeyinka A. Adeyiga	Professor and Director	Ph.D.	Chemical Engineering
2. Dr. Hoshang Chegini	Research Associate Professor	Ph.D.	Mechanical Engineering
3. Efat Miamee	Chemical Technician	B.S. MBA	Chemistry
4. Frances Watkins	Administrative Assistant	AST	
5. Devona Thomas	Student Worker		
6. Keara Harris	Student Worker		

3. Leaving/Retiring Staff

None.

E. Outreach Initiatives

1. Pre-College

Hampton University was involved with various outreach initiatives in 2000 with the Newport News Public School System. An example of this is the newly created "innovative" zone whereby Heritage High School in Newport News and its "feeder" middle school and elementary schools will completely integrate instruction from K to 12th grades. There are three magnet schools housed within Heritage itself:

- Comprehensive School for Excellence
- Engineering and Technology Magnet School
- Traditional Magnet School

Heritage High is an excellent school that serves a large economically disadvantaged population. The principal investigator for this Massie grant, Dr. Adeyiga, and Dr. M. Morgan, are serving on the Project Advisory Board for this project.

Hampton University also continues its involvement in the WBHR-AMPS Program (the Washington-Baltimore-Hampton Roads Alliance for Minority Participation in science, engineering and mathematics) funded by the National Science Foundation (NSF). The alliance, a multidisciplinary research and training

program, seeks to increase significantly the number of minority graduates in science, engineering, and mathematics at member institutions.

2. Community

None.

3. Other Minority Institutions

None.

4. Other Programs

None.

F. Problems Encountered/Addressed