CURRICULUM VITAE

ERIC P. VEJERANO

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EDUCATION

Ph. D.	Louisiana State University | 2011 | Baton Rouge, LA, USA Chemistry *Dissertation: Formation and Stabilization of Combustion-Generated Environmentally Persistent Free Radicals on Silica Surface*
B.Sc.	University of the Philippines Los Baños | 1999 | Philippines Agricultural Chemistry *Thesis: Modification of the Rapid test Kit Method for Detecting Organophosphate and Carbamate Pesticides Using Enzyme-Inhibition Technique*

ACADEMIC APPOINTMENT

Oct. 1, 2015-present	Research Scientist Department of Civil and Environmental Engineering Virginia Tech
Sept. 2011-Sept. 30, 2015	Postdoctoral Associate Department of Civil and Environmental Engineering Virginia Tech

GRANT AND PROPOSAL WRITING AND REVIEWING ACTIVITIES

- Co-PI on a recently awarded contract from the U.S. Army Research Office to study the partitioning of volatile organic compounds (VOCs) from the soil, gas, and particle phases to better predict human exposure to VOCs. $450,000, 3 years
- Initiated and assisted writing grants submitted to NIH to study deposition of nanoparticles in the air-liquid interface that realistically mimics those in the respiratory tract and evaluate the toxicity of nanomaterials to respiratory epithelial cells
- Assisted writing grants submitted to P3 Nano to study the toxicity of cellulose nanocrystals
- Assisted writing grants submitted to NIH to refine, test, calibrate, and deploy a micro-gas chromatograph for detecting and analysing hazardous air pollutants emitted by the transportation industry
- Peer-reviewer for *Environmental Science and Technology, PLOSOne, Environmental Science: Nano, Indoor Air, Hazardous Materials,* and *Building and Environment*

RESEARCH/PROFESSIONAL/GOVERNMENT EXPERIENCE

RESEARCH SCIENTIST | Oct 2015-Present
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
VIRGINIA TECH | Blacksburg, VA

- Studying phase transition and chemistry of micrometer-sized simulated airborne respiratory droplet as a result of changes in relative humidity to understand its effect on transmission and infectivity of viruses
- Measuring evaporation of droplet at different relative humidity

POSTDOCTORAL ASSOCIATE | September 2011- September 2015
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
VIRGINIA TECH | Blacksburg, VA

- Studying phase transition and chemistry of micrometer-sized simulated airborne respiratory droplet as a result of changes in relative humidity to understand its effect on transmission and infectivity of viruses
- Measuring evaporation of droplet at different relative humidity
- Worked of EPA project to determine the fate, transport, and transformation of nanomaterials in the waste stream during combustion
- Inventoried pollutants emitted from incineration of nanowaste such as polycyclic aromatic hydrocarbons (PAHs) and polychlorinated dibenzo-*p*-dioxin and dibenzofuran (PCDD/Fs)
- Investigated the cytoxicity, genotoxicity, and oxidative potential of particles emitted from incineration of waste employing a variety of acellular and cellular assays
- Developed and built environmental chamber to measure partitioning coefficients of semi-volatile organic compounds into the air and aerosol phases and performed preliminary measurements
- Tested and calibrated the performance of a lab-developed portable microGC for measuring hazardous air pollutants emitted from gasoline
- Investigated partitioning of nanomaterials in the aerosol phase and residual ash
- Characterized physico-chemical properties of nanomaterials
- Characterized physico-chemical transformation of nanomaterials after combustion and nanomaterial that partition in wastewater and sediment following wastewater treatment employing sophisticated analytical technique including electron microscopy, electron diffraction, and X-ray spectroscopy
- Identifying semiochemicals responsible for maternal-infant communication
- Updated the Nanoconsumer Product Database by adding new categories to increase its utility and the validity of the information it contains

RESEARCH ASSISTANT | October 2006-May 2011
DEPARTMENT OF CHEMISTRY
LOUISIANA STATE UNIVERSITY | Baton Rouge, LA

- Worked on a NIH project that investigated the formation, fate, and transformation of environmentally persistent free radicals (EPFRs) that are formed from the reaction between organic compound and transition metal
- Developed experimental set up for synthesizing free radicals
- Synthesized different EPFRs for used for in vivo/in vitro toxicity test
- Studied the formation of persistent free radicals and their physical and chemical properties including reaction mechanisms
- Identified reaction by-products resulting from free radical recombination and their mechanisms
- Synthesized nanocatalyst
- Built thermal reactor, furnaces, and vacuum chambers for studying free radicals

SENIOR SCIENCE RESEARCH SPECIALIST | February 2005 – June 2005
DEPARTMENT OF SCIENCE AND TECHNOLOGY | Republic of the Philippines

- Coordinated and managed research logistics between the Philippine Government and Japan Society for the Promotion of Science
- Facilitated correspondence among various government agencies in the Philippines and between the Philippines and the Japanese governments
- Initiated the creation of RONPAKU FELLOWS society to enhance networking among Filipino scholars

TEACHING EXPERIENCE

TEACHING ASSISTANT | August 2005 – August 2009
DEPARTMENT OF CHEMISTRY
LOUISIANA STATE UNIVERSITY | BATON ROUGE, LA

- Managed and assisted undergraduate course in General Chemistry and assisted students in performing experiments
- Guided student with lesson and helped them in technical and laboratory report writing

VOLUNTEER TEACHER | June 1999-March 2000
UNIVERSITY OF THE PHILIPPINES-UGANAYAN NG PAHINUNGOD/DEPARTMENT OF EDUCATION | PHILIPPINES

- Taught chemistry to underserved high school students

VOLUNTEER TEACHER-FACILITATOR | September 2003-June 2004
PAMANAKA | PHILIPPINES

- Taught science subjects to students ranging from elementary to high school levels using alternative teaching pedagogy
- Modified syllabi, workbooks, and various instructional materials to enhance their effectiveness incorporating the unique culture and learning style of indigenous Filipino students

TEACHER | 2002
PHILIPPINE SCIENCE HIGH SCHOOL | PHILIPPINES

- Taught chemistry and methods of research to high school students that are highly gifted in science and mathematics

PEER-REVIEWED PUBLICATIONS

1. Vance, M.E., Kuiken, T., Vejerano, E.P., McGinnis, S.P., Hochella, M.F. Jr., Rejeski, D., Hull, M.S. (2015). Nanotechnology in the Real World: Redeveloping the nanomaterial consumer product inventory. *Beilstein Journal of Nanotechnology*. 6, 1769-1780.

   Highlights. *The Nanoconsumer Product Inventory database is one of the most cited databases that catalogues consumer products containing nanomaterials or employing nanotechnology in their manufacture. The database was updated by adding new categories to enhance its utility and the validity of the information it contained.*

2. **Vejerano, E.P.,** Ma, Y., Holder, A.L., Pruden, A., Subbiah, E., and Marr, L.C. (2015). Toxicity of particulate matter from nanowaste incineration. *Environmental Science: Nano*. 2, (2), 143-154. JOURNAL INSIDE FRONT COVER

   Highlights. *Investigates the toxicity and oxidative potential of PM emitted by incinerated waste containing nanomaterials. In most cases, nanomaterials in the waste do not significantly affect the oxidative potential of PM.The presence of these seven nanomaterials at low concentrations in the waste stream is not expected to exacerbate the hazard posed by PM that is produced by incineration*

3. Apoorva, G., Akbar, M., **Vejerano, E.P.,** Narayanan, S., Nazhandali, L., Marr, L.C., and Agah, M. (2015). Zebra GC: A mini gas chromatography system for trace-level determination of hazardous air pollutants. *Sensors & Actuators B: Chemical*. *Sensors & Actuators B: Chemical*. (212), 145–154.

   Highlights. *Novel micro-gas chromatograph (μGC) architecture leverages monolithically integrated separation column and thermal conductivity detector. A method to perform highly sharp injections from preconcentrator that is compatible with flow-sensitive detector is developed. The prototypal μGC is tested for detecting hazardous air pollutants in gasoline.*

4. Ma, Y., Metch, J.W., **Vejerano, E. P.,** Miller, I.J., Leon, E.C., Marr, L.C., Vikesland, P.J. Pruden, A. (2014). Microbial community response of nitrifying sequencing batch reactors to silver, zero-valent iron, titanium dioxide and cerium dioxide nanomaterials. *Water Research*. 2015. 68, (0), 87-97.

   Highlights. *Nitrification function of microbial community unaffected by NanoAg, NZVI, nanoTiO_2 and nanoCeO_2 from 0.1 to 20 mg/L. Distinct effects of nanoAg and Ag^+ on microbial community structure decrease microbial diversity and abundance of gene markers responsible for nitrification.*

5. Ma, Y., Elankumaran, S., Marr, L.C., **Vejerano, E.P.,** Pruden, A. (2014). Toxicity of engineered nanomaterials and their transformation products following wastewater treatment on A549 human lung epithelial cells. *Toxicology Reports, 1*, (0), 871-876.

   Highlights. *Pristine nanomaterials exhibit different extent of cytotoxicity and genotoxicity to A549 cells. Following wastewater treatment, nanomaterials are not cytotoxic or genotoxic to A549 cells*

6. Tiwari, A. J., Morris, J. R., **Vejerano, E.P.**, Hochella, M.F., Marr, L.C. (2014). Oxidation of C_{60} aerosols by atmospherically relevant levels of O_3. *Environmental Science & Technology 48*, (5), 2706-2714.

   Highlights. *Reaction between aerosolized C_{60} and atmospherically relevant mixing ratios of O_3 at differing levels of relative humidity under ambient conditions forms a variety of oxygen-containing functional groups on the*

aerosol surface. Exposure to O_3 increases the oxidative stress exerted by the C_{60} aerosols.

7. **Vejerano, E.P.,** Leon, E.C., Holder, A. L., Marr, L.C. (2014). Characterization of particle emissions and fate of nanomaterials during incineration. *Environmental Science: Nano 1*, (2), 133-143. JOURNAL COVER

   Highlights. *Investigates the emissions of particulate matter (PM) and the effect of incineration on nanomaterials. Added nanomaterials do not affect particle number emission factor. Only at high mass loading of nanomaterials shifts PM size distribution to smaller size. Small amounts of the nanomaterials (0.023–180 mg/g of nanomaterial) partitions into PM while the majority remains in the bottom ash retaining their original size and morphology but form large aggregates.*

8. Holder, A.L., **Vejerano, E.** P., Zhou, X., Marr, L.C. (2013). Nanomaterial disposal by incineration**.** *Environmental Science: Processes & Impacts 15*, 1652-1664.

   Highlights. *The review ascertains the potential pathways by which nanomaterials in the waste streams may enter incinerators and their fate during incineration.*

9. **Vejerano, E.P.,** Holder, A.L., Marr, L.C. (2013) Emissions of polycyclic aromatic hydrocarbons, polychlorinated dibenzo-p-dioxins, and dibenzofurans from incineration of nanomaterials. *Environmental Science & Technology 47*, (9), 4866-4874.

   Highlights. *Examines the formation of polycyclic aromatic hydrocarbons (PAHs) and polychlorinated-dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) from incineration of waste containing various nanomaterials. Addition of nanomaterial in waste results in higher emissions of some PAH species and lower emissions of others, depending on the type of waste. The total PAH emission factors are on average ~6× higher for waste spiked with nanomaterials v. their bulk counterparts. Chlorinated dioxins are not detected from incineration of poly(vinyl chloride) (PVC) waste; however, elevated concentration of chlorinated furans forms with wastes containing silver and titania nanomaterials.*

10. **Vejerano, E.P.,** Lomnicki, S., Dellinger, B. (2012). Formation and stabilization of combustion-generated, environmentally persistent free radicals (EPFRs) on Ni(II)O supported on a silica surface. *Environmental Science & Technology 46*, (17), 9406-9411.

    Highlights. *Investigates the formation and stabilization of EPFRs on a Ni(II)O surface. Phenoxyl-type radical, with g-value between 2.0029 and 2.0044, and a semiquinone-type radical, with g-value from 2.0050 to as high as 2.0081 form. Long half-lives of EPFRs on Ni(II)O ranges from 1.5 to 5.2 days. Yields of EPFRs formed on Ni(II)O are ~8× higher than on Cu(II)O and ~50× higher than those on $Fe(III)_2O_3$.*

11. **Vejerano, E.P.,** Lomnicki, S., Dellinger, B. (2012). Lifetime of combustion-generated environmentally persistent free radicals on Zn(II)O and other transition metal oxides. *Journal of Environmental Monitoring. 14*, (10), 2803-2806.

Highlights. *EPFRs on Zn(II)O are the most persistent with half-lives ranging from 3 to 73 days compared to those on different transition metal oxides. The half-life of EPFRs correlates with the standard reduction potential of the transition metal.*

12. **Vejerano, E.P.,** Lomnicki, S., Dellinger, B. (2011) Formation and stabilization of combustion-generated environmentally persistent free radicals on an $Fe(III)_2O_3$/silica surface. *Environmental Science & Technology 45*, (2), 589-594.

    Highlights. *A phenoxyl-type radical with g-value of 2.0024−2.0040, and a second semiquinone-type radical, with a g-value of 2.0050−2.0065 form on $Fe(III)_2O_3$ surface. Yields of EPFRs were ~10× lower for iron than copper. Half-lives of EPFRs on iron ranges from 24 to 111 h, compared to the half-lives on copper which have half-lives ranging from 27 to 74 min.*

13. Khachatryan, L., **Vejerano, E.P.,** Lomnicki, S., Dellinger, B. (2010) Environmentally persistent free radicals (EPFRs). 1. Generation of reactive oxygen species in aqueous solutions. *Environmental Science & Technology 45*, (19), 8559-8566.

    Highlights. *Environmentally persistent free radicals (EPFRs) from 2-monochlorophenol on Cu(II)O/silica particles form hydroxyl radical as detected by spin trapping and electron paramagnetic resonance spectroscopy. EPFRs on Cu(II)O generate hydroxyl radical (•OH), superoxide anion radical ($O_2^{\bullet -}$), and hydrogen peroxide (H_2O_2). EPFRs catalytically produces •OH radicals.*

14. Lomnicki, S., Truong, H., **Vejerano, E.P.,** Dellinger, B. (2008). Copper oxide-based model of persistent free radical formation on combustion-derived particulate matter. *Environmental Science & Technology 42*, (13), 4982-4988.

    Highlights. Environmentally persistent free radicals (EPFRs) form by adsorption of substituted aromatic compounds particles containing Cu(II)O at the post-combustion zone (100 and 400 °C) and may form on other transition metal oxide as well. Phenoxyl and semiquinone radicals form depending on the precursor and the adsorption temperature. EPFRs form via sequential physisorption, chemisorption, and electron transfer mechanisms. Lifetimes of EPFRs' under vacuum appear to be indefinite

CONFERENCE PROCEEDINGS & PRESENTATIONS

1. Marr, L.C., Pruden, A., **Vejerano, E.P.,** Ma, Y., Elankumaran, S., Holder, A.L., Leon, E.C. Transformation and fate of nanomaterials during wastewater treatment and incineration, 9th International Conference on the Environmental Effects of Nanoparticles and Nanomaterials, September 7-11, 2014, Columbia, South Carolina.
2. Ma, Y., Metch, J., **Vejerano, E.P.,** Marr, L.C., and Pruden, A. Effects of nanomaterial disposal on wastewater treatment microbial communities and toxicity implications. 2012 Sustainable Nanotechnology Organization Conference. November 5-11, 2013, Santa Barbara, CA.
3. **Vejerano, E.P,** Dellinger, B., Marr, L.C., Holder, A.L. Leon, E.C. Environmentally persistent free radicals and nanomaterials as emerging environmental contaminant. 247th ACS National Award for Creative Advances in Environmental Science & Technology: Symposium in Honor of

Harold Bartlett Dellinger. March 16-20, 2014, Dallas, TX.

4. **Vejerano, E.P.,** Ma, Y., Metch, J., Leon, E.C., Holder, A.L., Pruden, A., and Marr, L.C. Fate and transformation of nanomaterials during wastewater treatment and incineration, 2013 NSF Nanoscale Science and Engineering Grantees Conference. December 4-6, 2014, Alexandria, VA.
5. **Vejerano, E.P.,** Holder, A.L., Marr, L.C. Emissions of polycyclic aromatic hydrocarbon, and polychlorinated dibenzo-*p*-dioxin and dibenzofurans from incineration of nanomaterials, 13th International Congress on Combustion By-Products and Their Health Effects. May 14-18, 2013, New Orleans, LA.
6. **Vejerano, E.P.,** Holder, A.L., Marr, L. C. Oxidative stress potential of combustion-derived nanomaterial-containing particulate matter, 13th International Congress on Combustion By-Products and Their Health Effects. May 14-18, 2013, New Orleans, LA.
7. Lomnicki, S., Kiruri, L., **Vejerano, E.P.,** Dellinger, B. Lifetime and stability of environmentally persistent free radicals - What matters? Southwest Regional ACS Meeting. November 4-6, 2012, Baton Rouge, LA
8. Marr, L.C., Pruden, A.J., Holder, A., Ma, Y., **Vejerano, E.P.,** Transformation and fate of nanomaterials during wastewater treatment and incineration, Society of Environmental Toxicology and Chemistry (SETAC) 33rd Annual Meeting. November 11-15, 2012, Long Beach, CA.
9. Hull, M.S., Kuiken, T., Wong, A., McGinnis, S., **Vejerano, E.P.,** Marr, L.C., Ewing, T., Rejeski, D., Hochella, M.F. Re-inventing the nanotechnology consumer products inventory through a university/NGO partnership, Sustainable Nanotechnology Organization Conference. November 4-6, 2012, Arlington, VA.
10. **Vejerano, E.P.,** Holder, A.L., Marr, L.C. Fate of nanomaterials during combustion. American Association for Aerosol Research 31st Annual Conference. October 8-12, 2012, Minneapolis, MN.
11. **Vejerano, E.P.,** Holder, A.L., Marr, L.C. Emission of PAHs from nanowaste incineration. Internal Meeting of the Center for Environmental Implications of Nanotechnology. Duke University. Durham, NC, March 2012.
12. Katchatryan, L., **Vejerano, E.P.,** Lomnicki, S., and Dellinger, B. Environmentally persistent free radicals: Generation of reactive oxygen species in aqueous solutions. 12th International Congress on Combustion By-Products and their Health Effects. Zhejiang University, Zhejiang, China, June 2012.
13. Lomnicki, S., **Vejerano, E.P.,** Dellinger, B. Transition metal ions and environmentally persistent free radicals. 12th International Congress on Combustion By-Products and Their Health Effects. Zhejiang University, Zhejiang, China, June 2012.
14. Lomnicki, S., **Vejerano, E.P.,** Dellinger, B. Lifetime of combustion-generated environmentally persistent radicals on Zn(II)O and other transition metal oxides Louisiana State University. 34th International Symposium on Combustion. July 29 - August 3, 2012, Warsaw, Poland).
15. **Vejerano, E.P.,** Lomnicki, S., Dellinger, B. Formation and stabilization of environmentally persistent free radical on an $Fe(III)_2O_3$ on silica surface. Superfund Annual Meeting. November 2010, Portland, OR.
16. **Vejerano, E.P.,** Lomnicki, S., Dellinger, B. Formation and stabilization of persistent free radical on $Fe(III)_2O_3$/silica surface. 11th International Congress on Combustion By-Products and Their Health Effects. June 2009, EPA, Research Triangle Park, NC.
17. **Vejerano, E.P.,** Lomnicki, S., Dellinger, B. Formation and stabilization of persistent free radical on Cu(II)O/silica surface. 10th International Congress on Combustion By-products and Their Health Effects. June 5-7, 2007, Naples, Italy.

HONORS AND AWARDS

- Article entitled "Characterization of Particle Emissions and Fate of Nanomaterials During Incineration" featured as journal front cover in *Environmental Science: Nano* │2014

- Article entitled "Toxicity of Particulate Matter from Nanowaste Incineration" featured as journal inside front cover in *Environmental Science: Nano* │2015
- National Science Foundation Travel Award to attend the 11th International Congress on Combustion By-products and Their Health Effects │June 2009 │EPA Triangle Park, NC, USA
- National Science Foundation Travel Award to attend the 10th International Congress on Combustion By-products and Their Health Effects │June 2007 │Naples, Italy

SKILLS

- Extensive experience on the principles and application of aerosols and their measurement.
- Extensive experience in assessing toxicity of nanomaterials with an array of acellular and cellular assays.
- Experience in the synthesis of nanoparticles
- Extensive experience for quantitative and qualitative analysis of organic and inorganic chemical using gas chromatograph (GC), gas chromatograph-mass spectrometer (GC-MS), gas-chromatograph-flame ionization detector (GC-FID), thermal desorption-gas chromatograph-flame ionization detector (TD-GC-FID), high performance liquid chromatograph (HPLC), Fourier transform-infrared (FTIR) spectrometer, inductively coupled plasma-mass spectrometer (ICP-MS), electron paramagnetic resonance spectrometer (EPR), fluorescence, atomic absorption spectrometer (AAS), ultraviolet-visible spectrometer (UV-Vis)
- Proficiency in conducting wet chemistry, epifluorescence and confocal laser scanning fluorescence microscope, and analytical QA/QC.
- Extensive experience on aerosol generation, sampling, and particle size measurement using Scanning Mobility Particle Sizer (SMPS) and Aerodynamics Particle Sizer (APS) instrument, aerodynamic particle sizer (APS), microparticle analysis sizer (MPS), cascade impactors, diffusion charger, photoemission aerosol sensors, constant output atomizer,
- Highly proficient on the physical and chemical characterization of nanoparticles employing a variety of sophisticated instrumentation including transmission electron microscope (TEM), scanning electron microscope (SEM), X-ray photoelectron spectrometer (XPS), selected area electron diffractometer (SAED), energy-dispersive X-ray spectrometer (EDS), dynamic light scattering (DLS) spectrometer, Brunauer-Emmet-Teller (BET) surface area analyzer
- Experience in devising different sampling method for extracting contaminants in air, liquid, and solid media
- Extensive knowledge of laboratory research with focus on air quality, sediment and wastewater
- Good practical experience in planning, organizing different lab projects and field work at the same time and setting up bench-scale studies
- Solid experience in building highly sophisticated and precision controls for experimental set up
- Interfacing/modifying of devices and instrument more than their standard use
- Proficient in chemical tagging of protein and viruses with fluorophore, and their separation, and purification.
- Expertise in developing assays and protocols for assessing toxicity.
- Expertise in using LabView for acquiring data acquisition and for controlling hardware that requires precise control and operation
- Experience in training new graduate students and guiding new post-docs with laboratory techniques and instrument and helping them start their research work
- Experience in modifying surface properties of materials
- Trained, worked, and co-wrote paper with a senior undergraduate student from Stanford University on characterizing nanomaterials before and after incineration

- Experience in managing lab according to Environmental Health & Safety (EHS) regulatory compliance and writing quality control reports especially for materials that require more than the conventional chemical hazards (nanomaterials)
- Designed and build specialized experimental set-up including thermal reactors, thermal system used for catalysis, environmental chambers, high-precision humidity generator with automated process controls, and disinfection system for viruses.
- Experience in testing system performance and calibration of devices/instruments. Ability to modify GC other than standard use.
- Strong skills in innovation, problem solving, laboratory techniques, research, presentation and writing
- Highly proficient in using technical, data analysis, multimedia, and programming software: IgorPro, Origin, ImageJ, WinEPR, Simfonia, ChemDraw, LabView, C/C^{++}, Adobe CS5 (Photoshop, Acrobat, Illustrator), Inkscape, and MSOffice (Word, Excel, PowerPoint, Access)
- Experience on project management on scientific research

PROFESSIONAL AFFILIATIONS

Member, American Association for the Advancement of Science | 2014-2015
Member, American Chemical Society | 2014-2015
Member, American Association for Aerosol Research | 2014-2015
Member, Center for Environmental Implication of Nanotechnology | 2014-2015
Member, Sustainable Nanotechnology Organization | 2014-2015
Member, Virginia Tech Sustainable Nanotechnology | 2014-2015
Member, Professional Regulatory Commission (Chemistry) | Philippines | 2000-2005

REFERENCES

DR. LINSEY C. MARR
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Department of Civil and Environmental Engineering | Virginia Tech
(540) 231 6071 | lmarr@vt.edu

DR. PETER J. VIKESLAND
Professor
Department of Civil and Environmental Engineering | Virginia Tech
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Eric P. Vejerano
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RESEARCH STATEMENT

Since the beginning of the Industrial Revolution, human demand for vast amounts of carbon-based energy and the desire to create new materials have increased our contribution to the earth's environmental burden. Today, materials are engineered at a scale smaller than living systems that has poorly understood environmental and health implications.

My research experience involves working on the interdisciplinary fields of environmental science and engineering, chemistry, combustion, aerosol science, inventory of pollutant emission, toxicology, nanoscience, and nanotechnology to address improving air quality. Building upon my experience, I plan to pursue research that addresses the fate, transformation, environmental and health impacts of emerging comtaminants, and their eventual release into the atmosphere as well as other environmental compartments. My objectives are to (1) investigate pollutant emissions catalyzed by emerging contaminants such as nanomaterials during incineration and thermal processing, (2) formulate simple control strategies to mitigate pollutant emissions, and (3) assess the environmental and health impacts of emerging contaminants. In my Ph. D research, I have investigated environmentally persistent free radicals (EPFRs) that form on surfaces of nanoparticles in atmospheric particulate matter. EPFRs have long existed but have only been discovered recently attesting that many unanswered questions in air quality still remain and even more with emerging contaminants. I have outlined three possible future research goals in line with my research vision. I also intend to work at the nano-bio systems building on my current research on the chemistry of bioaerosols.

Pollutant emissions. The majority of nanomaterials incorporated in consumer products contain transition metal/metal oxide. As these products are ultimately discharged into the environment and some incinerated, they can promote formation of EPFRs. Engineered nanomaterial may have higher potential to form elevated amounts of EPFRs than do their bulk counterpart because of nanomaterial's unique properties. My previous research suggested that that transition metal oxide nanomaterials promotes the formation of EPFRs which resulted in elevated concentration of chlorinated furans. My goal is to quantify EPFRs formed from incinerated consumer products containing nanomaterials and those from pristine nanomaterials with surrogate waste as radical precursors for comparison and assess combustion by-product formation. This information is important in identifying new sources of risks to nanoconsumer products. Results from this study would be an important addition to the hazards of nanotechnology, and will inform various stakeholders in addressing a sustainable disposal method for nanowaste.

Mitigating pollutant emissions. My preliminary research on aerosol emission suggests that other metal oxide nanoparticles (*e.g.,* $Fe(III)_2O_3$, titania, and C_{60}) may be more effective in reducing emissions of some pollutants compared to ceria which is used as diesel additive for reducing particulate emissions. My goals is to investigate the effect of different nanomaterials added as fuel-borne catalyst in reducing particle emissions and determine the fate and transformation of the nanomaterial. Because particulate matter stemming from anthropogenic sources has shorter residence time in the atmosphere; reducing its emission would immediately result to reduced adverse environmental and health impacts. In the long term, I would like to develop nanocatalyst that can be used for destruction of organic pollutants.

Assessing environmental and health impacts. Many methods used in investigating the toxicity of engineered nanomaterials and ultrafine particles involve collecting particles on filters and extracting them. These methods introduce artifacts and do not mimic the mechanism when particles deposit onto the respiratory tract. My goal is to develop/enhance method for sampling and deposition of particles that mimics those on the human respiratory tract for assessing particle toxicity where diffusion mechanism governs the deposition of particles on surfaces.

I intend to seek funding for these projects from the NSF, NIH, EPA, and from private institutions. In addition to these proposed research, I am interested in collaborating with the faculty at your university to formulate and address other research questions.

TEACHING STATEMENT

Eric P. Vejerano
evejer1@vt.edu

As a teacher, my objectives are to encourage, challenge, and support my students acquire skills and develop abilities that are essential in generating and understanding the issues of today's society. Personally, learning to learn is perhaps the most important ability I desire for students to develop. This however requires developing problem solving skills, asking thought provoking questions, understanding basic conceptual principles, communicating their work, and working collaboratively.

My teaching experience to date includes teaching from elementary to undergraduate level. I have taught both in public and private schools for four years. My primary method of teaching includes lectures that incorporate instruction, engagement, dialogues, and demonstration. On my first day in class, I ask students on their expectation and the relevance of the course to them. These help me address and identify ideas, assumptions, generalizations, some of which may need correction and identify topics to incorporate and focus in the course. I also asses their current learning needs using an essay type pre-test to ensure students are equipped with basic pre-requisite concepts and skills required to successfully complete the course.

I primarily assess the student mastery of concepts, problem solving proficiency, and ability to express ideas with essay type test and quizzes. I use these tools to also assess my effectiveness as a teacher. I have used them in the past to pinpoint strengths and identify areas that needed emphasis both for my students and for me. Aside from quizzes I believe problem sets and presentations by individuals or groups supplement classroom teaching. While I have taught diverse types of learners that required different motivations, for me, engaging students to learn remains the most challenging part of teaching. In the past, I have used demonstrations, debates, and hypothetical scenarios to engage them. As some students learn in 'non-traditional' modes, I envision using social media to discuss environmental issues to add to my assessment tool. Working with students on a one-on-one basis creates an opportunity to engage students that may not be active in big groups and provides learning opportunity for both students and instructor. I have taken substantial pedagogy courses which I have found useful in meeting some of the students' learning needs. I envision giving students a semester-long project, a proposal, that would require them to search and integrate meaningful information for proposing innovative solutions to environmental issues on climate change, air pollution, and fate and transport of contaminants using concept in nanoscience and nanotechnology. This project would require them to incorporate principles, concepts, and models presented in the course.

My teaching experience in the past had significantly impacted the skills I have developed in conducting research. Undergraduate students have been involved at various stages of my research. A senior undergraduate from Stanford has been my co-author on two peer-reviewed papers. For me teaching and research are complementary modes in advancing science. My best teaching contributions would be teaching environmental chemistry, air pollution control, fate and transport of chemicals in the environment, environmental organic chemistry. In addition to these, I would be interested in developing an upper-level course on atmospheric, aerosol chemistry, or environmental nanoscience, and teaching other courses as needed by the department.