

Dr. Alison Bain

NSERC POSTDOCTORAL RESEARCH FELLOW

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Education

McGill University

Montreal, QC

DOCTOR OF PHILOSOPHY, CHEMISTRY

2021

University of British Columbia

Vancouver, BC

MASTER OF SCIENCE, CHEMISTRY

2016

Carleton University

Ottawa, ON

BACHELOR OF SCIENCE, HIGHEST HONOURS CHEMISTRY, CONCENTRATION IN NANOTECHNOLOGY

2013

Research Experience

Oregon State University

Corvallis, OR

ASSISTANT PROFESSOR

Position Accepted - Starting Fall 2023

My research group will focus on characterizing the physical properties of aerosol, including surface tension, mixing state and water transport.

University of Oulu

Oulu, FI

VISITING SCIENTIST

2023

Exploring thermodynamic partitioning models to describe the surface composition and surface tension in finite volume liquids in collaboration with Prof. Nønne Prisle at the Center for Atmospheric Research (ATMOS).

University of Bristol

Bristol, UK

POSTDOCTORAL RESEARCH ASSOCIATE

2021 - PRESENT

Supervised by Dr. Bryan Bzdek, my research investigates the effects of surfactants in ternary aqueous systems, comparing partitioning in macroscopic solutions to picoliter droplets using a combination of bulk and single particle techniques. Ongoing collaborations with Prof. Nønne Prisle (University of Oulu) and Dr. Kevin Wilson (Berkeley National labs) aim to further understand the partitioning behaviour of surfactants in confined volumes. An ongoing collaboration with Prof. Man Nin Chan (Chinese University of Hong Kong) aims to understand the physical properties of organosulphate aerosol.

McGill University

Montreal, QC

PHD THESIS WORK

2016 - 2021

Supervised by Prof. Thomas Preston, my thesis work focused on building optical setups and using single particle optical spectroscopy to characterize the complex refractive index aerosol particles as well as building models for the refractive index as a function of composition and wavelength. In collaboration with Prof. James Davies (UC, Riverside) this model was used to model the properties of Humic acid aerosol. In addition to my thesis work, I investigated the hygroscopicity of microplastics and the effect of microplastics on the hygroscopicity of aqueous systems relevant to atmospheric aerosol.

University of British Columbia and Canfor Pulps Ltd.

Vancouver, BC

MITACS ACCELERATE PROJECT

2015 - 2016

Supervised by Prof. Ed Grant and Dr. Paul Bicho, I designed and tested a Raman probe for characterizing wood pulps during inline processing.

University of British Columbia

Vancouver, BC

MSc THESIS WORK

2013 - 2016

Supervised by Prof. Ed Grant and in collaboration with Canfor Pulps Ltd., I used Raman spectroscopy and chemometrics for the prediction of wood pulp physical properties including viscosity and tensile strength.

Carleton University

Ottawa, ON

UNDERGRADUATE HONOURS THESIS RESEARCH PROJECT

2012

Supervised by Prof. Sean Barry, I designed and tested methods for metal assisted electrochemical etching of silicon for light harvesting.

Teaching Experience

Demonstrating labs, answering student questions on discussion boards, grading reports and final projects, holding tutorials, facilitating discussion, supervising teaching assistants, developing course materials.

Supervisory Teaching Assistant

McGill University

CHEM 377 & 493: INSTRUMENTAL ANALYSIS AND ADVANCED PHYSICAL CHEMISTRY LABORATORY

2021

Teaching Assistant

McGill University

CHEM 110, 120, 345 & 493: GENERAL CHEMISTRY I & II LABORATORIES, QUANTUM CHEMISTRY, ADVANCED PHYSICAL CHEMISTRY LABORATORY

2016 – 2019

Teaching Assistant

University of British Columbia

CHEM 121, 123 & 315/323/335/345: GENERAL CHEMISTRY I & II LABORATORIES & INTEGRATED CHEMISTRY LABORATORIES

2013 – 2016

Undergraduate Teaching Assistant

Carleton University

CHEM 1101 & 3503: CHEMISTRY FOR ENGINEERS AND INORGANIC CHEMISTRY I

2009 – 2013

Research Support

AEROSOL SOCIETY CAREER DEVELOPMENT GRANT

2022–2023

Alison Bain “Characterizing the surface tension and surface partitioning of subpicolitre droplets”

MCGILL SUSTAINABILITY SYSTEMS INITIATIVE IDEAS FUND

2020–2021

Thomas C. Preston and **Alison Bain** “The effect of microplastics on cloud droplet formation”

Publications

Peer Reviewed Publications

10. A. Rafferty, B. Vennes, **A. Bain**, and T. C. Preston, “Optical trapping and light scattering in atmospheric aerosol science” *Physical Chemistry Chemical Physics* 2023, 25, 7066 – 7089.
9. **A. Bain** “Buoyancy and Brownian motion of plastics in aqueous solution: Predictions and implications for density separation and aerosol internal mixing state” *Environmental Science: Nano*, 2022, 9, 4249 – 4254.
8. H. Yin, J. Dou, L. Klein, U. K. Krieger, **A. Bain**, B. J. Wallace, T. C. Preston, and A. Zuend, “Extension of the AIOMFAC model by iodine and carbonate species: applications for aerosol acidity and cloud droplet activation” *Atmospheric Chemistry & Physics*, 2022, 22, 973 – 1013.
7. **A. Bain** and T. C. Preston, “Hygroscopicity of microplastics and mixed microplastic-ammonium sulfate systems” *Environmental Science & Technology*, 2021, 55(17), 11775 – 11783.
6. **A. Bain** and T. C. Preston, “The wavelength-dependent optical properties of weakly absorbing aqueous aerosol particles” *Chemical Communications*, 2020, 56, 8928 – 8931.
5. C. L. Price, **A. Bain**, B. J. Wallace, T. C. Preston, and J. F. Davies, “Simultaneous retrieval of the size and refractive index of suspended droplets in a linear quadrupole electrodynamic balance” *The Journal of Physical Chemistry A*, 2020, 124(9), 1811 – 1820.
4. **A. Bain**, A. Rafferty, and T. C. Preston, “The wavelength-dependent complex refractive index of hygroscopic aerosol particles and other aqueous media: an effective oscillator model” *Geophysical Research Letters*, 2019, 46, 10636 – 10645.
3. **A. Bain**, and T. C. Preston, “Mie scattering from strongly absorbing airborne particles in a photophoretic trap” *Journal of Applied Physics*, 2019, 125, 093131.
2. **A. Bain**, A. Rafferty, and T. C. Preston, “Determining the size and refractive index of single aerosol particles using angular light scattering and Mie resonances” *Journal of Quantitative Spectroscopy and Radiative Transfer*, 2018, 2221, 61 – 70.
1. N. Tavassoli, Z. Chen, **A. Bain**, L. Melo, D. Chen, and E. R. Grant, “Template-oriented genetic algorithm feature selection of analyte wavelets in the Raman spectrum of a complex mixture” *Analytical Chemistry*, 2014, 86(21), 10591.

Conference Proceedings

1. A. Christy, N. Tavassoli, **A. Bain**, L. Melo, and E. R. Grant, “Wide-field confocal interferometric backscattering (iSCAT)-Raman microscopy,” in *Optics in the Life Sciences, OSA Technical Digest* (online) (Optical Society of America, 2015).

Manuscripts in Preparation

4. **A. Bain**, K. Ghosh, N. Prisle and B. R. Bzdek, Surface tension and partitioning of nonionic surfactants in picolitre droplets.
3. **A. Bain** and B. R. Bzdek, Comparing thermodynamic and kinetic partitioning models to predict the surface tension of aerosol.
2. **A. Bain**, M. N. Chan and B. R. Bzdek, Quantifying the physical properties of organosulfate aerosol.
1. **A. Bain** and B. R. Bzdek, Determining the surface tension of aerosol containing complex mixtures of cosolutes and ionic surfactants.

Theses

3. **A. Bain**, The refractive index of single aerosol particles: measurements and models. PhD thesis, 2021. Advisor Prof. Thomas C. Preston. Faculty of Graduate and Postdoctoral Studies, McGill University.
2. **A. Bain**, Property prediction with Raman spectroscopy in the pulp and paper industry: a chemometric approach. MSc thesis, 2016. Advisor Prof. Ed Grant. Faculty of Graduate and Postdoctoral Studies, University of British Columbia.
1. **A. Bain**, Metal assisted chemical etches of silicon, BSc honours thesis, 2012. Advisor Prof. Sean Barry. Faculty of Science, Carleton University.

Invited Talks

Postdoctoral Seminar Series, School of Chemistry, University of Bristol

“Atmospheric microplastics and their impact on aerosol properties”, Jan. 27, 2023.

Department of Chemistry, Oregon State University

“Investigating aerosol physical properties at the single particle level”, Dec. 9, 2022.

Department of Chemistry & Biochemistry, Miami University

“Investigating aerosol physical properties at the single particle level”, Dec. 5, 2022.

Department of Biochemistry & Chemistry, New Mexico State University

“Investigating aerosol physical properties at the single particle level”, Nov. 29, 2022.

Energy and Environment Seminar Series, School of Chemistry, University of Bristol

“What is the surface tension of aerosol?”, November 23, 2022.

Department of Chemistry, Brock University

“Investigating aerosol physical properties at the single particle level”, April 12, 2022.

Other Presentations

Annual Aerosol Society Conference

A. Bain and B. R. Bzdek, “The impact of nonionic surfactants on aerosol surface tension”, November 17, 2022 (oral).

International Aerosol Conference

A. Bain and B. R. Bzdek, “Surface tension of surfactant containing aerosol droplets”, September 6, 2022 (oral).

Molecular Understanding of Atmospheric Aerosol

A. Bain and B. R. Bzdek, “The surface tension of ternary aqueous mixtures containing nonionic surfactants in macroscopic solutions and picolitre droplets”, May 16–19, 2022 (poster).

American Geophysical Union Fall Meeting

A. Bain and T. C. Preston, “Contributions of ions and organics to the refractive index of weakly absorbing, aqueous aerosol”, December 9, 2020 (poster).

Chemistry and Biochemistry Graduate Research Conference

A. Bain and T. C. Preston, “The refractive index of aqueous media: Considering solute concentration, wavelength and temperature”, November 20, 2020 (oral).

Chemistry and Biochemistry Graduate Research Conference

A. Bain, A. Rafferty and T. C. Preston, “The wavelength-dependent optical properties of weakly absorbing aqueous aerosol: model and measurements”, November 15, 2019 (oral).

Canadian Chemistry Conference and Exhibition

A. Bain, A. Rafferty and T. C. Preston, “An oscillator model for determining the complex refractive index of weakly absorbing aerosol”, June 6, 2019 (poster - *Award winning presentation*).

Chemistry and Biochemistry Graduate Research Conference

A. Bain and T. C. Preston, “Overcoming the barriers to characterizing strongly absorbing aerosol particles”, November 9, 2018 (oral).

SPIE. Optics and Photonics — Optical Trapping and Manipulation XV

A. Bain and T. C. Preston, “Investigating light absorbing atmospheric particles using a hollow beam optical trap and broadband scattering”, August 20, 2018 (poster).

Chemistry and Biochemistry Graduate Research Conference

A. Bain and T. C. Preston, “Designing a hollow beam optical trap for the study of atmospheric aerosol particles”, November 10, 2017 (oral).

Awards and Distinctions

NSERC PDF | 2023

Natural Sciences and Engineering Research Council of Canada (NSERC) Postdoctoral Fellowship (PDF) holder.

Early Career Scientist Travel Award | 2022

Awarded by the Aerosol Society to attend the International Aerosol Conference 2022.

PhD Thesis in the Top 10% | 2021

Doctoral thesis ranked in the top 10% by the external reviewer.

Graduate Mobility Award | 2019

Fellowship awarded to cover cost of a research stay at the University of California, Irvine.

Molson & Hilton Hart Fellowship | 2019

Fellowship awarded to fund graduate research for the 2019-2020 academic year in the Department of Chemistry, McGill University.

Best Poster in Environment CCCE | 2019

Awarded for the presentation of for “An oscillator model for determining the complex refractive index of weakly absorbing aerosol” at the 102nd Canadian Chemistry Conference and Exhibition.

David J. Simkin Award in Physical Chemistry | 2019

Awarded for excellence in the first two years of graduate studies in McGill Chemistry.

Graduate Excellence Fund Travel Grant | 2019

Awarded to cover costs associated with attending the 102nd Canadian Chemistry Conference and Exhibition.

Graduate Excellence Fund Travel Award | 2018

Awarded to cover costs associated with attending the 21st annual Chemistry and Biochemistry Graduate Research Conference.

T. Sterry Hunt Award in Chemistry | 2018

Awarded for teaching assistance excellence in the 2017 – 2018 academic year, CHEM493 - Advanced Physical Chemistry Laboratories.

Graduate Research Enhancement and Travel Award | 2018

Awarded to cover costs associated with attending the SPIE. Optics and Photonics Conference 2018.

Richard T Mohan Scholarship | 2018

Awarded by the Department of Chemistry at McGill University to a postgraduate student proceeding to the PhD degree.

Graduate Excellence Fund Travel Award | 2017

Awarded to cover costs associated with attending the 20th annual Chemistry and Biochemistry Graduate Research Conference.

MITACS Accelerate | 2015

Awarded a MITACS Accelerate to fund research partnered with Canfor Pulps Ltd.

UBC Entrance Scholarship | 2013

Awarded an entrance scholarship from the Department of Chemistry at the University of British Columbia.

Skills

Technical Computing MATLAB, Mathematica, Python

Optics Skilled in optical alignment

Instrument Development Development of single particle trapping and characterization techniques

Teaching Leading tutorials, demonstrating experiments and supervising teaching assistants

Course Design Tomlinson course design workshop

Service and Outreach Activities

Peer Reviewer | 2021 – Present

Peer reviewer for the American Chemical Society (ACS), American Institute of Physics (AIP) and Aerosol Science and Technology (a Taylor & Francis publication).

Research FUTURES: Discover and Discuss | 2023

Designed in class outreach activity to be demonstrated by the teacher and introduce school children to the concept of surface tension as part of the South West of England Research FUTURES Discover and Discuss program.

CIC PTC - Virtual Seminar Committee | 2022 – 2023

Organizing committee member for the Chemical Institute of Canada, Physical, Theoretical and Computational virtual seminar series.

Postdoctoral Research Seminar Series Co-chair | 2022 – 2023

Co-chair for the postdoctoral research seminar series in the School of Chemistry, University of Bristol.

Equity, Diversity and Inclusion (EDI) Committee | 2022 – 2023

Postdoctoral Representative on the University of Bristol, School of Chemistry EDI committee.

Research FUTURES: Student research fair | 2022

Designed and demonstrated outreach activities to introduce >250 school children to the concept of surface tension as part of the South West of England Research FUTURES Schools research fair outreach event.

International Buddy Scheme | 2022

Buddy with the International Staff Buddy Scheme at the University of Bristol.

Postdoctoral Representative Physical and Computational Chemistry | 2022

Liaison between the Physical and Computational Chemistry section and the postdoctoral researcher community.

Inclusive Research Collective (IRC) Steering Group | 2022

Steering group member for the development of a pilot training program about inclusive research practice at the University of Bristol.

Peer Mentor | 2020 – 2021

Chemistry Graduate Student Society (CGSS) peer mentor program

Chemistry Graduate Student Society (CGSS) of McGill University | 2016 – 2020

Treasurer 2017 – 2020, acting President winter 2019, First Year Representative 2016 – 2017

McGill Chemistry Web Communications Committee | 2018 – 2020

Graduate student representative

University of British Columbia (UBC) Chemistry Safety Committee | 2015 – 2016

Graduate student representative