

SPECIALISTS IN BIO/GEOCHEMICAL PROCESSES

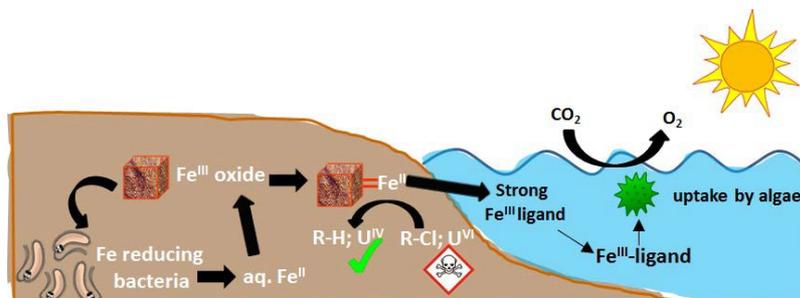
The Biogeochemical Engineering & Management (bioGEMS) Group within the Water Research Centre (WRC) consists of a team of 14 highly experienced researchers. Our research involves the examination of natural and anthropogenic biogeochemical processes that affect the transformation and transport of contaminants and nutrients within sediments, groundwaters, lakes, rivers and coastal environments. Through our research we aim to both improve our understanding of natural systems and develop improved remediation strategies.

While our expertise is applied principally to solving environmental engineering problems, our geochemical skills can assist in addressing a wider range of issues. These include the development of low carbon cements through improved understanding of transformations occurring in the cement hydration process and development of approaches to mitigating neurological disorders such as Parkinson's and Alzheimer's Diseases through improved understanding of metal-catalysed processes leading to oxidative stress.

THE TOOLS OF OUR TRADE

Our laboratories have state-of-the-art facilities that include:

- Numerous instruments for analysing a huge array of environmental species or contaminants
- A radiation laboratory for monitoring radionuclides or the use of radiolabeled environmental probes
- Numerical modelling techniques including chemical kinetics, thermodynamic speciation and 3D flow
- Expertise in X-ray adsorption spectroscopy (XAS) data for high level environmental speciation
- High-tech anoxic chambers for simulating anoxic groundwater and wastewater environments
- Electrochemical instrumentation and expertise



WHAT WE DO

Examples of research activities include:

- Monitoring the transport of radionuclides in subsurface systems
- The development of photovoltaic-powered groundwater treatment devices based on capacitive deionisation technology
- Investigating the generation of reactive oxygen species by natural/engineered systems with implications to natural systems, water & wastewater treatment and human health
- Developing advanced oxidation process (including Fenton/photo-Fenton and electro-Fenton processes) for treating contaminated wastewaters
- Investigating the transformation and fate of contaminants in the coastal zone
- Understanding the factors controlling growth and toxicity of marine and freshwater algae
- Understanding how biogeochemical processes are impacted by iron-reducing bacteria
- Using geochemistry to solve concrete problems
- Understanding processes which affect the transformation and transport of iron & aluminium from acid sulfate soils

OUR PARTNERS

A few of our past and current partners include:

- ANSTO
- Sydney Water Corp, WA Water Corp and NT Power & Water
- Boral Ltd
- Sydney Ports / Maritime Authority
- Pacific Northwest National Laboratory
- Tsinghua University
- Mincarb Pty Ltd
- ERA Ltd
- Tweed Shire Council
- Beijing Origin Water Ltd
- Pangu Environmental Technologies Ltd

ACADEMIC EXCELLENCE

Our group publishes in high impact academic journals specialising in biogeochemistry and environmental engineering. Our group leader is also an Associate Editor for the ACS journal Environmental Science & Technology.

OUR EXPERTS



Professor David Waite is the Director of the bioGEMS group. He is also the Deputy Dean for Research in the Faculty of Engineering. His research interests are focussed particularly on the dynamics of oxidation-reduction processes in natural and engineered systems and in innovative electrochemical technologies for water and wastewater treatment.



Dr Richard Collins is a senior researcher with the WRC. He is an XAS specialist and has an extensive knowledge of radionuclide chemistry, having previously worked as a research engineer at the French Atomic Energy Commission. He is also an expert on iron redox cycling in soils and a specialist in acid sulfate soil remediation.



Dr Shikha Garg is a Senior Research Associate with the WRC. Her expertise lies in the area of free radical chemistry involving iron and silver nanoparticles including Fenton based advanced oxidation processes.



Dr An Ninh Pham is a Lecturer and Research Fellow with the WRC. His expertise lies in the area of kinetic modeling of chemical reactions, the geochemistry of iron in natural systems and the role of copper in natural biological processes.



Dr Adele Jones is a Research Associate with the WRC. Her expertise includes iron redox cycling in natural systems coupled to the degradation of contaminants, in addition to concrete geochemistry.



Dr Mark Bligh is a Research Associate with the WRC. His expertise lies in the area of iron redox cycling in relation to nutrient uptake by algae in addition to concrete geochemistry.



Dr Andrew Kinsela is a Research Associate with the WRC. His expertise lies in the area of iron redox cycling in relation to radionuclide transport and acid sulfate soils.



Dr Xiaomin Li is a Research Associate with the WRC. Her expertise lies in the area of iron redox cycling in the presence of iron reducing bacteria and natural electron shuttling compounds.



Dr Chris Miller is a Research Associate with the WRC. His expertise lies in the area of iron-based advanced oxidation process including those involving electro-Fenton processes and iron sulfides.



Dr Di He is a Research Associate with the WRC. His expertise lies in the area of nanoparticles, reactive oxygen species and water treatment using CDI and advanced oxidation technologies.



Dr Peter Kovalsky is a Research Associate with the WRC. His expertise lies in the area of water treatment using CDI technology and 3D flow and thermodynamic speciation modeling.



Dr Xiu Yuan is a Research Associate with the WRC. Her expertise lies in the area of advanced oxidative water treatment processes involving iron and copper.



Dr Xabier Vazquez-Campos is a Research Associate with the WRC. His expertise lies in the area of iron reducing bacteria and microbiology in general.



Dr Jinxing Ma is a Research Associate with the WRC. His expertise is in development of innovative water treatment technologies involving electrochemical and advanced oxidation processes.