



Department of  
Process Engineering,  
Stellenbosch University

PhD and MEng Research Topics  
2017



## RESEARCH GROUP: BIORESOURCE ENGINEERING

<b>Lecturer:</b> <b>Dr Neill Goosen</b>	<b>Email:</b>	<a href="mailto:njgoosen@sun.ac.za">njgoosen@sun.ac.za</a>	
	<b>Tel:</b>	0218084105	
	<b>Office:</b>	C317.4	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Waste / Bioresource Engineering			
<b>Research Field:</b> Biorefinery; Sustainable Resource Utilisation; Aquaculture			
<b>General description of research field:</b> The majority of projects aim to develop products, and/or optimize the production conditions required to manufacture higher-value products from low-value or waste material (mostly biological feedstocks). A secondary research activity is the evaluation of nutritional products as feed ingredients in Aquaculture.			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Biorefinery of marine macroalgae	X	X	1xMEng or 1xPhD Funding pending
2. Extraction of high-value compounds from marine food processing by-products	X	X	1xMEng or 1xPhD Apply for Waste Roadmap bursaries before 2 <sup>nd</sup> September
3. Development of emulsions as enzyme carrier systems in aquafeeds	X		1xMEng
4. Evaluation of emulsions as enzyme carrier systems in aquafeeds (in collaboration with Animal Science)	X		1xMEng or BSc Animal Science
5. Evaluation of the bioavailability of distillers dried grains with solubles (DDGS) in aquaculture diets	X	X	1xMEng or 1xPhD Apply for Waste Roadmap bursaries before 2 <sup>nd</sup> September
<b>Special requirements:</b> South African citizens and permanent residents, and/or candidates that obtain own bursary funding (and adhere to entry requirements) will get preference.			
<b>Lecturer:</b> <b>Prof Johann Görgens</b>	<b>Email:</b>	<a href="mailto:jgorgens@sun.ac.za">jgorgens@sun.ac.za</a>	
	<b>Tel:</b>	021 808 3503	
	<b>Office:</b>	C407	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Bioresource Engineering			
<b>Research Field:</b> Lignocellulose biorefineries			
<b>General description of research field:</b> Production of chemicals and fuels from lignocellulosic plant biomass			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Experimental measurement and modelling of the kinetics of furfural production from hemicelluloses	X		R90 000 per annum
2. Catalytic pyrolysis of forestry wastes to produce diesel-like fuels	X	X	R90 000 / R110 000 per annum
3. Co-production of furfural and ethanol from sugarcane lignocelluloses		X	R110 000 per annum

For eligibility criteria application information, please contact Mieke du Plessis (Postgraduate Manager) at [miekedup@sun.ac.za](mailto:miekedup@sun.ac.za).

## RESEARCH GROUP: BIORESOURCE ENGINEERING

<b>Lecturer:</b> Prof Kim Clarke	<b>Email:</b>	<a href="mailto:kclarke@sun.ac.za">kclarke@sun.ac.za</a>		
	<b>Tel:</b>	+27 21 808 4421		
	<b>Office:</b>	C306		
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering			
<b>Research Group:</b> Bioresource Engineering				
<b>Research Field:</b> Bioprocess Engineering				
<b>General description of research field:</b> The research is directed towards the development and enhancement of biological processes for optimal production and purification of the bioproduct. A wide range of biological processes are researched, including those using bacterial, fungal and enzymic biocatalysts, resting and active cells, batch, fed-batch and continuous strategies and free and immobilised configurations. These studies are multidisciplinary in nature and are enriched by students who are trained in the fields of chemical engineering, molecular biology, biochemistry and microbiology.				
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>	
<p>This research project will focus on the bacterial production of novel antimicrobial agents effective against causative agents of tuberculosis.</p> <p>Lipopeptide molecules, produced by many <i>Bacillus</i> species, have been shown to exhibit biocidal activity against bacterial pathogens. Specifically, the homologues of the surfactin group of lipopeptides, which inhibit growth of TB surrogates, are potential weapons in the war against TB. In this project, the process conditions and operational strategy of the production process, both the upstream production of the surfactin by the <i>Bacillus</i> and the downstream processing involving concentration and purification of the surfactin, will be optimised to produce the maximum concentration with homologue ratios providing maximal efficacy against TB organisms.</p> <p>The proposed research approach will be multidisciplinary in nature with interrelated components of surfactin production, purification and efficacy, mediated by chemical engineers, microbiologists, biochemists and biotechnologists. It is envisaged that by connecting specialists in the fields of engineering and life sciences, that a synergistic solution to this complex problem will be realised.</p>	X		2 X MEng (research)	
<b>Special requirements:</b> Graduates with a BEng, BScEng or BScHons degrees are eligible to apply.				

For eligibility criteria application information, please contact Mieke du Plessis (Postgraduate Manager) at [miekedup@sun.ac.za](mailto:miekedup@sun.ac.za).

## RESEARCH GROUP: EXTRACTIVE METALLURGY

<b>Lecturer:</b> Prof Steven Bradshaw	<b>Email:</b>	<a href="mailto:smb@sun.ac.za">smb@sun.ac.za</a>	
	<b>Tel:</b>	021 808 4493	
	<b>Office:</b>	C310	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Extractive Metallurgy			
<b>Research Field:</b> Hydrometallurgy, pyrometallurgy			
<b>General description of research field:</b> Developing and modelling extractive metallurgical processes			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Extraction of rare earth elements	X	or X	R80 000 - R120 000 per annum
2. Dynamic modelling of a sulphur fixation plant	X		R 80 000 per annum
3. Crystal habit modifiers for CaSO <sub>x</sub> growth	X		R 80 000 per annum
4. Hydrometallurgical process development for sulphide ores	X		R 80 000 per annum

<b>Lecturer:</b> Dr Lidia Auret	<b>Email:</b>	<a href="mailto:LAURET@sun.ac.za">LAURET@sun.ac.za</a>	
	<b>Tel:</b>	021 808 4495	
	<b>Office:</b>	C213	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Extractive Metallurgy			
<b>Research Field:</b> Process monitoring			
<b>General description of research field:</b> Process monitoring of industrial processes is a necessary process control task, aimed at the detection of detrimental abnormal events or other sub-optimal process operation. Process monitoring using data-driven process models is attractive, due to: the increasing availability of more, and more frequent, process measurements; the increasing power and ease of application of statistical techniques; and the difficulty associated with developing fundamental process models for complex processes. Exciting developments in the field of artificial intelligence and machine learning also provide power tools for developing process monitoring techniques.			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Adaptive process monitoring incorporating semi-supervised learning	X		R 85 000 p per annum
2. Adaptive process monitoring incorporating process knowledge	X		R 85 000 per annum
3. Process monitoring incorporating energy-derived features	X		R 85 000 per annum
<b>Special requirements:</b> Interest in further developing computer programming skills.			

For eligibility criteria application information, please contact Mieke du Plessis (Postgraduate Manager) at [miekedup@sun.ac.za](mailto:miekedup@sun.ac.za).

<b>Lecturer:</b> <b>Prof Christie Dorfling</b>	<b>Email:</b>	<a href="mailto:dorfling@sun.ac.za">dorfling@sun.ac.za</a>	
	<b>Tel:</b>	021 808 3674	
	<b>Office:</b>	C305	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Extractive Metallurgy / Waste			
<b>Research Field:</b> Hydrometallurgy			
<b>General description of research field:</b> Development and modelling of hydrometallurgical processes for metal recovery from low grade /secondary resources			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. A zero waste approach to printed circuit board waste recycling	X		Bursary to be confirmed
2. Recycling of technology metals	X		
3. Precious metal recovery from leach solutions	X	X	
4. Dynamic modelling of hydrometallurgical processes	X		
5. Improving electrowinning efficiency	X		
6. Recycling economics and business case development	X		

<b>Lecturer:</b> <b>Dr Margreth Tadie</b>	<b>Email:</b>	<a href="mailto:mtadie@sun.ac.za">mtadie@sun.ac.za</a>	
	<b>Tel:</b>	+27208084153	
	<b>Office:</b>	Annexe 317.3	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Extractive Metallurgy			
<b>Research Field:</b> Extractive Metallurgy and Mineral Processing			
<b>General description of research field:</b> Metals are a vital component of everyday life. The minerals they are produced from are a finite resource. It is therefore vital that these resources are well managed and utilised in order to ensure a sustainable future. One way of ensuring resource optimisation is by improving the performance of the ‘Extractive Metallurgical’ processes which are used to beneficiate mineral resources. Recovery and product quality in these operations are highly dependent on operating conditions and process variables which require careful control. Challenges arise however due to the fact that these processes occur in very complex chemical environments. The research focus here is on investigating the interactions of process variables and their influence on recoveries in order to improve efficiency and performance of extractive metallurgical processes such as leaching and electrowinning and mineral processing operations such as flotation.			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. The role and effect of organic additives on cathode formation and cathode quality in electrowinning operations. Laboratory based project.	X		Bursary to be confirmed

## RESEARCH GROUP: SEPARATION TECHNOLOGY

<b>Lecturer:</b> Prof Cara Schwarz	<b>Email:</b>	<a href="mailto:cschwarz@sun.ac.za">cschwarz@sun.ac.za</a>	
	<b>Tel:</b>	021 8084487	
	<b>Office:</b>	C307	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Separation Technology			
<b>Research Field:</b> Low pressure phase equilibria			
<b>General description of research field:</b> The separations technology research group has a focus on the measurement and thermodynamic modelling of low pressure phase equilibria. In particular, systems involving organic compounds forming complex molecular interactions are considered. The research consist of the measurement of vapour-liquid, vapour-liquid-liquid as well as liquid-liquid equilibria and the thermodynamic modelling of such systems. Three state of the art experimental set-ups are available to conduct the measurements. At masters level existing thermodynamic models are considered while at PhD level thermodynamic model development is conducted.			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Implementation of online sampling for vapour-liquid and vapour-liquid-liquid equilibria and measurement of additional data	X	X	Limited bursaries available, depending on profile of candidate
2. Measurement of vapour-liquid and vapour-liquid-liquid equilibria of aqueous organic systems	X	X	
3. Thermodynamic modelling of complex aqueous organic systems	X	X	

<b>Lecturer:</b> Prof Cara Schwarz	<b>Email:</b>	<a href="mailto:cschwarz@sun.ac.za">cschwarz@sun.ac.za</a>	
	<b>Tel:</b>	021 8084487	
	<b>Office:</b>	C307	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Separation Technology			
<b>Research Field:</b> Supercritical fluid extraction or fractionation of plant materials			
<b>General description of research field:</b> The separations technology research group has a keen interest in supercritical fluid processing. Current and previous staff have over 25 years of experience in this field and are leaders in supercritical fluid processing research in South Africa. Supercritical fluid processing is ideally suited to the processing of plant materials, especially for high value products that are temperature sensitive.			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Supercritical fluid extraction and/or fractionation of South African plant materials	X	X	Limited bursaries available, depending on profile of candidate

<b>Lecturer:</b> <b>Dr Percy van der Gryp</b>	<b>Email:</b>	<a href="mailto:pvdgryp@sun.ac.za">pvdgryp@sun.ac.za</a>	
	<b>Tel:</b>	021 808 4108	
	<b>Office:</b>	C317.5	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Separation Technology and Waste Valorisation			
<b>Research Field:</b> Reaction Engineering, membrane technology, waste tyre.			
<b>General description of research field:</b> Upgrading waste tyre or low value chemicals to high value chemicals.			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Separation of solvents from oil using organic solvent nanofiltration.	X		R90000 per annum
2. Recovery of valuable minerals from e-waste using waste tyre.	X	X	R90000 / R110000 per annum
3. Co-gasification of crumb tyre with coal and/or biomass.	X	X	R90000 / R110000 per annum
4. Process simulation and economic evaluation of upgrading waste tyres to valuable chemicals.	X	X	R90000 / R110000 per annum

For eligibility criteria application information, please contact Mieke du Plessis (Postgraduate Manager) at [miekedup@sun.ac.za](mailto:miekedup@sun.ac.za).

## RESEARCH GROUP: WASTE VALORISATION

<b>Lecturer:</b> <b>Prof Johann Görgens</b>	<b>Email:</b>	<a href="mailto:jgorgens@sun.ac.za">jgorgens@sun.ac.za</a>	
	<b>Tel:</b>	021 808 3503	
	<b>Office:</b>	C407	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Waste Beneficiation			
<b>Research Field:</b> Waste tyres and plastics valourisation			
<b>General description of research field:</b> Recovery of chemicals, materials and energy from waste tyres and plastics			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Optimisation of pyrolysis char properties for materials applications	X		R90000 per annum
2. Catalytic pyrolysis of rubber crumb to maximise yield of chemicals in tyre-derived oil	X		R90000 per annum
3. Microbial devulcanisation of tyre crumb	X		R90000 per annum
4. Co-gasification of rubber crumb with coal and biomass	X		R90000 per annum
5. Process simulation and economic analysis of sustainable, bio-based processes for rubber production	X	X	R90000 / R110000 per annum
6. Pyrolysis of waste plastics to maximise the yield of diesel-like fuels	X		R90 000 per annum

<b>Lecturer:</b> <b>Dr Robbie Pott</b>	<b>Email:</b>	<a href="mailto:rpott@sun.ac.za">rpott@sun.ac.za</a>		
	<b>Tel:</b>	8082064		
	<b>Office:</b>	C211		
<b>Faculty:</b> Engineering		<b>Department:</b> Process Engineering		
<b>Research Group:</b> Waste Valorisation				
<b>Research Field:</b> Bioprocess Engineering				
<b>List of Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Extraction of resveratrol from wine wastes		X		R90 000 per annum
2. Development of soil amendments for water retention, slow fertilizer release and biofertilizer inoculation		X		R90 000 (TBC)
3. Hydrogen production for organic wastes		X		R90 000 (TBC)

For eligibility criteria application information, please contact Mieke du Plessis (Postgraduate Manager) at [miekedup@sun.ac.za](mailto:miekedup@sun.ac.za).



<b>Lecturer:</b> <b>Dr Tobi Louw</b>	<b>Email:</b>	<a href="mailto:tmlouw@sun.ac.za">tmlouw@sun.ac.za</a>	
	<b>Tel:</b>	021 808 4051	
	<b>Office:</b>	C317.2	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Waste Valorisation			
<b>Research Field:</b> Mathematical modelling of bioprocesses			
<b>General description of research field:</b> Biochemical processes are characterized by incredibly complex interactions with spatiotemporal variations across multiple scales. The development of predictive models to be utilized in the design and optimization of cutting edge biotechnologies using innovative modelling techniques (multiscale, agent based, etc.) is an active, challenging, and ultimately rewarding research field. A variety of processes are being investigated, supported by experimental observations.			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Probabilistic approach to predicting enzymatic hydrolysis of waste proteins	X		Bursary to be confirmed
2. Metabolic flux analysis of isoprene producing cyanobacteria	X	X	Bursary to be confirmed
3. Photobioreactors as an alternative waste beneficiation strategy	X		Bursary to be confirmed
<b>Special requirements:</b> A strong interest in fundamental mathematical modelling of biochemical processes.			

## RESEARCH GROUP: WATER

<b>Lecturer:</b> <b>Dr Tobi Louw</b>	<b>Email:</b>	<a href="mailto:tmlouw@sun.ac.za">tmlouw@sun.ac.za</a>	
	<b>Tel:</b>	021 808 4051	
	<b>Office:</b>	C317.2	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Water			
<b>Research Field:</b> Mathematical modelling of bioprocesses			
<b>General description of research field:</b> Biochemical processes are characterized by incredibly complex interactions with spatiotemporal variations across multiple scales. The development of predictive models to be utilized in the design and optimization of cutting edge biotechnologies using innovative modelling techniques (multiscale, agent based, etc.) is an active, challenging, and ultimately rewarding research field. A variety of processes are being investigated, supported by experimental observations.			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Agent-based modelling of manganese reduction in biofilms	X		Bursary to be confirmed
2. Multiscale simulation of decentralized sanitation systems	X	X	Bursary to be confirmed
3. Fate and effects of micropollutants (endocrine disruptors, pharma, personal care products) in wastewater systems	X	X	Bursary to be confirmed
4. Remote monitoring of key water quality indicators	X		Bursary to be confirmed
<b>Special requirements:</b> A strong interest in fundamental mathematical modelling of biochemical processes.			

<b>Lecturer:</b> Prof Lingam Pillay	<b>Email:</b>	<a href="mailto:pillayvl@sun.ac.za">pillayvl@sun.ac.za</a>	
	<b>Tel:</b>	021 808 4728	
	<b>Office:</b>	C212	
<b>Faculty:</b> Engineering	<b>Department:</b> Process Engineering		
<b>Research Group:</b> Water			
<b>Research Field:</b> Water/wastewater treatment, Membrane technology			
<b>List of Topics:</b>	<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1. Development of a water treatment filter for rainwater harvesting	X		R 80 000 - R 90 000
2. Fouling mechanisms in membrane bioreactors	X		
3. Membrane systems for industrial effluent treatment and reuse (various options)	X		
<b>Special requirements:</b> Strong practical engineering skills.			

For eligibility criteria application information, please contact Mieke du Plessis (Postgraduate Manager) at [miekedup@sun.ac.za](mailto:miekedup@sun.ac.za).