InnoVenton Times

January, 2019 | 041 504 3281 | info.InnoVenton@mandela.ac.za

2018—DIESEL AND DUST (MIDNIGHT OIL)

5 Steps to the moon in 3 days

1) **Assemble the pieces**
2) **Power up**
3) **Shoot to the moon**
4) **Pull up for landing**
5) **Take a walk and a souvenir.**

Letter from the Editor...

To all our readers, 2019 is upon us and we can expect nothing less other than another eventful and demanding year. Last year raced passed and a multitude of changes were implemented across the institute. Some of you have had new challenges and responsibilities to manage, thank you for rising to the occasion. Developments and highlights of projects and services tackled in 2018 are highlighted in this edition. I hope you will enjoy seeing what we have been up to over the last year. New endeavors for 2019 are also mentioned. Our working relationships with our host institution and the Faculty of Science will be an area of focus for the establishment of new initiatives going forward. We continue to work to serve and surprise our customers and stakeholders. There might not be an easy way to fly to the moon, but if you don't try you'll never get there. To do that, we are going to need some brilliant technological development based ideas. Remember, "making a difference in the lives of others, through the endeavors of our work at InnoVenton, shows and establishes purpose".———Melissa

Research Collaborations

As part of the ongoing initiatives focused on producing liquid biofuels from Coalgae®, InnoVenton has established a research collaboration with the Department of Process Engineering at Stellenbosch University. Dr Shaka Shabangu will spend the next few months in Stellenbosch working with the team there. The thermal behaviour of Coalgae® will be assessed under gasification-like conditions using a combination of pyrolysis testing, products characterisation and equilibrium modelling. The data will be used to elucidate the performance of Coalgae® in a typical gasifier with the aim to undertake a pilot-scale gasification/Fischer-Tropsch demonstration using several tonnes of Coalgae®. Complementary collaborative work on gasification with the Department of Chemical Engineering at North-West University is also underway.

InnoVenton

Dream. Innovate. Create.

COALGAE® AND TRANSPORT FUELS

InnoVenton has developed and patented a unique coal-algae composite, leveraging our extensive experience in microalgae cultivation and processing. The agglomerate of discard coal fines with microalgae, trademarked Coalgae®, contains a renewable fraction and is a direct replacement for coal, requiring no equipment changes when combusted for heat and electricity generation. The addition of microalgae imparts a number of technical and environmental benefits. Coalgae® can be further processed by thermochemical means into liquid transport fuel components. We are currently investigating and demonstrating pyrolysis and gasification of Coalgae® with particular emphasis on isolating the diesel and kerosene fractions.

Following successful completion of the microalgae-to-energy project, the Department of Science and Technology funded InnoVenton to commence a three-year project in December 2017 that aims to demonstrate the manufacture of liquid transport biofuels from Coalgae®. The project also aims to determine commercial downstream algae processing technologies and products that would form part of a larger biorefinery incorporating Coalgae® fuels.

The major transport fuel thrusts are pyrolysis of Coalgae® and subsequent processing of the bio-crude oil, and gasification of Coalgae® followed by Fischer-Tropsch (FT) synthesis. Over the past year we have commissioned a pilot fast pyrolysis reactor to supplement our slow pyrolysis system. This allowed us to determine the optimal conditions to maximise liquid yield from the Coalgae® microalgae-waste coal composites. Hydrogenation microreactors and a larger pressure vessel have been used to process the pyrolysis liquids before distillation of the fuel cuts. Larger-scale external tests on pyrolysis and gasification have also been conducted. Future development will be carried out through internal research and collaborative partnerships in order to manufacture approximately 100 litres of fuel components.

Various downstream opportunities that can form part of a Coalgae® platform have been completed or are in progress. These include a low-smoke fuel, biofertilisers and soil conditioners, formulated feeds, protein for feed and food, as well as ethanol from algae residues.

New Appointments

Mr Luvuyo Ndyenga

Mr Luvuyo Ndyenga, appointed as a Process Technician, completed a Diploma in Chemical Process Technology in 2018 at the Nelson Mandela University.

He has been working with the Microalgae to Energy Team and has gained experience in cultivating, monitoring and maintenance of the Microalgae greenhouse raceway population.

As Process Technician for the DST Project, he assists with various aspects of the practical cultivation of microalgae.

Luvuyo will be responsible for the monitoring and maintenance of the health of the microalgae population in the photo bioreactors. His biggest challenge, however, will be to collect samples from the raceway pond on a daily basis, building a data set, to predict and control the health of the microalgae population. Luvuyo also likes to Braai.

Brilliant Blue Algae

Spirulina has been exploited as a food supplement since the 16th century. This "super food" is part of the cyanobacteria family. It is a photosynthetic prokaryote that contains proteins known as phycobiliproteins, give that brilliant blue colour.

Phycocynanin is the most sought after of these proteins and is responsible for the pure blue pigments found in microalgae. It is used in food colouring, paint dyes and cosmetic eyeshadow powders.

Phycobiliproteins are water soluble proteins making them effective natural colourants. They are also considered powerful antioxidants. This has stimulated demand in the nutraceutical, cosmetic and pharmaceutical industries for more natural "Blue" pigments. Microalgae processing becomes viable when we consider the extraction of high value products.

Various processes can be employed to isolate the protein: Pigment extraction, Downstream fractionation, Microalgae biomass fractionation or Protein extraction and recovery.

Collaborations

Would you and your Team like to collaborate with InnoVenton ? For more information contact Dr Gary Dugmore .

E: Gary.Dugmore@mandela.ac.za /T: 041 504 3482

More than R2.9 Million for student bursaries

During 2018 InnoVenton managed to raise and pay over R2.9 Million in bursaries to under graduate bursaries. The support for our students came from a wide variety of sources that include scholarships from industries, accommodation and study-fee support from the Chieta, and grants from a variety of sources such as industry, TIA, and internal InnoVenton funds.

InnoVenton

Downstream Chemicals

Technology Station

From its inception the Technology Station activities at InnoVenton have been fully integrated in to the larger institute so as to maximise the impact that e could have externally and leverage the impact of the station on the institute itself.

InnoVenton/DCTS strives to provide specific technology support and innovation in the areas of:

- Product replacement; extension or formulations
- Improving production/process flexibility;
- Reducing production lead times; Reducing environmental impacts; improving product quality; improving working conditions/safety;
- Providing expert technology, analytical, testing services; and
- Providing custom designed short learning programs for industry
- Kilo-lab, Distillation and Process Plant Facilities
- TIA Seed Funded Projects, Major Projects and Youth development Projects.

Enquiries: Dr Gary Dugmore

Technology Station Manager

T 041 504 3482

technology innovation AGENCY

AECI, BASF, Chemical Systems, Heraeus, Orion and Umicore sponsored students to complete their in-service training in 2018. Gareth Ahlers, Doria Moyakhe, Zizipho Nogcinisa and Fred Onianwa were CPT IST's in 2018 at InnoVenton. Luzuko Matmela and Busisiwe Nkonki's internship was sponsored through TIA's 500 program and SASCE sponsored the in-service training of Simon Vico. Simamkele Gumisa carried out his Analytical In-service training with the Analytical team. Three Agri interns; Thabiso Bengu, Bungcwalisa Mxhobo and S'busisiwe Vilakazi worked on the Aquaponics and Soil fertilizer projects at InnoVenton.

Marketing ... A touchy Business

Bio Africa Convention - Mr Brian Tait was invited to attend the convention at the IEC in Durban on the 28th of August. He presented a talk on the developments of the Micro-algae to Energy Project.

Festival of Motoring - Mr Mofo Setloboko and Mrs Nozuko Mtwa represented InnoVenton in Kyalami from the 31st of August to the 2nd September. They partnered with the TIA exhibition promoting the testing capabilities we have on offer for the automotive sector.

Above: Mrs Nozuko Mtwa at InnoVentons stand at Kyalami.

Pearson School Careers Evening - Dr Shawn Gouws , Dr Melissa Gouws, Prof Zeni Tshentu and Ms Anita Noah represented InnoVenton and the Chemistry Department respectively at this annual careers day. They offered information about the Chemical Process Technology Diploma, the Formulation Science program and the mainstream B.Sci programs on offer at the university to Grade 9 learners. It looks like the CPT program will have a full class of first year students for 2019.

Above: Prof Tshentu and Dr Gouws discussing career options in Science with a group of learners at Pearson High.

New Appointments

Mr Michael Muller

Mr Michael Muller has been appointed as a Process Technician at InnoVenton. Michael has taken responsibility for the cultivation of micro-algae for the purpose of Coalgae® production as well as supplying other projects in need of algae. He is also responsible for the cultivation of Spirulina with the development of a tray cultivation system. He completed a Chemical Process Technology Diploma from the Nelson Mandela University and came to us to complete an internship. His biggest challenge, however, will be to ensure smooth production of micro-algae by controlling contamination of rotifers that diminish algae growth and cause culture crashes. Michael likes fast cars.

A Funky Festival of Formulations

The BSc Formulation Science Students, “Class of 2018” put forward an inspirational range of products at their annual product showcase held in November at InnoVenton. Each student was challenged to come up with a formulation that had a unique selling point, present the idea supported by marketing material and make a sample of the product for evaluation.

They developed business plans to support their products and had to “pitch” their ideas to a panel of critics who served as “potential investors”. The products ranged from cosmetics (moisturizer, facemask, face scrub, hand sanitizer, anti-dandruff shampoo) to pharmaceuticals (e.g. Aids prevention drug, asthma control drug, body protein supplement) to crumb rubber foam fillers and biocides.

Each of the products had something unique about them that set them apart from other products currently available in the market. It has been marvelous to see how this program has developed over the last 8 years to provide a platform for chemists to enter the business world and have a chance to become entrepreneurs. Dr Nicole Vorster is the programs coordinator; for more information feel free to contact her at

Nicole.Vorster@mandela.ac.za

New Equipment Acquisitions

During 2018 the local chemical industry contributed and re-sourced equipment to the value of R 2 million for training and projects, namely:

Stirred Tank Reactors: Umicore donated ten formulation reactors complete with mixing and electronic control to Inno-Venton. The reactors ranges in size from 100 L to 500 L and are valued at R135k each, on average. These reactors will be installed in the new laboratory space gained as part of the building expansions at InnoVenton. Apart from being used for scale-up of R&D technologies, the reactors will also be used for training of students from both the Diploma in Chemical Process Technology and the BSc Hons in Formulation Science

Crystallization unit: With help from AECI, InnoVenton was able to purchase a crystallization unit valued at R460000. This unit will be used as part of the practical training for Chemical Process Technology Students and trainees.

Scada system upgrade: BASF donated R100k towards the upgrade of the Scada system in the Kilolab; this system is used for training and industrial service operations.

Rotovap: Heraeus donated a Rotovap with a 50L vessel capacity valued at R150000. This will be added to our utilities for training and SME batch support services.

A Special Thank you to all our sponsors and partners for the contributions made to promote training and Technology Development at InnoVenton.

Automotive Components Testing

Our laboratory is able to carry out tests against various specifications and requirements fro a range of moulded automotive components or raw polymer materials used to manufacture interior car parts.

- Thermal Cycles
- Extensometer (Tensile) Testing
- Odour, Fogging
- Formaldehyde
- Flammability and
- Substances of Concern etc.

The laboratory management is committed to ensure that all laboratory staff are competent and conversant with a management system that is externally accredited to comply with the requirements of ISO 17025 in order to achieve continuous improvement in meeting customer expectations through on time service delivery and accuracy in work done. ***So if you need to have some chemical analysis done and are not sure who to ask, give us a call for all your analytical testing requirements.*** *Enquiries:* Louise Hamilton, Technical Manager, T 041 504 3953

New Appointments

Mr Marcio Agulhas

Mr Marcio Agulhas has been appointed as a Process Technician at InnoVenton. Marcio has taken responsibility in the areas of microalgae cultivation, spray drying Coalgae, and assisting with algae raceway system improvements together with Mr JJ De Jongh. He has a diploma as a Chemical Process Technologist from the Nelson Mandela University and came to us to complete an in-service training internship.

His biggest challenge, however, will be to assist and gain experience on some of the aspects of the pyrolysis work and continue with activities in the Micro-algae greenhouse facility.

National Science Week

InnoVenton participates in the National Science week, inviting learners to visit our facility. JJ as tour guide for 2018.

Above: Mr JJ de Jongh and a group of learners from Linkside High and their teacher.

Fish, Food and Aquaponics

Aquaponics, cultivation and designs.– Dr Candace Davison

Above: Our Aquaponics system.

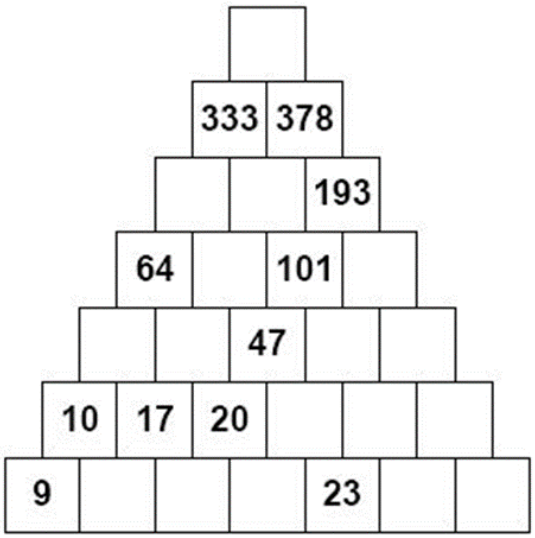
The projects main aim was to determine whether algae – either in whole form or as extracted crude protein – could replace fishmeal in aquafeed diets. Fishmeal is commonly used as a protein source in feed formulation, but its use is unsustainable and environmentally unsound. Algae, which contain a high protein content (60 – 70% protein in Spirulina), promise to be an excellent source of sustainable protein. Two Spirulina aquafeeds were formulated and compared with a control feed containing fishmeal. The feeds were tested in an aquaponic system as part of initial field trials demonstrating the cultivation of tilapia and various vegetables. The aquafeed serves a dual role as fish feed and as biofertiliser due to the nitrogen cycle established within the aquaponic system.

One of the benefits of aquaponics over aquaculture and hydroponics is that much less wastewater is produced. The waste from the latter systems needs to be treated before release into waterways. Water quality is a vital aspect of aquaponics and was routinely monitored during the course of the project. The main parameters are the levels of nitrite, nitrate and pH, as well as temperature, which all influence the welfare of the fish and performance of the system. Nitrites and nitrates were observed to be below toxic levels to the fish at all times, indicating that the nitrogen cycle was well established and that uptake of nitrites by the plants was occurring effectively. This was further confirmed by the observed increase in growth of the plants within the systems. pH levels were generally within the recommended range after the water cycle had been established. Two main crops were harvested during the trials, namely celery and Swiss chard. We hope to repeat the study by comparing Spirulina and Scenedesmus as a protein source. With the help of Martin Fick an aquaponics expert, we will refine the system for future trials. We believe that the feed developed has commercialization potential based on the findings of this project.

Above: Monitoring water quality in the system.

Soccer at the Rag Farm

The extra space at the Rag Farm has its perks, the guys decided to blow off some steam with a friendly game of soccer before a Friday afternoon Braai.



Biofertilizers

We are nearing the end of our two-year investigation into the use of algae as biofertilisers, undertaking field trials at the Rag Farm site on the south campus. Various vegetable crops have been grown over the seasons to compare algae-based fertilisers with traditional fertilisers. Microalgae have a high nitrogen content, prompting their use in this application. In addition, algae may improve the soil structure and condition, as well as promoting beneficial soil microbes. Preliminary results are encouraging and indicate that algae perform just as well as a traditional inorganic fertiliser, if not better.

Above: Crops currently being grown are spinach, turnips, cabbage, tomatoes, maize and cauliflower.

Search and Circle

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Can you find the words:

Aroma, Aquaponics, Blue, Burn, Cave, Chemist, Coalgae

Drill, Gas, InnoVenton, ISO, Mould, Oven, Plastic, Pellets,

Phycocyanin, Policy, Smoke, Spend, Spirulina, Tilapia, Tile.

New Appointments

Mr Sifundo Duma

Mr Sifundo Duma has been appointed as a Research technician at InnoVenton. Sifundo has taken responsibility for research projects within the thermochemical processing of Coalgae ® to liquid fuels as well as carrying out operational activities to support the research work. He has a degree in Chemical Engineering from the Cape Peninsula University of Technology and came to us to complete an internship. His biggest challenge, however will be Fischer Tropsch synthesis of syngas from Coalgae ® and completing his Masters. Sifundo likes listening to music.

Short Learning Programs

If your company is interested in InnoVenton presenting a tailor made Short Learning program for your staff, please contact Mrs Louise Hamilton T 041 504 3953 to find out what we could offer you.

"Biological warfare" – friend or foe?

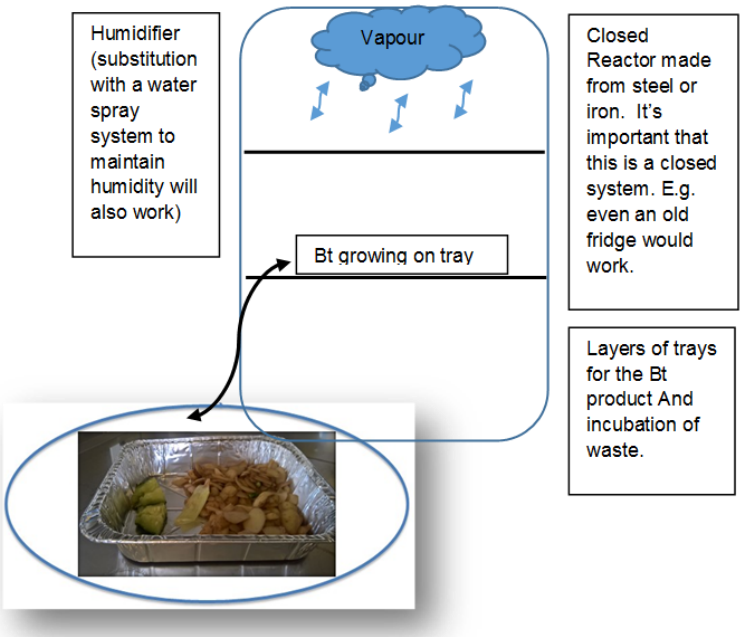
By: Kudzai Mtambanengwe and Brian Tait

When most people hear about bacteria, viruses, fungi and nematodes they immediately think of "germs" or elements that cause food to spoil. Although this is true in its own sense, these so-called germs can also play a role as entomopathogens (pathogens of insects). Of particular interest are a group of viruses known as baculoviruses and bacteria known as *Bacillus thuringiensis* (*Bt*). These entomopathogens have a specific mode of action that involves being activated in the insect midgut because of the alkaline surrounding, ultimately resulting in insect mortality. This in turn means that these pathogens do not affect mammals and many other non-target pests because of neutral to acid guts that are common.

Entomopathogens are commonly referred to as biopesticides. Biological control agents are relatively inexpensive, environmentally friendly and safe. They also offer effective solutions for pests that are hard to manage. The most common biopesticide is *Bt* which produces toxins that are harmful to target pests.

Given that *Bt* is a bacteria that is soil borne, it is theoretically possible to grow the *Bt* on different organic sources provided the necessary nutrients are available. This has led to the current research of culturing *Bt* on organic food waste in a process known as solid state fermentation (SSF). In SSF the culturing medium is in a solid state as the name suggests, unlike in liquid form which is the common cultivation process, and a range of organic waste is being tested.

The research being conducted has increased the potential of downstream beneficiation of organic waste through the production of high value products. The research is currently on-going with the next focus being on the efficacy of the SSF *Bt* as a biopesticide for a range of insects. Below : SSF setup of Bt on organic waste.



So if you need something built, fixed or modified— who do you call?

None other than Philip, Unathi, Michael or Derek. This Team of super heroes at InnoVenton can handle everything, from a dripping tap to a quirky instrument and utilities beyond.

Simplified Photobioreactor Design

The unique, patented NMU hybrid microalgae cultivation system comprises a combination of photobioreactors with a traditional raceway system. Raceways are commonly used commercially because they are cheap to construct. However, the efficiency of raceways is low because of the low surface area to volume ratio and limitations with gas-liquid transfer of CO_2 for photosynthesis. Photobioreactors (PBRs) overcome these limitations, but at a high capital cost. Combination of the two systems provides the advantages of each, with efficiencies approaching that of PBRs but at lower cost. As part of our continuous improvement efforts of the NMU system, we have simplified the design of our bubble-column PBR, reducing the cost by 27%. The original design had a relatively complicated internal structure, which has been removed without compromising performance. Efforts continue to further reduce capital and operating costs. Watch this space!

Spirulina Cultivation

Spirulina is considered a “superfood” and contains up to 70% highly digestible vegetable protein, has high concentrations of beta-carotene, vitamin B12, iron and trace minerals, and the rare essential fatty acid GLA – Gamma-Linolenic Acid. It has a balanced spectrum of amino acids, cleansing chlorophyll, and the blue pigment, phycocyanin. Spirulina are multicellular and filamentous blue-green algae that have gained considerable popularity in the health food industry and increasingly as a protein and vitamin supplement to aquaculture diets.

InnoVenton is cultivating Spirulina in various systems, which include the simple bucket system described elsewhere, as well as in traditional raceways, photobioreactors and a novel tray-based system. The Spirulina we grow is currently being used to formulate various feeds, such as the aquafeed for the tilapia in our aquaponics system, and for extraction of high-value compounds, e.g. phycocyanin.

The cost of the nutrient medium is one of the largest cost components of Spirulina cultivation and we are researching alternative, lower-cost media. We have had success with a medium consisting of readily available agricultural fertilisers and are currently investigating other alternatives.

The Blue Container…

so what's in there?

Have you ever wondered what the “Big Blue” container is for? It’s right next to the Coalgae processing shed. Dr Shaka Shabangu, Mr Johannes De Jongh and Mr Sifundo Duma will be setting up a Thermo Chemical Laboratory as part of the transport fuel study for the DST project at InnoVenton. We need to make 100L of liquid fuel from processed Coalgae pellets.

Spirulina Bucket System

A funky, simple and cheap algae cultivation system has been put together for Spirulina production. The system uses readily-available plastic clear buckets and irrigation tubing. Performance of the demonstration system, comprising 12 buckets, has exceed expectations. It is modular and can be expanded by adding more buckets. Spirulina is a nutritious “wonderfood” with a protein content of up to 70%, and is often grown to supplement the nutrition requirements in underdeveloped communities.

The system can be used in rural feeding schemes, clinics, orphanages, old-age homes and penal institutions, for example, as well as commercial production. In fact, it can be integrated in aquaponics systems where it serves as part of the fish-feeding regime, reducing of the costs of fish production against commercial aquafeeds. And the wide variety of plants from the aquaponics system are nutritious too!

We plan to demonstrate the cultivation system in conjunction with aquaponics on a larger scale of 100 buckets. A Port Elizabeth NGO, Maranatha House, has been identified as partner for the field trials. Marantha House cares for abused children and destitute families from the Eastern Cape and provides skills training and wider community engagement. They also run an aquaponics system and piggery, making it ideal for our demonstration project. We are currently seeking funding to implement the project.

Above: Spirulina bucket system matched to a single aquaponics system

Above: Harvesting Spirulina from the bucket

Agro-food waste beneficiation

By: Dr Nicole Vorster

At InnoVenton, we are always coming up with innovative ideas on how to develop products from either biomass or agricultural waste. Dr Nicole Vorster together with her PhD student initiated the idea of using olive oil waste pomace as a source of bioactive compounds which have beneficial properties for the skin and general human health. These properties include anti-oxidant, antibacterial, antifungal and anti-inflammatory action. As part of the PhD project, which was partly funded by TIA, the olive pomace was collected from various olive farms, freeze-dried for preservation, and subjected to a unique extraction process which maximised the amount of water-soluble polyphenolic anti-oxidants that could be extracted from the pomace. The unique solvent mixture also allowed the more nonpolar anti-oxidants such as vitamin E and squalene to be extracted. Squalene is a fatty molecule excreted by the sebaceous glands and is present in the hydro-lipid layer which covers and protects the skin. However, with ageing skin, the amount present in this excretion is reduced. The olive pomace is thus an ideal non-animal source of squalene usually obtained from shark fat, and can be used successfully in cosmetic skin care products since it is skin compatible and readily absorbed.

The extracts prepared by Dr Vorster and her student were quantitatively analysed by HPLC for five desired bioactive antioxidants and extracts from different olive cultivars were compared. As expected, the different cultivars had different amounts of the desired antioxidants but all five were present in each cultivar. The extracts were tested for antimicrobial and antioxidant ability and were found to exhibit both. The extracts were also tested for long-term stability in accelerated temperature conditions and they were successfully incorporated into a cosmetic gel and skin cream formulation containing only natural ingredients.

The idea of beneficiating waste for financial gain and to solve a massive waste problem was considered as a viable business option, and Dr Vorster entered two biotechnology entrepreneural competitions during 2016.

The first one was the GAP (Gauteng Accelerator Programme) run by the Innovation Hub in Pretoria. During this competition, Dr Vorster attended a business training course in Pretoria in which she learnt how to write a business plan and how to pitch a business idea.

She was selected as one of the finalists to present her business plan at the Innovation Hub and then won the prize for the Eastern Cape region which included a small amount of funding and a year of business incubation at the Innovation Hub.

The second competition was the TIA-Swiss Venture Leader programme in which 20 technology business ideas were chosen from around the country. The chosen applicants attended a business pitching training session in Johannesburg in which they had to pitch their businesses to a panel of judges which included Swiss entrepreneurs from the Venture Leader Training programme. Of the 20 business ideas, the 10 best ones were chosen and these 10 potential entrepreneurs of whom Dr Vorster was one, were selected to attend a week-long Venture Leader training programme in Switzerland in December 2016.

This was a very valuable learning experience for Dr Vorster who had to make a mind shift from a being a scientist to thinking more like a business person. Below: The delegates at the training program.

A provisional patent was taken out on the process and extract content and this patent is now in the international PCT application stage.

This work has now been expanded to extract caffeine and other methylxanthines from spent coffee grounds as this is another waste product of which enormous amounts are produced, and contains valuable anti-oxidants. Caffeine has recently become the miracle ingredient of the cosmetic world as it has been shown to aid in the reduction of cellulite due to its ability to break down fats. It is also lauded for its ability to stimulate hair growth in the hair follicles, thus it is currently being used in shampoo formulations.

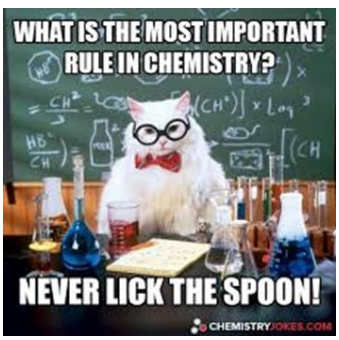
In 2017 Dr Vorster and her student presented aspects of the olive research at the Coschem conference in Johannesburg while in 2018 her Master's student presented the coffee research at the same conference while Dr Vorster presented further aspects of the olive research at an international cosmetics conference, IFSCC 2018, in Germany. (Photographed below)

Dr Vorster has incorporated the BSc Honours Formulation Science students in her research by encouraging them to develop innovative products containing extracts from waste. This year's Formulation Showcase saw some face creams/gels and exfoliant creams being produced by some of the students incorporating olive and coffee extracts as well as the freeze-dried solid form of the wastes as natural exfoliants.

Above: LeukaDerm an antidandruff hair shampoo developed by one of the students.

Above: An exfoliating cream by MaCwerha Formulations, a product developed by a Formulation Science Student.

Next year will see the research expand even further by investigating the use of marula fruit waste to create innovative cosmetic, animal feed, or fuel products.



If you are interested in aspects of Formulation Science that you think Dr Vorster could assist with.

Please contact her at Nicole.Vorster@mandela.ac.za

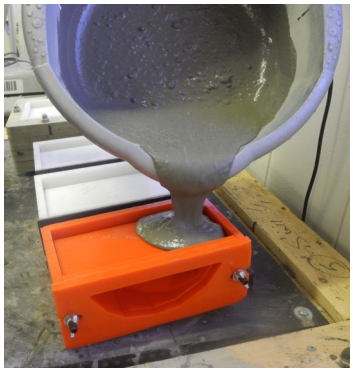
Wild Wall Tiles

Vertical Wall Garden Tiles: - A Johannesburg based artist, who specializes in large public art installations approached InnoVenton to develop the concept of a vertical garden wall using tiles. She designed the tiles with an adjacent cup to hold a plant. These tiles are made from a custom concrete mixture. Several formulations were developed at InnoVenton, one proved to be rather successful and was used to make the vertical wall tiles for the installation shown below.

Part of the challenge was to design and make moulds from which the cement tiles could be cast and demoulded. These were developed in collaboration with eNtsa and Stellenbosch University. Part of the brief was to ensure demoulding of each cast without breaking the tile, the design was key. A local service provider has been approached o produce more moulds as the project develops. Moulds, curing times, casting and willing hands are needed to complete this art demonstration. The first prototype demonstration wall is complete and can be viewed at the Nelson Mandela University Rag Farm on the South Campus. A second installation has just been completed to undertake a temperature study. The purpose of this is to see if an exterior vertical garden has any effect on the interior temperature of a structure. A suitable irrigation system is also part of the installation, and the bigger the installation the more complex the irrigation.

Above: The vertical wall garden prototype at the Rag Farm.

This project was sponsored by TIA who assist small businesses to develop concepts and prototypes. The Technology Station at InnoVenton. Manages these projects. If you think your business could benefit from InnoVenton's expertise in solving a production problem or developing a new product, feel free to contact innoventon@mandela.ac.za. LHS: Pouring concrete into moulds.



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Specialist Analytical Services

Gas Chromatography

- GCMS, (Fingerprinting comparison of volatile/semi-volatile organic compounds)
- SIMDIS, (Simulated Distillation of Fuels)
- GC x GC, (Separation of complex hydrocarbon mixtures)

Coal and Biomass Analysis

- Thermal Gravimetric Prox-Analysis (moisture, volatiles, ash, fixed carbon)
- Calorific Value

Spectroscopy

- ED-XRF, Fast Semi-quantitative elemental analysis.
- UV/Vis, Qualitative and Quantitative analysis
- FTIR, Raw material fingerprinting

Water Testing

- Drinking water Testing SANS 241
- Storm water and Effluent Analysis
- Irrigation and Borehole Water

Fuel Analysis

- Flash point, Density, Viscosity
- IR , FAMES, Cetane number
- Copper Strip, Iodine Value
- CFPP, Cloud Point, Oxidation Stability
- Vapour Pressure, Distillation Points
- Energy Value, Carbon Residue
- Methanol Content
- Sulfated Ash
- Total Contamination

Looking forward - 2019—EDIT

Despite many uncertainties and a tight economic climate, the year 2019 promises to be another hectic year. The following are a few of the main activities planned :

Microalgae Technologies: The establishment of a Microalgae Technologies Research Centre at InnoVenton stems from success and deliverables met during the first 3 Years of this project. Support from the Department of Science and Technology has enabled InnoVenton to expand the previous Microalgae to Energy Project into much larger Microalgae Technologies Research. Deliverables and focus areas for the next 3 years will hone in on the development of energy and liquid fuels from microalgae. One of the main aspects will be in the areas of fuels, chemicals and specialities.

TIA Seed Fund Projects:

Flameless Paraffin: The project proposes an alternative cooking stove to the open flame paraffin fuelled cooking devices known to cause domestic fires and health problems. It would be developed as a catalytic heater that operates with no flame. The feasibility of supported oxidation catalysts suitable for affordable flameless heating and cooking devices would be investigated.

Spirulina Bucket system: This seed fund application proposes optimising and refining the current process making the cultivation system simpler and easier to operate. The project also considers packaging the production of phycocynanin further as a transferable technology. A local NGO is considering incorporating a system like this into their existing aquaculture activities.

4IR Process Control Systems : This seed fund application proposes the installation of a small control system as part of the algae growth system at InnoVenton. This system would allow automated control and data collection 24hrs a day. It would be developed as part of the algae growth system technology package for the commercialisation of phase of the Algae to Energy Project.

Tsetse Fly Attract: Tsetse flies are disease carrying pests causing many deaths annually. They can be lured into poisonous traps with chemical attractants. This project proposes the development of a method to manufacture Prophenol from clove oil. After laboratory synthesis is optimised we would propose a scaled up synthesis at our pilot plant for trials.

Phycocyanin: Refinement and optimisation of the laboratory-scale process we have developed on plant scale. We aim to develop a technology package for transfer to an entrepreneur or SME.

Technology Station Projects: Technology Station Projects are continue into 2019, namely:

Wild Wall Garden Tiles project which involves assisting a prominent South African Artist to optimise her idea of a cement-based wall tile with a cup for growing small plants in continues into 2019 with monitoring of a wall installation at the Rag Farm.

Inulin in Pet Food project is an extension of the work carried out for Chicory SA, it will be an addition to their range of product applications for inulin.

Our 2019 Strategic Priorities are:

- Increase effective collaboration
- Align resourcing
- Build core technological capability
- Ensuring excellence and efficiency
- Customer Focus
- Ensure optimum balance of leverage (Services/Technology Development/ Basic Research)

Our role is to provide technology support services, skills development training and a technology development capability for basic research and client projects. This includes improving the alignment of basic research and formal teaching with needs.

Looking forward - 2019

Baked Alaska (ice-cream cake)

Something for those who are a little adventurous in the kitchen. You'll need:

3 egg whites

45ml castor sugar

1 ml vanilla essence

1 rectangular sponge cake, about 2.5 cm high

1 litre brick ice cream

Preheat the oven to 230°C.

Beat the egg whites until stiff and gradually add the castor sugar. Add the vanilla essence and beat until the mixture is sufficiently stiff to hold its shape.

Cover a suitable wooden board with butter paper and place the sponge cake on it.

Place the ice cream brick on top so that the cake forms a 1.25cm edge all around

Cover the ice cream and cake completely with the meringue so that no air can reach the ice cream. Spread evenly with a spatula.

Bake for 1 to 3 minutes until the meringue is pale brown. Serve immediately, while the ice cream is still firm. Wood, paper and sponge cake are all poor conductors of heat, thus the ice cream will not melt during the short time it is in the oven.

Hint: Individual cakes can be baked in the same way. Cut the sponge cake into squares or rounds, top with ice cream and cover with meringue.

Enjoy!

InnoVenton

Dream. Innovate. Create

InnoVenton/DCTS strives to provide specific technology support and innovation in the areas of:

- ***Research***
  - Applied Chemistry in Product and Process Development
- ***Teaching and Learning***
  - Formal qualifications and non-formal short courses.
- ***Engagement and Services***
  - Technology Support
  - Technology Demonstration
  - Analytical and testing services
  - Quality services

Our SANAS Accredited Laboratory is willing to assess and assist you with your testing and analysis requirements.

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