InnoVenton Times

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2017—FLY TO THE MOON (PARLOTONES)

Things are hotting up this year.

"This is a new year. A new beginning. And things will change" _ _ Taylor Swift.

Letter from the Editor...

To all our readers, another year has flown by, welcome to 2018. "The Times they are a changing" could not have described the year that has passed for InnoVenton more appropriately. That was the title of our last edition. It has been a busy year, this issue reflects on the developments that have taken place in some of our activities and projects. Dr Gary Dugmore and the Management Team have lead InnoVenton through some challenging times and a maze of changes. "Change is hard at first; messy in the middle and gorgeous at the end" - Robin Sharma. I can't neglect to say to each and everyone, a very BIG thankyou for your contributions in 2017, particularly under some extraordinary circumstances which called for the commitment and perseverance of extraordinary individuals. This last year was particularly difficult with the passing of InnoVenton' founder, Prof Zeelie, I would like to encourage you to continue to give of your best as we work to establish the legacy he left us. Making a difference in the lives of others, through the endeavors of our work at InnoVenton, shows and establishes purpose. ———Melissa

Microalgae Technologies Research Centre

The past 12 months have seen three significant events that have had both positive and negative impacts on the Research Centre and InnoVenton as a whole. To start, the Fees Must Fall campaign and the disruptions experienced by the University didn't leave InnoVenton's operations unaffected. Secondly, the untimely passing of the Institute's Director and inventor of the basic Microalgae Technologies, Prof Ben Zeelie could not have been more unexpected. Lastly, the Institute and the microalgae project in particular, gained enormous exposure at the 2017 National Science Week held at the Nelson Mandela University. Aside from the visit of the Minister of Science and Technology with other dignitaries, the Microalgae Project featured on television, radio and print media, as well as a presentation at the official launch event. Very positive feedback was received overall. The year saw the appointment of several new staff members and interns to meet the deliverables of the Research Centre, together with a complement of senior students completing the doctorates.

The highlights and major achievements of the last 12 months include:

The successful conclusion of the Mini-Scale Technical Demonstration Facility campaign in November 2016. We manufactured 5.5 tonnes of Coalgae® and achieved what is believed to be the longest, uninterrupted cultivation campaign in the world. Combustion tests of Coalgae® were concluded by John Thompson and Eskom.

Continued cultivation of microalgae biomass in 2017 to support the Research Centre activities.

Instituting a culture medium maintenance and system cleaning regime and methodology.

The development of a cultivation system control system in-house .

(cont. on pg. 2)

Highlights cont.

Demonstration on a laboratory-scale of heterotrophic cultivation of our mixed algae colony.

A redesigned prototype of the photobioreactor component of the mixed cultivation system, which promises to decrease the cost substantially by simplifying the design and reducing the number of components. The prototype will be tested next year.

Successful commissioning of an expanded small-scale slow pyrolysis system (3kg solids per run) and production of 60 litres of biocrude pyrolysis oil. The biocrude oil has been distilled into various fractions for analysis and testing.

Procurement and commissioning of a small-scale fast pyrolysis/ gasification system.

Development and market testing of a low-smoke household fuel based on pyrolysed Coalgae®, branded "Ivuthakahle".

Formulation, characterisation and testing of an aquafeed (fish feed) from whole algae biomass.

Formulation, characterisation and testing of a biofertiliser product from whole algae biomass.

Formulation, characterisation and testing of a soil conditioning product from whole algae biomass.

Preliminary demonstration of fractionation of algae biomass and recovery of crude protein.

Initial test work on fermentation of the residue after protein extraction to ethanol (biofuel).

A proposal was submitted to the DST for continued funding of the Research Centre, which was approved in December 2017. We are extreme grateful for the continued support of the DST and the funding for three years that was granted.

The main focus of the research and development over this period is energy and liquid fuels from microalgae, with a component focused on chemicals and specialities. The latter can serve as enablers of energy and/or liquid fuels applications through a biorefinery approach that monetises the high-value constituents of microalgae biomass, thereby improving the economic competitiveness of the energy and fuel technologies.

A motion of Congratulations from Parliament (7 Sept 2017)

The National Assembly congratulated the InnoVenton Team for their sterling work so far on the pioneering microalgae to energy project, which is proving, to be a highly versatile eco-solution. The Vice Chancellor, Prof Derrick Swartz echoed their sentiment by adding his own congratulations to the Team. It is an accolade to the pioneering work Prof Ben Zeelie undertook, honouring his work and shows the level of esteem with which his work is held and the legacies that are continuing because of it. …Well done.

New Appointments

Mr Mofo Setloboko

Mr Mofo Setloboko, appointed as InnoVentons Research Analytical Scientist, completed a MSc in Applied Science in 2012 from the Sheffield Hallam University, England. Specializing in Forensic science and analytical method development. After a few years as a science teacher he joined a forensic laboratory in Lesotho, gaining experience in laboratory techniques and instruments. As Project Manager for the Biofuel platform Major Project and Research Analytical Scientist, Mofo will be responsible for the development of analytical methods for the platform and other Major Projects at InnoVenton. He has also taken responsibility for teaching Analytical Method Validation in the Formulation Science program. His biggest challenge, however, will be the development of expert analytical capacity to the Institute and our customers.

Mr Johannes De Jongh

Mr JJ de Jongh has been appointed as a Process Engineer at InnoVenton. JJ has taken responsibility in the Micro Algae Pilot Plant for Optimizing and Developing Production methods. He has a BSc in Chemical and Polymer Science from Stellenbosch University and came from the Automotive Industry with experience working in Engineering and Production. His biggest challenge for 2018, however, will be to optimize and test alternative harvesting methods that could increase process economics for Commercial applications.

InnoVenton's New Laboratories

This year three new laboratories have been made fit for use. The Product and Process Development laboratory hosts the Technology Station Project Scientists and the Micro algae to Energy product development project, thank you to the TIA for their contributions to this investment. The Formulation Science students now enjoy a laboratory environment of their own, to mix and concoct lotions and potions. The Chemical Process Technology students get a chance to train on computer simulation software, learning the results and consequences of operating large process plant systems. Thanks must go to AECI, partners of ours in this training program, for the resources used to equip these students. Let's not forget the new post-graduate work and study area upstairs either. No doubt, most of us remember the hard work Ben, Phillip and Co. put into getting these laboratories ready and fit for our students to use. "If you don't do it, no one else will." ---Ben

We still need to work on that covered outdoor commons area for staff and students. Doing the internal fittings in-house translated into substantive savings for the Institute and eventually the University.

More than R3.5 Million for student bursaries

During 2017 InnoVenton managed to raise and pay over R3.5 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, bursaries through the NRF (specifically the RSES bursary scheme for support of post-graduate studies in the Microalgae to Energy project), and grants from a variety of sources such as industry, TIA, and internal InnoVenton funds.

Coalgae ® Investors Information Session

InnoVenton held a session with various companies that are interested in Coalgae and/or microalgae. The aim of the session was to get feedback from the investor community on what they believe we still need to do to commercialise the technology. This serves as confirmation of our proposals to the DST over the last few months.

The session went very well and we had many positive responses to what we have done so far, as well as constructive input from the participants. The main outcomes were agreement that a larger-scale, outdoor demonstration plant is a vital next step and that we should continue to develop value-add applications of Coalgae®, such as pyrolysis for liquid fuels/biocrude oil and higher-value char, as well as downstream applications of microalgae in fertilisers, feeds, nutraceuticals, etc. The development activities already form part of research plan proposals for the Microalgae Technologies Research Centre and confirm that we are on the right track. The DST/TIA also confirmed their commitment to the Coalgae® project, but because a demo plant requires a large investment (R24 -87 million depending on the scope), they are looking for co-investors. A number of companies expressed interest in partnering with us on this initiative and we will continue discussions with them in the coming months.

I would also like to thank the team for making this successful event possible and especially to everyone for the great team effort in preparing the greenhouse for the visitors. It took a concerted effort to get everything ready in time and your hard work and commitment are very appreciated.

Daniel Bothua and Seiyefa Otokolo (Interns) working with Dr Gary Dugmore. Candice Davison, Incke Erasmus, Luvuyo Ndyenga and Sifundo Duma were interns in 2017. AECI, BASF, Heraeus, and Umicore sponsored students to complete their in-service training in 2017. Marcio Agulhas, Conner Blewett, Ntandokazi Bulo, Loyiso Ceza, Sisanda Fata, Lindiwe gqwaru, Asithandile Lamani, Khanyisa Mahlangabeza, Sibongile Mampane, Zimkita Mbete, Hlumela Molose, Michael Muller , Bathabile Ntshona, Nkateko Shingange were also IST's in 2017 at InnoVenton.

Fynbos Flower Preservation

Cape Fynbos Preservation for NikwiFlora has enabled the company, based in the George - Mosselbay region, to expand their business substantially. They can now market a larger range of fynbos flowers to their clients, which not only last longer, but can be made available during the off-season. They will also be able to expand the radius of clients they are able to reach with product, in addition to an international market. The formulations for the preserved fynbos flowers has been handed over to Nikwaflora who want to invest in setting up a greenhouse as part of their Business Plan and Operations for 2018.

Cold Brew Coffee Extraction Process The project has seen the development of the freeze dry process for cold brew coffee, quality control procedures around the product, and ensuring an acceptable shelf-life for the product. Other products developed from the waste coffee beans include: white wax coffee-scented candles, coffee flavoured shavings for smokeboxes, firelighters (shown in the photograph) made from the coffee bean waste and fire "logs" made from coffee bean waste fused with wax.

Everyone will admit that the "taste cupping exercises" were quite an experience—ask Michael all about it.

Marketing ... A tricky Business

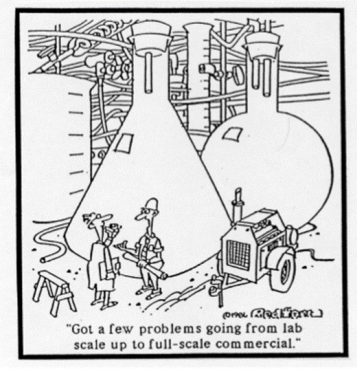
Ivuthakahle - a group of students braved the public domain and took to the streets to gather some market related information. Areas they visited were Dwesi, New Brighton, Daku Spar and the Kinako Mall in Algoa Park.

The public, was introduced to Ivuthakahle and their expectations and comments recorded, we received some really positive feedback from our future customers.

Inulin production facility

Experimental trials were conducted by Dr Gary Dugmore at Chicory SA in Alexandria, to confirm the de-ashing of inulin (a long-chain sugar used as a pre-biotic) extract solution obtained from locally cultivated fresh chicory root and the conditions leading to hydrolysis (undesired) of the inulin product.

Pilot scale extraction and de-ashing of inulin from fresh chicory root was investigated with the emphasis on proving the de-ashing step using a multi stage ion exchange process. These trials successfully demonstrated that it is possible to firstly reduce the conductivity of the municipal water. Secondly, the ash content of the inulin solution and final inulin product was also significantly reduced. Suitable operating procedures were put in place describing how resin regeneration, water de-mineralization and de-ashing of inulin, is carried out.

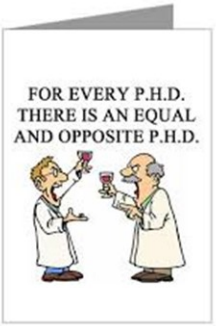


Validation of an assay method for the quality of inulin produced is underway. Naturally, the seed variety, growth conditions, harvest timing and extraction timing will all affect the quantity of inulin recovered from the chicory roots.

New Appointments

Dr Candace Davison

Candace has been appointed as a Research Scientist at InnoVenton. She has a BSc. degree in Biochemistry and Microbiology and a BSc honours degree in Biochemistry, specialising in proteomics. Her MSc degree in Biochemistry involved the study of *Tulbaghia violacea* as an anti-diabetic and anti-coagulant agent. Her PhD in Biochemistry obtained from the Nelson Mandela University entailed the use of synthetically derived xanthones in the treatment of breast cancer. Her research focus at InnoVenton involves the cultivation and production of Astaxanthin from *Haemococcus pluvaris* at both a laboratory and pilot scale. One of her focus areas is research into the use of microalgae and the extracted protein of microalgae as a replacement protein for aquafeeds. Developing and constructing an aquaponics plant where the aquafeed will promote a self-sustaining aquaponics system. Her greatest challenge will be to integrate and scale-up the lab results to a fully operational pilot plant to produce Astaxanthin.



New Equipment Acquisitions

During 2017 the local chemical industry contributed and resourced equipment to the value of R 2 million for training and projects, namely:

X-Ray Fluorescence Instrument - BASF donated a wavelength dispersive XRF to InnoVenton, which was moved to our laboratories in September. Apart from being used for the analysis of mine waste samples for the Southampton Project at InnoVenton, this instrument will allow us to expand our range of routine analysis services for XRF analysis to the coal and mining sector, not only research activities.

Rotovap - Heraeus donated a Buchi Rotovap unit for the CPT Program and product formulation activities.

Community Radio

A Team of students researchers involved with the development of Ivuthukahle were interviewed by the Nkqubela community radio station. They were given an opportunity to tell the community about Ivuthukahle, what it is, explain its advantages and how people can access it. This was part of the marketing and community surveys undertaken at shopping malls in Dwesi, New Brighton and the Kenako Mall.

We were on TV

SABC 2's Morning Live Team interviewed Mr Brian Tait during the National Science week in Port Elizabeth. It allowed us to bring attention to the Coalgae and Microalgae Technologies developed at InnoVenton. On the 22 August, SABC 3's RealTalk show host, Anele Mdoda included a slot as part of their focus on Science and Technology about InnoVenton. Dr Gary Dugmore and Mr Brian Tait explained the main areas of operation at InnoVenton. Both opportunities gave InnoVenton exposure and highlighted our purpose in the areas of technology we focus on.

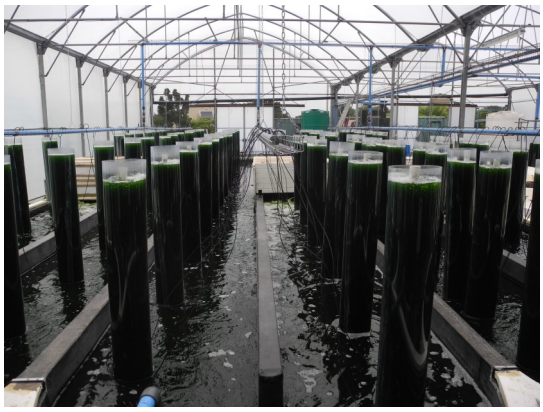
New Appointments

Mr Peter Grant

Peter Grant has been appointed as a Project Scientist for Technology Station Projects. Peter completed his MSc at the University of Pretoria where his area of specialization was in Applied Sciences: Chemistry. He has served as a Senior Process Engineer at EHL Consulting Engineers where his area of expertise extended to ISO 9000 Quality Management, Auditing, Chemical process support, Chemical process design, optimize and design of chemical processing plants and mentoring engineers on project management. He also spent time at NCP Chlorchem / DOW Sentrachem as a Technology Leader and R&D Specialist. The CSIR made use of his expertise as a Research Chemist too. Peter's new role as a Project Scientist has drawn him into and as a part of our Technical Team. In his new role as Project Scientist, Peter will be responsible for reviewing and executing projects for SME's that the Technology Station has approved. In the meantime, Peter has been focused on the DST's Geographical Footprint Expansion Project at InnoVenton, to establish products for an Agro-Refinery using Prickly Pear plants as the base raw material for processing. One such success has been flour from the cactus plants cladodes, to be used in baked goods.

National Science Week

The start of the National Science week ushered in a visit by the Minister of Science and Technology, Ms Naledi Pandor, to InnoVenton's Microalgae Pilot Scale Facility on the 5 August. She was accompanied by the Director General of the DST, Dr Phill Mjawara; the Eastern Cape Premier, Mr Phumulo Masulle; the Nelson Mandela University Vice Chancellor, Prof Derrik Swartz; the Deputy Vice Chancellor of Research and Engagement, Prof Andrew Leitch and a host of VIP's and Security detail.



Dr Gary Dugmore had an opportunity to tell the minister about the work being done at InnoVenton, about some successes, challenges and opportunities we would be facing in the immediate future. The Institute participated at the Expo held at the Universities Missionvale Campus, where it marketed its training programs to learners, educators, policy makers and politicians.

Mr Brain Tait addressed the National Science week opening ceremony assembly with a lecture describing the Coalgae projects' developments, how it has evolved based on observations scientist had made and applications the team developed under the guidance of Prof Ben Zeelie, to where we find ourselves today. There were also opportunities for an Open Day; Demonstrations to learners; A Radio interview on PowerFM and a Television interview on SABC 3's Real Talk with Anele Mdoda.

Great job guys—really great job.

Above from Left to Right: Prof Azwinndini Muronga (Dean of the Faculty of Science at the Nelson Mandela University), Dr Gary Dugmore (InnoVenton: Acting Director), Ms Naledi Pandor (The Minister of Science and Technology), Prof Derrik Swartz (Vice Chanellor of the Nelson Mandela University), Mr Phumulo Masualle (The Eastern Cape Premier), Prof Andrew Leitch (Deputy Vice Chancellor, Research and Engagement at the Nelson Mandela University), Dr Phil Mjwara (Director General of the DST).

New Appointments

Mrs Shamimah Balkissoon

Mrs Shamimah Balkissoon has been appointed as the Administrative Assistant and Secretary at InnoVenton. Shamimah has taken responsibility for the Front Desk Reception and day-to-day administrative, clerical and financial processing support. Shamimah has a diploma as an Executive Secretary from the Academy of Learning Computer and Business College and came to us with experience working for a medical fund and attorneys. The skill that had us most fascinated and captivated was her claim of being a Head Chef –cooking South African traditional food. As you all know, cooking is an essential skill if you want to be part of the InnoVenton family.

Low Smoke Fuel

Low Smoke Fuel for Low Income Households: The project, funded by the TIA Seed Fund, tested various formulations of waste coal, microalgae and torrefied biomass as potential candidate low-smoke fuels. The initial screening revealed that torrefied biomass imparted no significant benefits to the fuels and hence further development was aimed at coal-microalgae composites (Coalgae®) that had been thermochemically treated. This involved heating the Coalgae® solid form to approximately 100 °C under pyrolysis conditions in order to devolatilise the product partially (topped pellets or briquettes) or heating to approximately 450 °C (full pyrolysis) for complete devolatilisation (char product).

Comparison of the topped and charred Coalgae® pellets using proximate and ultimate analysis shows that the removal of volatile components during the pyrolysis process leaves behind a reactive char with higher carbon content and improved value as a solid fuel. Char pellets have a higher calorific value and lower ignition temperature than topped pellets. The burn-out temperature is slightly lower in the case of char pellets, with the maximum combustion temperature being lower. The comprehensive fuel index (S-value) shows it is a better combustion fuel than topped pellets.

Various mechanical property characteristics are also provided, namely water resistance, impact resistance and compression strength. The pyrolysed pellets, as the preferred low-smoke fuel, perform well in these tests and pass quality requirements. Two new solid fuel stoves were designed and manufactured. The candidate low-smoke fuels were tested in one of these and compared with a cast iron stove and a typical Imbaula. The new stove design exhibited improved properties. The stoves and fuels were tested for temperature and combustion profiles, as well as particulate matter (smoke) emissions. In addition, the emissions of CO, NO and SO_2 were measured. Water boiling tests are also performed. The general conclusions are that char pellets represent the optimal low-smoke fuel product tested and the improved stove designs enhance the product efficacy. In summary, the low-smoke fuel developed during the course of this project:

- Burns longer, on average at least 50% longer than coal and wood
- Reduces environmental pollution
- Can provide job creation opportunities
- Can be competitively priced; and
- Is cost-effective.

Techno-economic analysis indicates a reasonable level of financial return when the product is sold at the prevailing market price of coal in townships. In addition, there are various means that can be explored to improve the return or lower the selling price to the end-user while still achieving an acceptable return.

The low smoke fuel (Coalgae® char) has been branded as “Ivuthakahle” (“It burns well”). Ivuthakahle promotion started with a radio interview on Nkqubela radio station in September 2017, where the venues of the upcoming exhibitions of the stoves and the fuel were announced to the public. The promotions took place at the following shopping centres: Dwesi Spar, New Brighton Spar and Daku Spar in Port Elizabeth. The feedback received from the people at all three shopping centres was very positive. The interest was for both Ivuthakahle fuel and the stoves, with more interest in the stove (maybe because people in Port Elizabeth do not have the old Welcome Dover stoves). The reaction has been encouraging and it appears there is definite market interest. Future test marketing should take place in regions where coal is used more extensively at household level (Gauteng, Mpumalanga, etc.).

New Appointments

Mr Kudzai Mtambanengwe

Mr Kudzai Mtambanengwe has been appointed as a research scientist at InnoVenton. Kudzai has taken responsibility for the bioprocessing of microalgae into high value fractionation products for consumer and energy use. He has an undergraduate degree in Biochemistry and Microbiology from Rhodes University, and a Masters in Biotechnology from Rhodes University. He has experience working with microalgal species as this was part of his Masters research. His biggest challenge, however, will be the qualitative and quantitative analysis of microalgae production and downstream products to ensure a competitive market penetration.

Biological Fertilizers and Soil Conditioners

Biological fertilisers and soil conditioners: Another TIA Seed Fund project that is aimed at demonstrating the promising benefits of soil products based on microalgae, both as a fertiliser (because of the high nitrogen content of microalgae) and as soil conditioning agent. Following successful conclusion of laboratory tests on microalgae-based products as biofertilisers and soil conditioners in the first half of 2017, activities shifted to outdoor field trials.

Test gardens, complete with automatic drip irrigation, have been established at the old Rag Farm site within a shade cloth structure to protect against wildlife. The establishment of the garden beds provided excellent practical opportunities for second-year Agricultural Management students, who prepared the beds and then planted the seedlings. The trials were run from September and were concluded in December. Four fertilisers namely, manure, Inorganic fertilizer, Algae-manure, Algae solution were tested and used to grow Maize, Spinach, Tomatoes and Cabbage. A balanced factorial design with 4x4 = 16 blocks was used. Each block contained 25 plants, giving a total of 100 plants per crop and per fertiliser. Five random samples were harvested from each block at five time intervals, starting at thirty days after planting and ending at ninety-four days after planting. The mass of each plant was recorded to determine the biomass yield.

Compost was added equally to each of the 16 test beds as part of the bed establishment. Two microalgae treatments were applied, namely algae-manure (10% algae-90% manure) and algae solution (2% m/m).

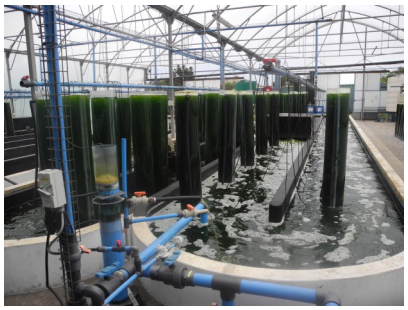
The two control treatments are inorganic fertiliser (2:3:2) and cow manure. The nitrogen content of each fertiliser was analysed and the fertilisers were then applied at a rate of 15g N/m^2 (150 kg/ha N).

The results from the first summer season trial indicate that microalgae-based fertilisers are as effective as a general inorganic fertiliser, which is typically used in horticultural practice. At this stage, in terms of plant growth rates, algae-manure and algae solution are neither better nor worse than the controls. The results are encouraging and suggest that microalgae can be used as a substitute fertiliser in especially organic produce cultivation. It should be noted that the fertilisers were applied to give the same nitrogen content in each test bed. Hence, the same response (within experimental error) would be expected if each form of nitrogen can be used effectively by the plants. This appears to be the case, i.e. the nitrogen contained in protein in microalgae can be assimilated by the plant, probably after bacterial degradation of the protein in the soil. The next step is to set up the first winter season trial. It is anticipated that this will commence in April 2018.

Looking forward - 2018

Despite many uncertainties and a tight economic climate, the year 2018 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.



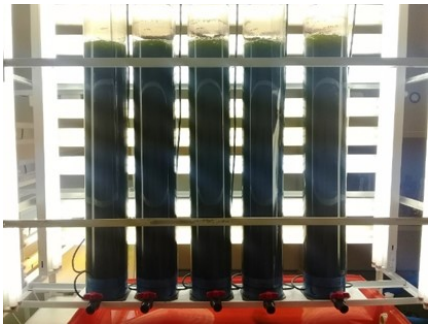
Deliverables and focus areas for the next 3 years will hone in on the development of energy and liquid fuels from microalgae. One of the main aspects will be in the area of chemicals and specialities.

TIA Seed Fund Projects:

Aqua-hydroponics Cultivation Designs: The project aims to develop, optimise and demonstrate integrated microalgae cultivation in conjunction with aquaponics and/or hydroponics in an environmentally friendly, renewable and sustainable process.

Astaxanthin Cultivation : A project of this nature has a relatively slow ramp-up phase because it requires the planning and establishment of a new pilot cultivation system and culturing a microalgae species to sufficient quantities for the pilot-scale tests.

Haematococcus grown in a laboratory culture chamber in preparation for pilot-scale studies



Haematococcus was obtained from the US (Utex culture bank) as a slant that contains milligramme quantities of the microalgae species. A portion of this was cultured in a specially-design laboratory culture system (growth chamber). The growth medium has been changed from the Utex medium to that which we use in our mixed colony technical demonstration plant with excellent response. We produced 100 litres of concentrated *Haematococcus* culture, which is shown below in our laboratory growth system.

The outdoor tunnel system was completed and is now fully functional. It contains traditional and modified raceways of various sizes to allow scale-up. The seed colony bank is in place. Contamination

issues in open ponds when cultivating a single species are well-known, and we experianced this ourselves when *Scenedesmus started to dominate the culture*. As a result, many parties use expensive closed photobioreactors to maintain axenic conditions. It should still be possible to use an open system as long as the correct protocols are established. With a mitigation plan underway we will attempt to maintain the seed colony under sterile conditions. Although some contamination is inevitable, it can be tolerated as long as it is relatively minor. The seed culture will then be placed in the open ponds for a relatively short time period of vegetative growth. This will be followed in the same system by the cyst formation and pigment accumulation stage, i.e. a two-stage, one-step process. This differs from the traditional astaxanthin process, which is a two-step process – the algae are first cultivated vegetatively in one system, then transferred to a second system for stressing. We will test the new system in the next quarter. The astaxanthin standard has been received and the analytical method for astaxanthin has been validated. It is based on spectrophotometric absorbance of the red pigment.

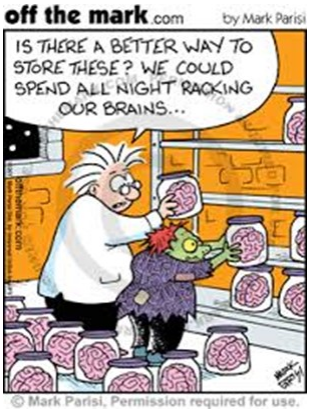
"Everyone thinks of changing the world, but no one thinks of changing himself" _ _ _ Leo Tolstoy

Looking forward - 2018

Technology Station Projects: Several large Technology Station Projects are planned for or continue into 2018, 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 2018.

Spirulina Cultivation involves assisting a business man to establish a new method of cultivation using his novel specifications for a photo -bioreactor. The design aims to increase the volume and surface area of a single tray by stacking multiple trays horizontally. InnoVenton will be building a prototype and investigating methods for mixing, recirculation, the introduction of artificial light, harvesting methods and the supply of carbon dioxide for his chosen algae species. We expect the project to commence towards the beginning of March of this year.



"Nothing is so painful to the human mind as a great and sudden change" _ _ _ Mary Wollstonecraft Shelly, (Frankenstein)

Agro-Refinery for the Sarah Baartman Municipal District - a joint project between InnoVenton and the Agrifood Technology Station at Cape Peninsula University of Technology. The development and implementation of South Africa's first Agro-Refinery will be based on exploiting the significant quantities of cactus pear populations in this District. The most promising product developed from the plant is a cactus flour. ATS has assisted with the nutrient analysis of baked goods. A Market and Financial analysis has been conducted. We maybe able to extend the value chain to include a flour mill and small containerized, bread bakery to produce cactus flour supplemented bread. The South African National Defence Force could be instrumental in bringing this commodity to local government as part of their focus to empower small previously disadvantaged producers and farmers in the local areas around their military bases who supply commodities.

Routine Laboratory Services and Technology Support Services - the Analytical Team has been working tirelessly to complete the implementation of a new laboratory quality management system. This, all in preparation for an audit by SANAS so that InnoVentons' ISO 17025 Accreditation status is recognised once again. In addition to the routine testing activities provided by the laboratory, added focus will be given to the Technology Station Services that will be expanded in 2018.