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SPES BONA

INNOVATION OPPORTUNITIES
Summer 2015

Contents

Introduction

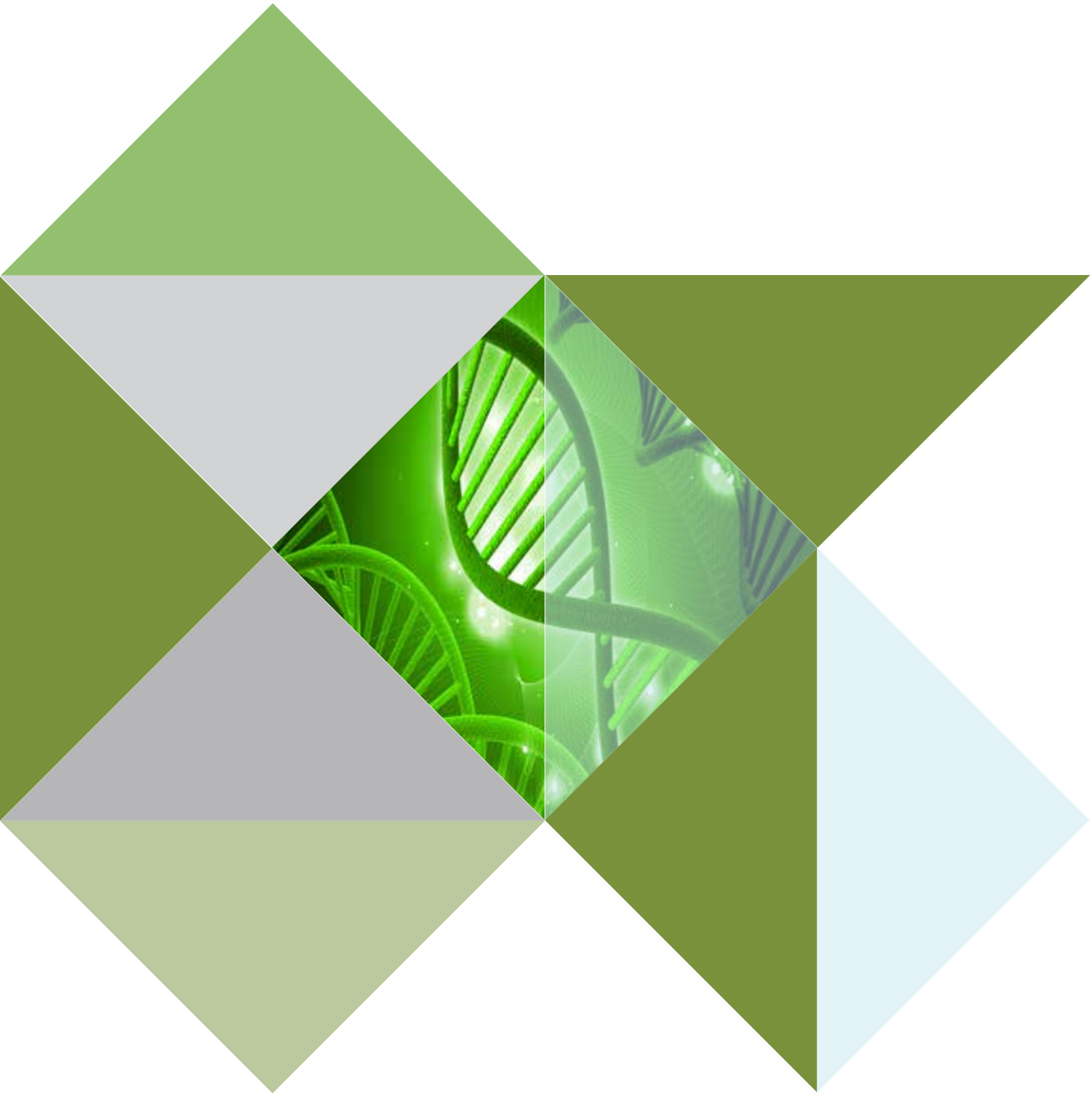
Innovation Opportunities presents some of the recent technologies emanating from the University of Cape Town's (UCT) research in different industry sectors that are available for commercialisation. Technologies range from early stage, where development is still required, to those licensing opportunities where a commercial partner is needed to realise the innovation. The university also incubates virtual companies and new ventures that have started making their products available commercially – these have also been included in the 'products' section.

Whilst technologies have been categorised in their primary sector, they may be relevant to other sectors too. This publication is printed periodically, the on-line version will include the most current, latest offerings (www.rcips.uct.ac.za).

Research Contracts and Intellectual Property Services (RCIPS) acts as the liaison between UCT's research community and the private sector with regards to intellectual property, commercialisation and business development activities. RCIPS has helped to transfer numerous technologies from the university laboratories to industry both locally and internationally.

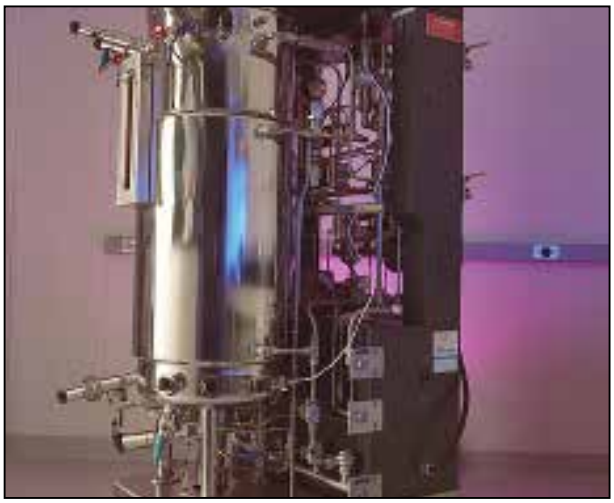
RCIPS seeks to stimulate the growth of a diversified South African economy that is globally competitive, especially by fostering small business development and through the creation of local jobs. Additionally selected technologies are actively licensed to global market leaders who have the capacity to bring products to international markets, whilst ensuring that the South Africans see the benefits of this innovation.

For additional information, or to discuss any other these opportunities in more detail, please contact Dr Revel Iyer, Business Development Manager, at RCIPS (phone: +27 (0)21 650 1746; email: Revel.Iyer@uct.ac.za) or innovation@uct.ac.za and +27 (0)21 650 4015.



BIOTECHNOLOGY

Biotransformation of linear alkanes



This technology is based on existing technology known as EnBase®, developed and patented by the University of Oulu in Finland and commercialised through a spin out company.

The UCT technology enhances bioprocesses for the production of valuable oxygenated chemicals, such as alcohols, ketones, aldehydes, hydroxyacids, and dicarboxylic acids, from alkanes via enzymatic biotransformation. In contrast to conventional processes, the growing whole cells are used as the biocatalyst leading to a significant increase in catalyst efficiency and activity.

Large stockpiles of linear hydrocarbons have arisen as by-products from the global expansion of gas-to-liquid refining processes. An example is the alkane group of hydrocarbons.

Linear alkanes feature some of the strongest chemical bonds in nature and typically are of a low value due to their inertness. Beneficiation into valuable products is therefore an important area of research and development.

The enzymatic assisted release of glucose from starch is a patented technology known as EnBase®, developed for growing microorganisms. This the first time that EnBase® technology has been applied in biotransformation reactions and organic media.

Applying EnBase® technology to the biotransformation of alkanes has resulted in a number of unexpected advantages. For example, co-factor regeneration (a typical problem in conventional processes for the biotransformation of alkanes) has been improved through the stable supply of glucose through EnBase®.

Also, when using growing cells (log phase) as opposed to resting cells (stationary phase), the inventors achieved a 40% increase in catalyst efficiency and 1.8 times catalyst activity. This is an unexpected result as resting cells are widely considered to be about 50% more efficient than growing cells in biotransformation processes. This would greatly aid the conversion of alkanes into valuable products.

Benefits

The innovation presents one major advantage over legacy processes. The use of EnBase® technology allows for fed-batch conditions to be simulated, i.e. by controlling the supply of glucose, while the reactor is actually operated in batch mode.

Applications

The bioprocess has potential in large scale production of alcohols, ketones, aldehydes, hydroxyacids, dicarboxylic acids, and other valuable oxygenated chemicals, from alkanes.

Technical description

The invention provides a method for whole-cell catalysed biotransformation of linear alkanes to oxygenate products in cells, where the cells are maintained in a growth medium as growing cells. The method includes the following steps:

step 1: controlled growth of the cells by incubating the cells in a medium, where a metabolically inactive substrate is enzymatically transformed into a metabolically active growth substrate at a controlled rate; and

step 2: a step of incubating the cells of step (1) in a biotransformation medium comprising a linear alkane, to catalyse the conversion of the linear alkane into the oxygenated product.

Intellectual Property Status

Type	Region	Application No	Filing Date	Priority Date
Priority founding	Great Britain	1411177.7	24-June-14	24-June-14

The inventors are Oluwafemi Olaofe, Sue Harrison, Caryn Fenner and Murray Meissner.

A drought stress inducible plant promoter

Abiotic stresses, which include drought, salinity, cold and extreme temperatures cause extensive losses to agricultural crop production. It is estimated that these loses can be as high as seventy percent. These losses could be dramatically reduced if the crops were able to tolerate drought conditions.

Stress-inducible promoters have previously been identified, but there is a shortage of efficient promoters for gene expression that display favourable characteristics in their native plants as well as in xenogenic species. The Psap1D promoter offers advantage over constitutive promoters to produce genetically modified drought tolerant crops.

The Psap1D promoter causes an increase in expression of genes under its control during adverse climatic conditions. The promoter induces expression at a level about six times higher than under unstressed conditions. In contrast to constitutive promoters it only expresses significant amounts of effector protein when needed. Unnecessary metabolic stress, which may cause unwanted phenotypic characteristics in transgenic plants, is therefore avoided.

Benefits

- The promoter is relatively short, which is an important consideration in the creation of genetically modified organisms. This allows for better transformation efficiency and increased stability
- The promoter is inducible under drought stress, which circumvents where the target protein is continuously produced. Expression of genes in large amounts at times when they are not needed is metabolically taxing to the plan
- Expression returns to baseline upon rehydration
- The promoter is functional in both monocots and dicots

Market

- Seed companies
- Plant biotech sector

Technical description

Psap1D is derived from Psap1, which is a promoter isolated from the resurrection plant, *Xerophyta viscosa*. Psap1D is 1103 base pairs long as compared to the full length promoter (2083 base pairs). The reduction in size has been accomplished by removing an internal section of the promoter, which is not required for normal activity. The promoter does have a few ABRE motifs, however, these have not been confirmed to be functional.

Intellectual Property Status

Type	Region	Application No	Filing Date	Publication Number	Priority Date
Provisional	South Africa	2012/06750	10-Sep-12		10-Sep-12
PCT	PCT	PCT/IB2013/058399	09-Sep-13	WO 2014/037919	10-Sep-12

The inventors are Revel Iyer, Jennifer Thomson, Mohamed Rafudeen, Kershini Iyer, Tamaryn Ellick and Bronwyn Arendze-Bailey.

Ostrich probiotic

A generic problem of ostrich farming, which is practised in a number of countries, is chick mortality rate. In the first three months, this can often be as high as 50%. In 2013/14 the chick mortality rate on some South African farms was an alarming 80%. This is a critical issue when concentrating on establishing the flocks after extensive culling due to bird flu.

A predominant cause of death is pathogenic infections of the gastrointestinal tract. Treatment with antibiotics often results in the development of resistant pathogens and prevents the invasion of naturally occurring protective intestinal flora in young birds.

In the wild, ostrich chicks acquire the necessary gut microorganisms through the consumption of the faecal matter of adult birds. The composition of the intestinal microflora is critical to the development of a strong immune system. Farmed ostrich chicks are not reared alongside adult birds, making it more difficult to ensure that the correct balance of gut bacteria is obtained. Furthermore, the microflora is considerably affected by diet components.

As a reaction to this critical issue, this ostrich probiotic has been formulated from specific microorganisms isolated from the faecal matter from healthy adult ostriches. Probiotics are live microbial feed supplements that, when administered in sufficient quantities, confer a health benefit to the host animal. This is most generally done by improving intestinal balance. The use of probiotics on farm animals has increased considerably over the past 15 years. Once ingested, the probiotic microorganisms can modulate the balance and activities of the gastrointestinal microbiota. This is fundamental to gut homeostasis.

The ostrich probiotic is positioned as an alternative product to conventionally available antibiotics. The product has been developed to facilitate high bird density farming practises, encouraging high ostrich chick survival rates.

The probiotic is currently being fested in benchmarking trials ahead of larger efficacy trials.

Benefits

- Improved health, growth and survival of ostrich chicks
- Replaces antibiotics
- Enhances normal development of the intestinal tract
- Stimulates immune development

Market

- Ostrich farming sector

Technical description

The technology provides an ostrich feed supplement composition which includes at least one bacterial strain of *Lactobacillus oris, Lactobacillus brevis, Lactobacillus johnsonii, Bifidobacterium pseudolongum subsp, globosum*, and *Enterococcus faecalis*. These bacteria have GRAS (generally accepted as safe) status and are frequently used as food supplements, as they can survive in air and are effective colonisers of the gastro-intestinal tract.

Currently, the technology only allows for delivery through the water system direct dosing of the ostriches.

Intellectual Property Status

Type	Region	Application No	Filing Date	Priority Date
Provisional	South Africa	2010/6209	31-Aug-10	31-Aug-10
National Phase	Australia	2011218616	26-Aug-11	31-Aug-10
National Phase	Brazil	PI1104336-9	08-Nov-11	31-Aug-10
National Phase	South Africa	2011/06400	01-Sep-11	31-Aug-10

The inventor is Sharon Reid.

Multi-gene drought tolerance cassette for crop transformation

A combination of genes are expressed in concert by a single inducible promoter to produce a drought tolerance phenotype in crops. The individual genes and promoter are derived from a resurrection plant with each individual gene linked to the precursor by a small gene sequence. The gene cassette in plants confers tolerance to drought as well as a positive side effect, which is faster maturation. The market for drought tolerant maize alone is estimated at $2.7 billion per year.

About 70% of worldwide crop productivity reduction is due to abiotic stresses which include drought, salinity, cold and extreme temperatures. These stresses, particularly drought as a result of climate change, cause extensive losses to agricultural crop production. For farmers, the effect of climate change is simply that the weather has become far more unpredictable, and extreme weather has become far more common, so drought tolerant crops are desireable.

Using a multi-gene approach, whereby a number of genes are arranged in tandem behind a single promoter makes it feasible to apply a polygenic (number of genes) approach to something as complex as drought tolerance where previously only single genes were applied. In such systems the specific combination and arrangement of the genes has an influence on the phenotype. This innovation relates to a specific combination.

A drought stress inducible promoter is used, which circumvents the problem with constitutive promoters where the target protein is continuously produced. Constant overexpression of genes can be problematic, resulting in unwanted phenotypic characteristics in transgenic plants. These negative traits can be attributed to the constitutive expression of the transgene. Expression of genes in large amounts at stages when they are not needed is metabolically taxing to the plant. Using Psap1D the protein is only produced when it is required thus avoiding any significant metabolic burden to the plant.

Benefits

- Using Psap1D the protein is only produced when it is required thus avoiding any significant metabolic burden to the plant
- A number of genes are controlled by a single promoter limiting the amount of recombinant DNA
- A number of genes are directed at a complex trait rather than a single gene
- The system is functional in both monocots and dicots

Market

- Seed companies
- Plant biotech sector

Technical description

The technology incorporates a stress inducible promoter to drive expression of a multi-gene construct. This ensures that the transgenes are only expressed under stress conditions albeit relatively early (60-65% RWC).

The specific combination that produces a drought tolerance phenotype includes three genes. Two of the three genes can be disclosed:

- Prx2 is a type 2 peroxiredoxin obtained from the resurrection plant, *Xerophyta viscosa*. The primary substrate for the enzyme is hydrogen peroxide, while it has a high affinity for t-butyl hydroperoxide. Essentially the enzyme scavenges reactive oxygen species, which are especially generated during periods of stress

- Xv4 (Ald) is an aldose reductase obtained from *Xerophyta viscosa*. The enzyme is involved in the reduction of glucose to sorbitol. Studies have shown that transgenic plants expressing Xv4 (Ald) survived longer periods of water deficiency and salinity stress and exhibited improved recovery after rehydration as compared to the wild type plants.

The technology applied in order to generate a multi-genic transcript is referred to as the 'foot and mouth virus 2A peptide system'.

The multi-gene constructs have only been assessed in tobacco. However, a number of lines were generated from multiple transformation events. Approximately 60% of transgenic plants displayed a drought tolerant phenotype based on comparisons with wild type plants following a dehydration-rehydration assay.

Intellectual Property Status

Currently patent protection is being considered by UCT, whilst the details are maintained confidential. The strategy is to file a patent once field trials have progressed sufficiently.

A commercial partner is sought to undertake field trials in a desireable food crop.

MEDICAL DEVICES AND HEALTHCARE

Improving image quality in MRI scanners by correcting for magnetic distortions

A Magnetic Resonance Imaging (MRI) scanner applies magnetic fields to a human or animal in order to generate an image of a specific region of the body. Due to a number of internal and external effects these fields are never completely homogenous. Distortion of the magnetic fields may lead to defective images which could potentially lead to false diagnoses.

Typically during the course of an MRI scan there is a level of magnetic drift which reduces the image quality. It is therefore important to estimate and correct for inhomogeneity in the magnetic field. Modern scanners adjust for this through a process called shimming. The shim device in most MRI scanners includes a number of coils that produce small magnetic fields which are superimposed on the main magnetic field. Shimming of the magnetic field is performed once, and typically before the scan sequence begins. However, during a long scanning period, the initial shim prepared by the scanner could be compromised, rendering the final MRI images inaccurate.

This innovation estimates and corrects for main magnetic field drift as to improve the accuracy of the shim correction applied at the start of a run. The method ultimately improves the quality of images produced by imaging scanners such as MRI's.

Benefits

- Measure, report and correct for all changes in magnetic field throughout an MRI scan
- Improved image quality
  - Fewer misdiagnoses
  - Fewer corrupted images
- A major advantage is the ability of the double volumetric navigator sequence to measure and adjust shim over selected regions in a 'slab-by-slab' or 'slice-by-slice' fashion

Applications

- The invention can be integrated into any MRI pulse sequence, including functional MRI (fMRI) and diffusion tensor imaging (DTI)
- It can be implemented in parallel imaging scans
- Higher order shims can be implemented if the hardware of the particular MRI scanner allows for this

Market

Hospitals, medical practices, MRI instrument manufacturers and veterinary practices that require accurate images in order to investigate the anatomy or physiology of a human or animal body.

Technical description

The invention is a method of correcting for main magnetic field drift in a MRI scanner during a scanning sequence, which includes acquiring successive volumes by means of magnetic resonance pulse sequences.

The method includes the following key steps:

a. interleaving a first three-dimensional (3-D) navigator pulse sequence into the scanning sequence by applying a 3-D navigator after the acquisition of each volume in the scanning sequence;

b. interleaving a second 3-D navigator pulse sequence, with a different echo time to the first, into the scanning sequence by applying a second 3-D navigator after each first navigator and before the acquisition of the next volume in the scanning sequence;

c. obtaining two corresponding navigator images;

d. determining a magnetic field map by complex division of the first and second navigator images;

e. using the magnetic field map to determine parameters required to adjust a system central frequency of the MRI scanner to compensate for a drift in the main magnetic field (B0); and

f. adjusting the system central frequency of the MRI scanner based on the determined parameters.

Intellectual Property Status

Type	Region	Application No	Filing Date	Priority Date
Provisional	Britain	1412382.2	11-Jul-14	11-Jul-14

This IP is co-owned by The General Hospital Corporation, USA (Harvard).

The inventors are Alqadafi Alhamud, Ernesta Meintjes and Andre van der Kouwe.

Improved Cardiac MRI images by correcting for movement due to breathing

Cardiac Magnetic Resonance Image (MRI) scanning spans several heart beats. Respiratory motion of the heart is a particular problem for high resolution cardiac MRI scanning. This innovation enables respiratory motion to be automatically compensated for whilst the patient breathes normally, resulting in timesaving and clear MRI images.

Usually, since a patient's breathing can cause blurring of the acquired image, he or she is most frequently asked to hold his or her breath. However, patients with heart problems may experience tremendous discomfort and difficulty holding their breath for as long as 20 heartbeats. Furthermore, where more than one breath-holding period is required to complete an image slice, the position at which the patient holds their breath is rarely identical.

The invention compensates automatically for the respiratory motion allowing crisp images to be obtained whist the patient is breathing normally. This is achieved by obtaining a set of pre-measurements of the patient's movement during breathing, or 'navigators'. During the actual image capture these navigators are used to predict the displacement of the heart, enabling the image to be mathematically reconstructed to produce a clear image.

Benefits

- Clear cardiac images during MRI scanning
- Avoids patient discomfort allowing him/her to breathe normally; especially important for cardiac patients
- Increases efficiency by reducing time taken to obtain a clear image
- Improves productivity of MRI machines

Applications

- Used as an add-on processing technique on MRI equipment to sharpen images blurred by respiratory motion
- The software can be written to enable the algorithm to be applied on different MRI scanning equipment

Market

- MRI equipment manufacturers
- MRI users, specialist imaging centres, hospitals, etc.

Technical description

The correction technique has been tested using both phantom and healthy volunteers. Research is currently being undertaken to validate the method on patients.

'Diaphragmatic Navigator Gating' with a 5 mm acceptance window is most commonly used to limit the impact of respiratory motion, but the technique has an inherently low respiratory efficiency, which is further compromised by respiratory drift. 'Prospective Slice Following' has been implemented to enable larger gating windows and increased respiratory efficiency. This technique uses the navigator position immediately prior to the imaging segment to correct the slice positions throughout the segment. Consequently, the navigator data becomes temporally more outdated as the segment duration increases and the slice following less accurate.

A technique has been developed, which uses the data from multiple navigators prior to the imaging segment as input data for a predictor estimator, which estimates the position of diaphragm throughout the imaging segment.

The difference between the measured output and the estimated output (the error) is fed back constantly to correct the model to minimise divergence as time during image capture elapses.

The diaphragm motion is mathematically modelled as a sine wave with the frequency set to the breathing rate of the person being scanned. This is determined from a short period of diaphragm monitoring integrated into the start of the scan.

A navigator repeat time of 100 ms is typically used and the Siemens CV Nav sequence was used as a foundation for implementing the control system. The first navigator is triggered by the ECG and the subsequent navigators followed. After completion of the last navigator, the predicted positions are calculated, up sampled and saved. This does not interfere with the rest of the MRI sequence, as all this is done in the time prior to the imaging segment when the heart is stationary.

Intellectual Property Status

Type	Region	Application No	Filing Date	Publication Number	Priority Date
Provisional	South Africa	2010/01281	23-Feb-10		23-Feb-10
PCT	PCT	PCT/IB2011/000345	23-Feb-11	WO2011/104605	23-Feb-10
National Phase	Britain	1103067.3	22-Feb-11	2478403	23-Feb-10
National Phase	South Africa	2012/06353	24-Aug-12		23-Feb-10
National Phase	United States	13/580,640	22-Aug-12	US-2012-0319685-A1	23-Feb-10

The inventor is Ian Burger.

A robotic hand exoskeleton to rehabilitate fine motor control in stroke patients

The UCT Robotic Hand Exoskeleton (reScribe™) is a medical device designed to aid patients with hand rehabilitation. This robotic technology can be used to fill the growing demand for stroke rehabilitation driven by a shortage of therapists, and helps to overcome the limitations of existing medical devices.

Stroke is the number one cause of disability among adults globally. Millions of families are vulnerable to the direct and indirect costs associated with stroke survivors who fail to recover lost mobility and movement. These physical and neurological impairments may take many months of specific rehabilitation and can result in some form of permanent disability where rehabilitation is not successfully completed.

Chief amongst lost function in a majority of stroke victims is fine motor control of the affected hand and fingers needed to perform a task such as handwriting. reScribe uses task-oriented handwriting therapy, leveraging robotic technology, to aid in the speedy recovery of fine motor control. Traditional rehabilitation approaches rely heavily on passive-movement oriented therapy, and often several one-on-one interactive sessions with the appropriate physio- or occupational therapist. This approach limits access to quality rehabilitation for many and often results in patient fatigue or loss of engagement in hand exercise programmes due to their tedious and repetitive nature.

reScribe is portable and easily connected which allows stroke patients to undergo treatment in the comfort of their own homes. The device is intended to aid therapists both in a more traditional setting of a rehabilitation clinic and remotely by issuing reScribe to appropriate out-patients who need fine motor rehabilitation. Interaction of the hand exoskeleton with a platform containing a touch screen and a computerised controller allows for precise control of finger movement during handwriting therapy. This enables repetitive handwriting therapy exercises to be executed in an interactive manner. Using the device in a task-oriented manner, with interactive therapy software, aids in the recovery of lost fine motor control via neural remapping.

Benefits

- reScribe is a therapist 'force multiplier' for efficient delivery of rehabilitation to stroke affected hands
- A portable medical device, connected and especially easy to use for out-patients and remote therapy
- Touch screen enabled programmable-therapy allows for interaction between robotic hardware and interactive software applications, to keep patients engaged with therapy whilst simultaneously recording rehabilitation progress digitally for therapists

Applications

- Can be used by stoke patients in traditional rehabilitation settings without the need for continuous, direct supervision by the attending therapist
- Can be used by stoke patients in out-patient settings where patients make use of reScribe for extended therapy

Market

- Medical device companies seeking to augment existing products with reScribe technology
- Public hospitals and rehabilitation centres for treating in-bound patients
- Private physio- and occupational therapists for treating out-bound patients
- Stroke patient end-users with longer term rehabilitation requirements

Technical description

The innovation is a hand exoskeleton medical device used in handwriting rehabilitation of stroke patients and other persons having limited or impaired control over finger movements. The device utilises a tripod handwriting grip with three robotic units, one each for the thumb, index and middle fingers, with five actuated degrees of movement. Direct matching of finger-joint axes via hinge joints with a 4-bar lever transmission system allows for increased effective sensor and actuator precision levels for natural movements. Micro servo motor actuation (180 steps, ~0.33° precision) is used with resistive angular sensors (converted to a 10-bit range).

Intellectual Property Status

Type	Region	Application No	Filing Date	Priority Date
Provisional	South Africa	2012/08238	01-Nov-12	01-Nov-12
PCT	PCT	PCT/IB2013/059809	31-Oct-13	01-Nov-12

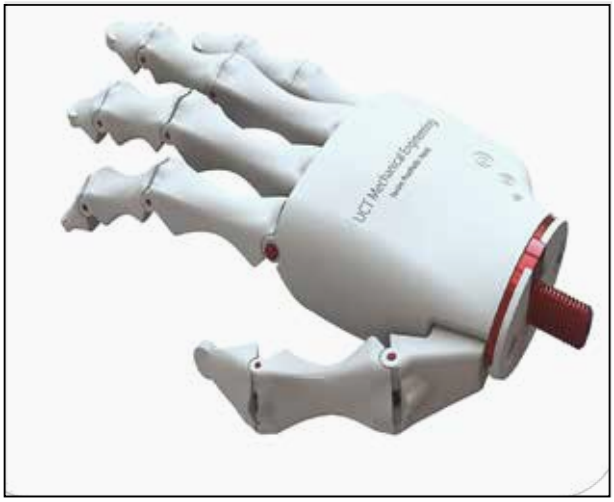
The inventors are Lester John, Sudesh Sivarasu and Yasheen Brijlal.

Prosthetic hand

This is a human-like prosthetic hand designed for upper limb amputees. Current mechanical prosthetic hands tend to be designed either with appearance in mind, rather than functionality, or are functional but not aesthetically appealing. Prosthetic hands that are both aesthetically appealing and functional are often very costly.

This prosthetic hand, which allows the patient to use the amputated hand to perform everyday activities, is functional and aesthetic appealing whilst remaining easy to use and cost effective. At present the device is mechanically operated. Future developments will involve incorporating myoelectric sensors to operate the hand.

A fully functional prototype has been developed and positive feedback has been received from prosthetists regarding the functionality and usability thereof. Further refinements are being made, along with the development of an external 'glove' for aesthetic appeal.



The device was awarded the Popular Mechanics 'Inventor of the Year' Award in the 'Cutting Edge' category.

Benefits

- It grants patients independence to perform their daily activities
- Ergonomically designed, mimics standard anatomy
- Actuator cables are well aligned to prevent fatigue failure
- Fingers operate independently to grasp a round object
- Several positions
- Low cost of manufacture and easy maintenance
- Good product positioning compared to competitors with superior functionality and aesthetics
- Ability to upgrade to myoelectric sensor-based operation
- 3-D laser sintering technology is used for fabrication allowing the product to be designed and built according to the patient's needs and size
- The prosthetic hand is attached to the patient's amputated limb by using a conventional socket
- A strap/harness, across the user's shoulder is used to actuate motion through flexure of the shoulder muscles

Applications

The device can be used by right or left hand (or forearm) amputees.

Market

- Public healthcare
- Low cost mechanical prosthetics

Technical description

This invention discloses a mechanical prosthetic hand that comprises four fingers and a thumb, which are movable to enable the hand to take on a position of an open, partially closed and fully closed hand. The hand has a metal cord at the wrist that is either released or pulled in a direction parallel to the fingers. By pulling the cord, the fingers will grip until the hand is closed. The cord works together with a knob, adjacent to the fifth metacarpal (little finger). When the knob is manually rotated or pushed the fingers become locked in position. The thumb is attached by a swivel to rotate and move either towards or away from the fingers.

Opportunities

Further development and commercialisation into a global market.

Intellectual Property Status

Type	Region	Application No	Filing Date	Priority Date
Provisional	Britain	1412034.9	07-Jul-14	07-Jul-14

The inventors are George Vicatos and Severin Tenim.

Fleurest MRI cushion kit

The Fleurest™ MRI Cushion is an innovative head stabilising pillow that provides the required comfort and stability to support a patient's head during an MRI scan. Its simplistic design facilitates easier implementation compared to systems that are currently available in the market. It also allows technicians to obtain good quality scans within a short period of time.

During a brain scanning procedure, a person is required to lie down and place his or her head in an MRI coil. A problem encountered during MRI brain scans is that, due to the inherent variability in the shape and size of patients' heads, the brain is often not in the desired position leading to suboptimal results.

This cushion conforms to the contours of the patient's head, placing it in the optimum position for the MRI Scan. Further, the MRI cushion provides adequate support and securely positions the patient's head preventing possible involuntary or voluntary movements that could hamstrung the efficiency and effectiveness of the scanning process. It is particularly useful for elderly patients and children.

Benefits

- Significantly improves the quality of brain scans
- Decreased time for an MRI scan and easy to use
- Provides cushioning comfort and stability to the patient's head during the scan whilst keeping the head in an optimal position
- Covered with material that prevents heat generation during the scan; allergic reactions in sensitive individuals; the creation of artefacts on images; does not stick to a person's face; easy to clean; resistant to body fluids

Market

- MRI scanner manufacturers
- Users of MRI scanners

Technical description

The MRI head stabilising cushion is curved and comprises of two layers of the same length and varying density, which are glued or moulded together. It has a cleanable cover to maintain good hygiene for patients. The kit includes a set of wedges that are fitted on either side of the cushion to further secure the head of the patient in place. The side wedges are made of non-viscoelastic polyurethane foam.

Intellectual Property Status

Type	Region	Application No	Filing Date	Priority Date
Provisional	Britain	1318310.8	16-Oct-13	16-Oct-13
PCT	PCT	1318310.8	16-Oct-14	16-Oct-13

The inventor is Fleur Howells.

ELECTRONICS

Symbiotic radar and communication system

The innovative aspect of this radar system is that it is designed to function as part of a communication system that utilises the electromagnetic spectrum in the whitespace allocations (previously used for TV broadcasts). The system functions as a symbiotic radar and communication system, with the radar forming an integral part of the whole system. Although it is built on the principals of commensal radar, it differs in many respects. Commensal radars (also known as passive, or sometimes, parasitic radars) do not have their own electromagnetic transmitters, utilising the electromagnetic transmissions of existing systems, such as communication systems. Commensal radars, therefore, make use of existing transmitters to detect and determine the range of targets. FM, digital TV and satellite signals are among the signals the system is known to piggyback off of.

The current invention differs from conventional commensal radars in that a spatially distributed network of receivers and transmitters are leveraged to achieve the detection and tracking of objects. This eliminates the need for complex cancellation techniques common to other systems or a design limited to area topography. Systems utilising whitespace are being developed to penetrate remote regions where ordinary wireless internet may not be available. Using a whitespace communication system is ideal for sparsely populated areas, areas that are usually suited for radar surveillance as well.

Benefits

- Allows excellent direct signal suppression without the need for expensive and complex techniques while still allowing access to reference waveforms
- Dual functionality as a provider of high speed wireless internet of more than 10 Mbps in addition to providing radar surveillance of remote areas
- Improved synchronisation of multiple sensors
- Uses diverse frequencies, lessening the effects of signal jamming and interference
- Provides mobile data access to users (airborne and land based)

Applications

- Detecting moving objects such as aircraft, vehicles, animals and humans via the reflections from the surface of the target
- Several applications in the defense and aerospace sectors. Some potential uses are border control, coastal surveillance, homeland security and the protection of assets, particularly in remote regions or developing countries

Market

The ideal commercial partner would be a large, multinational aerospace and defense company with interests in developing economies. Potential partners include government bodies responsible for coastal surveillance, border control and homeland security.

Technical description

The invention is a symbiotic radar and communication system that includes a number of base stations in communication with a wider communication network. Each base station is able to transmit and receive communication signals to and from a number of user terminals. The system is able to perform communication data processing and radar data processing on received signals.

Each base station includes a transmitter able to transmit signals that include digitally multiplexed data over a frequency band to the user terminals. The base station also has a receiver able to receive signals over a frequency band that at least partially overlaps with the transmitted frequency band. The system further includes a radio frequency (RF) front-end capable of processing the transmitted and received signals, a digitiser to digitise the received signals, radar processing modules, and communication processing modules.

Intellectual Property Status

Type	Region	Application No	Filing Date	Publication No	Priority Date
Provisional	South Africa	2013/01224	18-Feb-13		18-Feb-13
PCT	PCT	PCT/IB2014/059036	17-Feb-14	WO 2014/125447 A1	18-Feb-13

The inventors are Amit Mishra, Mike Inggs, Alan Wilson-Langman.

INFORMATION TECHNOLOGY

Optimal wireless communication by 'sensing' clear transmission space

This technology optimises the use of wireless spectrums and does this by identifying 'clear transmission space'. More specifically, the technology improves channel estimation performance in dynamic spectrum access (DSA) multi-carrier systems operating in an interference-affected environment. DSA channels are characterised by the presence of multiple in-band interference sources, having random spectrum characteristics. In such conditions, conventional pilot signal patterns are often inapplicable for the channel state information identification. The technology resolves this issue, increasing bandwidth for wireless network service providers, wireless device manufacturers, and regulatory structures. This innovation, using a novel method and algorithm, improves channel estimation performance in DSA multi-carrier systems operating in an interference-affected environment.

Benefits

- The algorithm limits interference from primary spectrum users during DSA and optimises the pilot structure
- Minimises channel estimation error variance
- Is capable of incorporating any restrictions on the transmit sub-carriers
- Uplink multi-user multi-carrier interfaces can be developed
- Suitable for systems operating in the range 1-100 GHz

Market

The technology has been developed specifically for pilot-assisted systems, i.e. communication systems embedding continuous channel identification (tracking) procedures and will find application in new generation and dynamic broadband wireless communication systems.

The technology could be of value to:

- Wireless network service providers
- Wireless device manufacturers
- Regulatory structures

Technical description

The scope of the patent application covers a method for improving the channel estimation performance in a dynamic spectrum access multicarrier system, using a pattern of pilot symbols included in transmitted signals. The algorithm could be implemented on either a general purpose signal processing hardware system (such as a Software Defined Radio platform) or integrated into the PHY protocol of a bottom-up designed ASIC-based transceiver. The appropriate pilot symbols are determined adaptively by carrying out the following steps:

a. explicitly characterising an interference-affected propagation environment by defining a covariance matrix of interference and white Gaussian noise based on external measurements for the propagation environment;

b. determining the placement of a predetermined number of equally powered pilot symbols by computing a placement pattern that results in the minimum sum of square errors of a maximum likelihood channel estimation performed based on the covariance matrix; and

c. with the pilot symbols in their placed positions, determining relative power distribution between the placed pilot symbols by computing a power loading that results in the minimum sum of square errors of a maximum likelihood channel estimation performed based on the covariance matrix.

Intellectual Property Status

Type	Region	Application No	Filing Date	Publication No	Priority Date
Provisional	South Africa	2009/08684	08-Dec-09		08-Dec-09
PCT	PCT	PCT/IB2010/003140	08-Dec-10	WO 2011/070427	08-Dec-09
National Phase	South Africa	2012/03925	30-May-12		08-Dec-09
National Phase	China	201080055508.1	07-Jun-12	CN 102792653 A	08-Dec-09
National Phase	United States	13/514.346	07-Jun-12	US 2012/0243630 A1	08-Dec-09

The inventor is Eugene Golovins.

ENERGY AND ENGINEERING

Optimal current injection to or extraction from a utility network

An algorithm has been developed that is applied to an invertor so that power can either be injected into the network optimally, or withdrawn. This will become increasingly important as 'green' technologies such as wind farms and solar panels are connected to the grid. It can be aplied to a single phase or multi-wire power network so that the power reaches its destination where it is consumed with minimal losses. This increases the efficicy of utility networks.

Practically the algorithm is implemented through software installed on inverters and the efficiencies, increased capacity and importantly network stabilisation that result, will be of interest to utility providers who control power networks.

New innovations in power electronics have provided new ways to optimise power distribution systems by reducing power losses in the electrical distribution network. An added consideration is that there are also new opportunities for private customers to generate power from wind or solar energy and to inject power into the grid.

Benefits

- Decreased losses of electrical energy on the distribution grid thereby leading to power savings
- Improved quality in power supply

Applications

- Dispatching conventional and/or renewable energy sources more efficiently into a distribution network
- Receiving electrical power into a storage device or at a consumer point
- Making informed decisions in selecting the best generation point or storage point for electrical energy. For example, where the control centre management system of a network has a choice between various potential dispatch or storage points
- Power factor compensation at any load node on the network using reactive power by re-distributing the current between the phases
- Measurement of and instrumentation for critical electrical parameters on the electrical network to provide for improved power factor definitions and tariff management applications

Market

- Utility providers who control power networks
- Industries who consume large amounts of electrical energy
- Industries who have large reticulation systems such a petrochemical plants and mines

Technical description

The most efficient way of transmitting power in a two wire single generator system occurs when the current is in phase with the generator voltage. In the case of multiple wires and generators, the way of transmitting currents with minimum losses becomes more complex to resolve, but is achieved by determining an equivalent Thévenin circuit that is representative of the whole network. A complicated mesh network may be represented as a simple Thévenin network for each phase.

The algorithm for injecting power into or extracting power from a network involves:

a. Determining dynamically changing Thévenin parameters in the form of a Thévenin voltage and a Thévenin resistance of an equivalent Thévenin circuit with respect to each wire of a point of common coupling;

b. Calculating a total Thévenin power for all the wires based on a specific amount of power at the point of common coupling and the determined Thévenin parameters; and,

c. Calculating a dynamically changing optimal current to be injected into or extracted from the point of common coupling so as to inject or extract a specific amount of power based on the total Thévenin power and the dynamically changing Thévenin parameters.

Intellectual Property Status

Type	Region	Application No	Filing Date	Priority Date
Provisional	Britain	1322487.8	19-Dec-13	08-Dec-09

The inventors are Charles Gaunt and Michel Malengret.

CHEMICAL AND MATERIAL SCIENCES

Soluble biopolymer catalyst backbone

Chitosan has been modified transforming the sparingly soluble natural polymer so that it becomes almost completely soluble in aqueous media. This broadens the application to green chemistry technologies that replace or minimise the use of organic solvents particularly in the pharmaceuticals industry.

Chitin is the second most abundant natural biopolymer in the world, behind cellulose. This abundance, combined with the specific chemistry of its derivative, chitosan, provides for an array of potential applications. Chitin is recovered from a number of bio sources such as waste crayfish shells.

The present trend, in industrial applications, is to produce high value products, such as cosmetics, drug carriers, feed additives, semi-permeable membranes, chromatographic supports and supported catalysts. The difference in value between newly developed high-end products and the low-cost polymers that dominated the industry in the past is one of the main driving forces behind studies on new applications of chitin and chitosan in both chemical and biotech industries.

Benefits

- Current technologies utilise polymer-free homogeneous catalysts, or heterogeneous synthetic polymer-based catalysts, or unmodified chitosan. The latter two polymers have limited solubility whereas the modified chitosan polymer is water soluble, biodegradable, and permits double the catalyst loading

- The polymer can be selectively functionalised to perform stereo-selective reactions (stereo-selective hydrogenation and carbon-carbon bond formation are likely)

Applications

A number of industrial opportunities exist for application of the biopolymer support. There is an opportunity to establish a business creating specialist catalysts for a variety of industrial applications. This can also be achieved through joint technology development ventures and ultimately catalyst lisencing or supply.

Market

The main market is the production of catalysts used in the production of pharmaceuticals, fine chemicals, cosmetics, and in the biotechnology industry.

Technical description

Chitin derived from a source such as crayfish shells is converted to chitosan. In turn the chitosan is modified (by converting the 6-hydroxy group of the polymer to a 6-amino-group). The modified-chitosan polymer support which can have a variety of linkers onto which active molecules can be attached. For example, a metal immobilised 6-amino-6-deoxy-chitosan, which utilises Schiff-base ligands as linkers that coordinate metals such as palladium, platinum, rhodium, ruthenium, iridium, manganese, osmium, nickel, cobalt and iron.

Intellectual Property Status

Type	Region	Application No	Filing Date	Publication Number	Priority Date
Provisional	South Africa	2009/06358	14-Sep-09		14-Sep-09
PCT	PCT	PCT/IB2010/002291	14-Sep-10	WO 2011/083360	14-Sep-09
National Phase	Britain	GB 10842020.9			14-Sep-09
National Phase	China	201080040614.2	13-Mar-12	CN102639627A	14-Sep-09
National Phase	Europe (France, Germany, Ireland, Italy, Switzerland)	10842020.9	04-Apr-12	2478049	14-Sep-09
National Phase	India	2724/DELNP/2012	29-Mar-12		14-Sep-09
National Phase	South Africa	2012/02047	20-Mar-12		14-Sep-09
National Phase	United States	13/496,116	14-Mar-12	US2012/0178916 A1	14-Sep-09

The inventors are Anwar Jardine, Greg Smith and Banothile Makhubela.

Silver modified chitosan polymer support for separation of fatty acids

Argentation is a silver ion liquid chromatography technique integrating silver ions onto the stationary or mobile phases where it can react with unsaturated components of fatty acids to form weak polar complexes. At present, the only commercially available argentation column is the Discovery® column. However, these columns have only been used on an analytical scale, and are too expensive to use for preparative purposes. Bulk separation of marine oils requires a cost effective solid support material.

This modified chitosan provides an alternative support for argentation by providing a solid support. The polymer, derived from naturally occurring chitosan found in crayfish or lobster shells, is designed to effect the separation of fatty acids into valuable saturated and unsaturated fatty acids and into cis and trans unsaturated fatty acids.

Marine and plant oils contain saturated and unsaturated fatty acids, both of which have economic value once separated. Unsaturated fatty acids, such as omega 3 and 6 fatty acids, have nutritional value, whereas saturated fatty acids are being used in cosmetics. Trans fatty acids have been known to increase the risk of coronary heart disease and, as a result, an interest in separating trans fatty acids from their cis counterparts has greatly increased.

Various existing technologies claim selective fractionation of saturated and unsaturated fatty acids, such as liquid-liquid extraction, liquid extraction of urea complexed fatty acids, and argentation chromatography using solid supports such as benzene sulfonate resins, zeolites, or alumina.

Benefits

- Significantly higher silver loading is achieved: In excess of 10x that of conventional resins
- Produced from biodegradable marine waste products, such as crayfish shells, and as such provides a more environmentally friendly and sustainable alternative to conventional resins
- One waste stream (crayfish shells) used to add value to another low value product (fish oil)
- After the extraction of residual silver ions, the material can be used as an organic fertilizer

Applications

- Fatty acids fractionation of various plant or marine oils, such as fish oil, citrus oil and olive oil
- The technology could be applied to the production of nutraceuticals, health products, cosmetics and fragrances

Market

The invention targets two possible markets: (1) the market for Solid Phase Extraction (SPE) resins, and (2) the bulk separation of plant of marine oils into valuable constituents.

Technical description

The invention relates to a chromatography resin consisting of a sulfonated chitosan polymer support complexed with silver ions. The sulfonated polymer may include sulphonamide chitosan, 2-N-sulfopropyl chitosan, 2-N-sulfobenzamido chitosan, 6-deoxy-amino chitosan, sulphonamide-6-deoxy 6-amino chitosan, 6-deoxy-2,6-bis-[sulfopropyl] chitosan, and 6-deoxy-2,6-bis-[sulfobenzamido] chitosan.

Intellectual Property Status

Type	Region	Application No	Filing Date	Priority Date
Provisional	South Africa	2012/08014	24-Oct-12	24-Oct-12
PCT	PCT	PCT/IB2013/059617	24-Oct-13	24-Oct-12

This IP is a specific 'selection' patent relating to UCT's modified chitosan patent family.

The inventor is Anwar Jardine.

Process control to select for valuable olefins

This technology is a process modification, which allows one to dramatically improve the olefin selectivity over a wide carbon number range in the Fischer-Tropsch reaction via co-feeding of suitable gases such as ammonia. Noteably this is achieved with no or tolerable loss of catalyst activity.

Fischer-Tropsch synthesis is an important process to convert coal, natural gas and biomass to a variety of hydrocarbon products of different chain length. These products mainly find use as transportation fuels including petrol jet fuel and diesel as well as speciality waxes. Fischer-Tropsch synthesis is however, also known for its capability of producing chemicals such olefins, which are of a much higher value than low value fuels.

The techno-economics of feeding ammonia versus the improved 'higher value' olefin profile, achieved using this process, have been assessed and found to be positive.

Benefits

- Improvement of selectivity of valuable chemicals in Fischer-Tropsch synthesis
- Can be incorporated in existing Fischer-Tropsch plants/units without catalyst modification (both cobalt and iron based catalysts can be used)
- Allows flexible operation of Fischer-Tropsch plants/units in either ‘fuels’ or ‘chemicals’ mode

Market

An ideal commercial partner to use this modified process will be a company that is in the the feed-to-liquid (XTL) business with focus on chemicals production or a company that is already in the XTL business, but with an interest in making use of the potential of the Fischer-Tropsch synthesis to produce highly valuable olefins.

Technical description

The process involves the production of hydrocarbons from synthesis gas during hydrogenation of a carbonaceous gas component in a synthesis gas in a feed to a reactor in which a catalyst acts on the feed at a temperature of between 160°C and 400°C and under a pressure of between 1 bar and 50 bar, the process being characterised in that at least one compound containing one or both of nitrogen and phosphorous is fed to the reactor together with the synthesis gas and in that the catalyst and process conditions are selected to favour the productions of olefins.

Intellectual Property Status

Type	Region	Application No	Filing Date	Publication Number	Priority Date
Provisional	South Africa	2008/03392	16-Apr-08		16-Apr-08
PCT	PCT	PCT/IB2009/005256	15-Apr-09	WO2009/127950	16-Apr-08
National Phase	China	200980115993.4	03-Nov-10		16-Apr-08
National Phase	Europe	09732501.3	04-Nov-10		16-Apr-08
National Phase	GCC	13301/2009	16-Apr-09		16-Apr-08
National Phase	South Africa	2010/07627	26-Oct-10		16-Apr-08
National Phase	United States	12/937,694	13-Oct-10	US-2011-0160510 A1	16-Apr-08

This IP is jointly owned by UCT and Carol von Ossietzky Universitat Oldenburg (Germany).

The inventors are Michael Claeys, Eric van Steen, Frank Rößner and Andreas Rausch.

Synthesis of nitrogen or phosphorous containing compounds

In this modified Fischer-Tropsch process valuable nitrogen or phosphorous containing products of varying chain length are produced via co-feeding of suitable gases such as ammonia. These nitrogen-containing products include amines, nitriles, amides and formamides.

The Fischer-Tropsch synthesis is an important process to convert coal, natural gas and biomass to a variety of hydrocarbon products of different chain length. These products mainly find use as transportation fuels including petrol jet fuel and diesel as well as speciality waxes.

Amines and nitriles are important base chemicals and they are typically produced from oxygenate precursors which themselves are derived from olefins. The UCT process eliminates the use of two steps.

Benefits

- Can be incorporated in existing Fischer-Tropsch plants/ units without catalyst modification (iron based catalysts are best suited)
- Allows flexible operation of Fischer-Tropsch plants/ units in either 'fuels' or 'chemicals' mode
- Production of valuable chemicals not traditionally obtained in the Fischer-Tropsch synthesis such as nitrogen and phosphorous containing compounds
- One-step synthesis of nitrogen and phosphorous containing compounds instead of two-step process
- Suppression of oxygenate formation including carboxylic acids
- Possibility to selectively convert oxygenates including glycerine to valuable nitrogen and phosphorous containing compounds
- Can be tailord to respond quickly to changing market conditions ('demand driven production')
- Ideal for smaller Fischer-Tropsch operations

Market

An ideal commercial partner to use this modified process will be a company that is in the feed-to-liquid (XTL) business with focus on chemical production or a company that is already in the XTL business, but with an interest in making use of the potential of the Fischer-Tropsch synthesis to produce highly valuable nitrogen and phosphorous containing compounds. It is also to those who want to selectively convert oxygenates including glycerine to nitrogen and phosphorous containing products.

Moreover, catalysts manufactures who may improve and maximise the performance of catalysts for the modified process will have an interest in this process.

Technical description

A process for the production of at least one nitrogen or phosphorus containing compound selected from linear nitriles, amides, formamides and linear phosphorous containing compounds from synthesis gas during the hydrogenation of carbon monoxide and or carbon dioxide components in a synthesis gas in a feed to a reactor in which a catalyst acts on the feed at a temperature of between 160°C and 400°C and under a pressure of between 1 bar and 50 bar, the process being characterised in that at least one nitrogen and phosphorous containing compound is fed to the reactor together with the synthesis gas and in that the catalyst is heterogeneous and the process conditions are selected to favour the production of said at least one nitrogen or phosphorus containing compound selected from linear nitriles, amides, formamides and linear phosphorous containing compounds.

Intellectual Property Status

Type	Region	Application No	Filing Date	Publication Number	Priority Date
Provisional	South Africa	2008/03393	16-Apr-08		16-Apr-08
PCT	PCT	PCT/IB2009/005242	15-Apr-09	WO2009/127942	16-Apr-08
National Phase	China	200980113744.1	18-Oct-10	102026962	16-Apr-08
National Phase	Europe	09733651.5	01-Nov-10		16-Apr-08
National Phase	GCC	13302/2009	16-Apr-09		16-Apr-08
National Phase	South Africa	2010/07629	26-Oct-10		16-Apr-08
National Phase	United States	12/988,052	15-Oct-10	US-2011-0092728-A1	16-Apr-08

This IP is jointly owned by UCT and Carol von Ossietzky Universitat Oldenburg (Germany).

The inventors are Michael Claeys, Eric van Steen, Frank Rößner, and Tawanda Sango.

MINING AND PETROLEUM

Enhanced recovery of oxidised base and precious metal bearing minerals

Oxidised and surface oxidised minerals containing base metals such as copper and nickel often float poorly during mineral processing to create a concentrate from which the metal can be recovered downstream.

The production and subsequent use of base and precious metals from their associated minerals plays an important role in the technological and economic well-being of society. In the separation processes commonly employed to recover these base and precious metal minerals, oxidised surfaces significantly impact upon the efficacy of such processes. These oxidised mineral surfaces most commonly arise through the oxidation processes that occur during the weathering of a sulfidic ore-body, however, they can also occur during the mining and processing of that ore-body, forming both oxidised and surface oxidised minerals.

This invention is designed to recover 'difficult to sulphidise' base metal minerals including surface oxidised base metal sulphides. The procedure has been demonstrated for surface oxidised base metal sulphides, particularly pentlandite. It is likely that a range of other minerals that normally require 'heavy' sulphidising or are difficult to sulphidise, such as the various forms of heterogeneite and chrysocolla, would be expected to respond favourably to this approach.

Benefits

- Increased base metal mineral recovery from oxidised and surface oxidised minerals that are difficult to recover during conventional floatation.

Applications

- Recovery of oxidised and surface oxidised base metal ores, such as copper and nickel

Market

Two base metal and precious metal mineral groups that would be amenable to the recommended procedure may be defined as follows:

Group 1 : surface oxidised : sulphides, arsenides, antimonides, selenides and tellurides (note that this includes precious metal [silver gold, palladium and platinum] minerals); and,

Group 2 : conventional 'oxide' minerals : oxides, hydroxides, hydroxy-oxides, carbonates, hydroxylcarbonates, sulphates, hydroxyl-sulphates, phopshates (e.g. pseudo malachite), silicates, hydroxyl-silicates, arsenates, chromates, vandanates, etc.

Technical description

The oxidation of sulfide mineral surfaces in a Nkomati sample significantly affected their floatability, particularly for pentlandite and pyrrhotite. These minerals were readily oxidised and subsequently displayed a poor flotation response. Chalcopyrite retained a reasonable degree of floatability and thus had not been heavily oxidised. Sulfidisation restored the floatability of the three sulfide minerals, although not to the same degree.

Intellectual Property Status

Type	Region	Application No	Filing Date	Publication Number	Priority Date
Provisional	South Africa	2006/09492	15-Nov-06		15-Nov-06
PCT	PCT	PCT/IB2007/054603	13-Nov-07	WO 2008/059439 A1	15-Nov-06
National Phase	ARIPO	AP/P/2009/004867	15-May-09		15-Nov-06
National Phase	Australia	2007320759	15-May-09		15-Nov-06
National Phase	Canada	2,669,785	15-May-09		15-Nov-06
National Phase	China	200780042453.9	15-May-09	CN101583728	15-Nov-06
National Phase	Eurasia	200900639	15-May-09		15-Nov-06
National Phase	South Africa	2009/03361	15-May-09		15-Nov-06
National Phase	United States	12/514,926	15-May-09	US-2009-0225972-A1	15-Nov-06

The inventors are Deidre Bradshaw and Andrew Newell.

PHARMACEUTICALS

Phenothiazine-based anti-TB drugs

Phenothiazine, a tricyclic organic compound with formula S(CH)NH, is well known for its use as antipsychotic and antihistaminic drugs. The compound has also been reported widely as having antimicrobial activity, including anti-tubercular (anti-TB).

Phenothiazines have also demonstrated synergistic interaction with a wide spectrum of anti-microbial or anti-bacterial agents. It has been proven that thioridazine is active against multi- and extremely drug resistant forms of tuberculosis (TB).

With the chemically modified phenothiazine-based compounds of the invention, it is now possible to separate the anti-TB activity from the psychotropic activity by increasing the polarity of the molecules and hence the solubility of the compounds. This reduces their ability to cross the blood-brain barrier and thus minimises the psychotic side effects. The phenothiazine drug, Chlorpromazine, has been successfully used to treat a TB patient.

Benefits

- It retains antimicrobial activity while excluding psychotic side effects
- It is non-toxic to macrophage cells with no negative impact on the patient's immunity

Applications

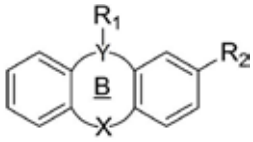
- Potential to be used alone or in combination with other anti-TB drugs, with limited side effects
- Potential to be extended to tricyclic derivatives other than phenothiazine, such as phenoxazines, phenazines, acridines, oxazepines, diazepins, xanthenes, and thioxanthenes

Market

TB sufferers worldwide, with specific focus on countries with a high incidence of TB.
Note: In 2012, 8.6 million people were diagnosed with TB globally and 1.3 million died from the disease.

Technical description

The invention is a tricyclic derivative of general formula,



where R_1 is an alkyl sulphonate or sulphonamide group; R_2 is hydrogen, a halogen, a substituted alkyl group, a thioether or an acetyl group; Y is N, or C; X is S, SO, SO_2, N, O, CH_2, C(O), CO_2, NHCO, and ring B is a 6, 7 or an 8 membered cycloalkyl ring. When (1) is a phenothiazine derivative, then R_2 is not H.

Intellectual Property Status

The IP covers modified tricyclic derivatives of phenothiazines, phenoxazines, phenazines, acridines, oxazepines, diazepins, xanthenes, thioxanthenes and uses thereof.

Type	Region	Application No	Filing Date	Publication Number	Priority Date
Provisional	South Africa	2012/08875	26-Nov-12		26-Nov-12
PCT	PCT	PCT/IB2013/060403	26-Nov-13	WO2014/080378	26-Nov-12

The inventors are Anwar Jardine and Muazzam Jacobs.

WASTE MANAGEMENT AND BENEFICIATION

EFC waste management solution for saline brines, especially in mining

Eutectic Freeze Crystallisation (EFC) offers a novel, sustainable method for the treatment of brines and concentrates that were previously regarded as difficult to treat. It is particularly suitable for those components of mine water waste streams, which are currently discharged into evaporation ponds.

The EFC technique operates by cooling the hypersaline brine to the eutectic temperature at which point both ice and pure salt will form simultaneously. Ice, being less dense than water will float, whilst the salt, being denser, will sink. The outcome is usable water and salts. The added advantages are therefore, a reduction in total water consumption and a potential additional revenue stream through the sale of salts.

Eutectic Freeze Crystallisation offers a sustainable treatment process to turn wastewater into a resource with multiple benefits, particularly in a water-scarce country such as South Africa.

Benefits

- Produces saleable products from the waste
- Reduces the cost of brine management. Decreases the long term liabilities and risk associated with brine management
- Contributes to water conservation
- Operation at lower temperature, is safe to operate and minimises corrosion
- Extends the life span of evaporation ponds
- Modular technology- can be scaled up based on process demand

Market

- Mining industry and metallurgical refiners
- Power generation industry
- Fuels and fine chemical production companies
- Textile companies
- Pharmaceutical manufacturers
- Agricultural industry

Intellectual Property Status

Type	Region	Application No	Filing Date	Publication Number	Priority Date
Provisional	South Africa	2008/07293	22-Aug-08		22-Aug-08
PCT	PCT	PCT/IB2009/006612	21-Aug-09	WO2010/020872	22-Aug-08
National Phase	Australia	2009283940	11-Feb-11		22-Aug-08
National Phase	Canada	2,732,629	17-Feb-11		22-Aug-08
National Phase	Europe	9807969.2	11-Feb-11	2321024	22-Aug-08
National Phase	Germany	2321024			22-Aug-08
National Phase	Netherlands	2321024			22-Aug-08
National Phase	South Africa	2011/01228	16-Feb-11		22-Aug-08

The inventors are Alison Lewis and Jeeten Nathoo.

INVESTMENT AND OTHER OPPORTUNITIES

Elemental Numerics: Next generation computational fluid dynamics software

Elemental software can be used to model fluid flow in three dimensions for applications ranging from aeronautics to heart valves. Mathematical equations reveal the dynamics of fluid flow in complex real life systems through this computer model giving unprecedented insight during the product design phase. Current focal areas for *Elemental* include liquid transport modelling and design (space and aerospace) as well as industrial fan optimisation.

Elemental has undergone extensive evaluation by respected international companies over the past two years and found to have exceptional capabilities. Airbus found *Elemental* 'scientifically innovative while outperforming competing codes by a significant margin' and Airbus Defence and Space, Europe's top space technology company share the sentiment. Local South African industry has also benefitted, with the software raising design capabilities to produce cutting edge products that are globally competitive.

Benefits

Existing commercial CFD codes are typically composed of separate modules to simulate different physics, but many real-life systems are multi-disciplinary. For example, aircraft and spacecraft are composed of a fluid (the air or space in which they travel) and a structure, with the latter containing large amounts of liquid fuel. All of these interact as a whole. *Elemental* is multi-disciplinary in form and function, covering everything in a single code, significantly increasing efficiency and modelling applications.

Market

Elemental software is of significant benefit to engineering design where it obviates the need for physical prototyping, substantially reducing cost whilst improving safety, particularly important in the aerospace sector. The software has application across industries with applications as diverse as heart valves and aircraft. It is used by highly-skilled engineers in-house within large corporations such as Airbus, or by engineering design firms and specialist consultants.

Elemental could be licensed as a software product, but could also be used to support specialist consulting conducted by a spin-off company.

Today, CFD is both highly strategic as well as one of the fastest growing areas of engineering, which is predicted to grow by more than 65% over the period 2014-2016. The market is dominated by only four codes, with international license fee revenue being estimated at R5.6 billion annually.

Technical Description

Elemental software creates a computational model that represents a system or device, which is to be investigated or designed. Once the fluid flow physics haves been selected for the virtual prototype, the software outputs an accurate prediction of the fluid dynamics in detail. In this, CFD is a sophisticated analysis technique that offers quantitative insights that allow different scenarios to be simulated, tested and understood. It not only predicts fluid flow behaviour, but also the transfer of heat, mass (such as in perspiration or dissolution), phase

change (such as in freezing or boiling), chemical reaction (such as combustion), mechanical movement (such as an impeller turning), and stress or deformation of related solid structures (such as a mast bending in the wind).

The Elemental principle breaks from traditional coding practices in placing both 'less is more' and 'rigour' at the top of the priority list. This has resulted in a highly modular yet flexible code, which is easily maintainable and extendable to the many new multi-physics applications still to be modelled. As such, Elemental comprises less than 100 000 lines of code, yet models with exceptional speed and accuracy in 2D and 3D compressible flow, incompressible flow, free-surface-modelling, heat transfer and fluid-structure-interaction problems with a selection of state-of-the-art fast parallel solvers and on platforms ranging from desktops to massively parallel super computers general purpose graphical processing units (GPGPUs).

Opportunity

Elemental Numerics (Pty) Ltd is a registered company and at present is developing a business plan to commercialise the Elemental software. There are two potential modes of commercialisation: software licensing and specialist consulting. The strategy that will emerge will identify how this potential will be unlocked and the funds required to support the venture. Once the business plan has been developed there will be opportunities for investment in the company.

Companies who can benefit from using Elemental during the design and prototyping of their products are also currently being sought.

Intellectual Property Status

- Software code is copyright protected
- '*Elemental*' is a registered trademark

Whilst Prof Arnaud Malan holds the SA Research Chair in Industrial Computational Fluid Dynamics in the Department of Mechanical Engineering at UCT, he started work on *Elemental* in 2003. The IP created prior to Malan joining UCT is owned by Elemental Numerics (Pty) Ltd. His research focus will lead to further development of the *Elemental* code and an agreement between UCT and Elemental Numerics will see these new modules being transferred to the company to commercialise. The UCT research group will also produce highly-skilled engineers trained in the adaptation of the code to different applications.

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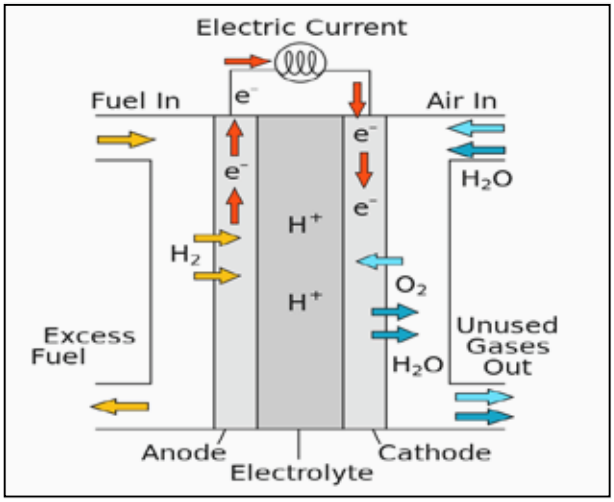
HyCat (Pty) Ltd - Innovation in hydrogen fuel cell power

HyCat (Pty) Ltd, is an intellectual property (IP) holding company commercialising hydrogen fuel cell IP specifically in the segment.

Its primary goal is to develop the fuel cell supply chain in South Africa with local manufacturing partners to provide the most technologically advanced products and components to a global market. In doing this, HyCat will unlock value addition for SA's platinum resources and create manufacturing jobs, a service industry and secondary businesses. This will be achieved through the licensing of South African IP, as well as in-licensed IP from global players, with which the SA IP will be integrated to ensure that the ventures are immediately at the global forefront.



Fuel cells (FC) are one of the promising power sources for replacing internal combustion engines powered by fossil fuels. They are highly efficient, quiet, clean, and maintenance free electricity generators that use hydrogen and air as fuel.

Business Focus

The initial focus at HyCat will be on establishing a catalyst and Membrane Electrode Assembly (MEA) supplier. The HyCat metal based gas-diffusion electrode is cheaper and more durable than the commonly used carbon fibre based electrode, which also relies on a complicated manufacturing process. An inorganic based nanofibre sheet as a platinum support has also been developed and performance and durability results to date are promising. Two patent applications have been filed to date[1], with several others in preparation.

Several additional innovative developments are underway; including novel graphene based materials for electrolyte membranes, compact fuel cell assembly structures, and novel gasket systems for metal based electrodes. These technologies can make the fuel cells smaller with increased power and durability. In addition to this, the fuel cell design aims to remove certain sub-systems surrounding the fuel cell, resulting in system cost reduction, which is the most crucial issue for fuel cell related companies.

Key objectives include:

- Commercialisation of SA research and IP output from the DST HySA/Catalysis Centre of Excellence at UCT in collaboration with HySA partner, Mintek
- Having a major impact on Platinum Group Metal beneficiation, sales of MEAs with HySA catalysts must be achieved. HySA has set a target to meet 25% of the global hydrogen and fuel cell catalyst demand by 2020 and to enter the lucrative automotive MEA market. HyCat will strive to achieve this goal
- Creation of jobs for highly skilled scientists and engineers who will be able to enter the workforce in fuel cells in South Africa
- Creation of a fuel cell supply chain, exploiting South African IP, through an integrated network of companies with complementary skills. Secondary business opportunities will arise from commercialisation, such as fuel distribution, service and maintenance jobs and service providers
- Partnering strategically with global players and in-license additional fuel cell technologies that can be integrated with SA innovations

1 Tanaka, S. A Clamp Assembly for a Fuel Cell Stack and a Method of Assembling a Fuel Cell Stack. Provisional Patent Application Britain 1320838.4
Hussain, N., Tanaka, S. Fuel Cell MEA with Combined Metal Gas Diffusion Layer and Microporous Layer. Provisional Patent Application Britain 1405659.2

Market

Potential customers include the aerospace and automotive industries, both of which require high performance, 20 year durability, and low cost materials. The technologies currently under development at HySA/Catalysis (that will be commercialised by HyCat) are predicted to meet the requirements of these industries in the future.

Opportunity

HyCat (Pty) Ltd was registered in 2014 and is currently a 100% UCT owned Spin-off Company. Whilst it was established primarily as an IP holding company to commercialise the hydrogen fuel cell IP emanating from the DST HySA/Catalysis Centre of Competence at UCT, the company will collaborate closely with HySA partner Mintek who are creating associated IP to align the commercialisation initiatives through licensing.

Importantly, HyCat will partner strategically with global players and in-license additional fuel cell technologies that can be integrated with South African innovations. Two important partnerships have already been negotiated with international companies that are dependent on approval of a funding application that is undergoing due diligence.

A number of opportunities exist:

- Licensing of relevant fuel cell IP to HyCat
- Investment in the various ventures as the fuel cell supply chain is established in South Africa
- Business development partner and opportunities for joint ventures where IP is licensed from HyCat
- South African manufacturers interested in becoming involved in manufacturing fuel cell components, etc.

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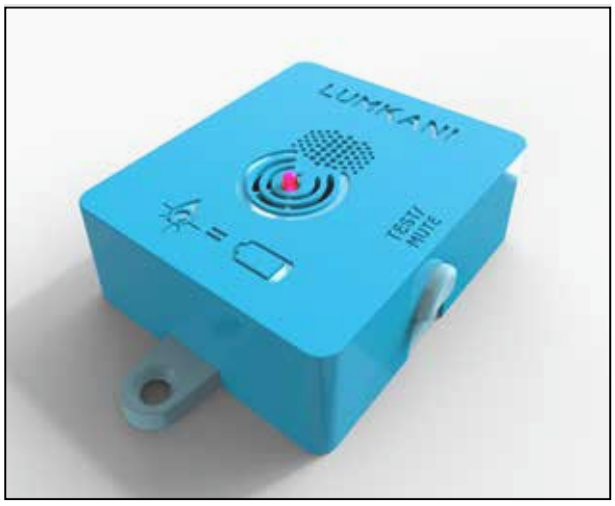
Lumkani - low cost fire detection system

Lumkani ('to be aware') is a low cost fire detecting and an early warning system to reduce the damage and destruction caused by the spread of fires in urban informal settlements. To sense fire, the Lumkani detector measures the rate at which temperature increases. rather than smoke levels within a shack (house). The reason for this is that many cooking, lighting and heating methods used by people living in informal settlements produce smoke, which would generate false alarms with standard devices.



All devices are connected in a transmission network. If a signal is not disarmed within 30 seconds, neighboring detectors are also activated and relevant authorities alerted, enabling action to be taken before a fire becomes unmanageable.

During December 2014 two real-life demonstration, funded by Technology Innovation Agency's University Seed Fund, have shown the efficacy and the effectiveness of the system. This has resulted in dramatic increase in community interest.

Market

Lumkani offers an affordable and easily implementable solution to significantly decrease risk and impact of fires in sprawling informal settlements.

Business Opportunity

Lumkani is seeking funding and partnerships to pursue large-scale roll-out, initially in South Africa, and eventually internationally, through a to-be-formed spin-off company.

Intellectual Property Status

Software code is copyright protected and patent applications are in progress.

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PRODUCTS

IKEY XRD cell

An X-ray diffratometer (XRD) is a measuring instrument that uses the scattering pattern produced when X-rays interact with materials to analyse material structures. The Ikey XRD cell allows for the characterisation of materials, including catalysts, under reaction conditions. The instrument makes it possible to observe rapid structural changes in real time as they happen, enabling an increased understanding of the changes materials undergo during exposure to different environments.

Benefits

Advantages over commercially available *in situ* cells include minimised dead volume and the possibility of co-feeding gases such as water vapour. The reaction vessel, a capillary tube (75 mm long and outer diameter of 1 to 2 mm), can withstand pressures in excess of 20 bar and temperatures up to 500°C.

This uniquely designed *in situ* reaction cell can be mounted on any commercial XRD and it can be used both with conventional diffractometers and in conjunction with synchrotron facilities.

Purchase

These units are currently being manufatured within UCT by an incubated company. For more information please contact Cobus vd Merwe on jacobus.vandermerwe@uct.ac.za/ or call +27 (0)21 650 5895.

IKEY magnetometer

This world-first *in situ* magnetometer can analyse ferromagnetic materials under actual operating conditions. Its ability to operate under high temperature (500°C) and pressure (50 bar) conditions as well as the ability to control gas and/or liquid flows through the material makes it an indispensable tool for advanced research and industrial catalytic process optimisation.

Benefits

- Ability to provide *in situ* characterisation of material containing ferro-magnetic matter at actual conditions of their industrial application
- Ability to provide information on crystallite size and size distributions in nanomaterials
- Ability to provide information on phase changes and changes of crystallite sizes. For example, in catalysis the degree of reduction and sintering of crystallites can be monitored in real time
- Ability to operate at high temperature and pressure (500°C, 50 bar)
- Ability to control gas and/or liquid flows through the material at elevated temperature and pressure
- A metallic reactor vessel can be used

Purchase

These units are currently being manufatured within UCT by an incubated company. For more information please contact Cobus vd Merwe on jacobus.vandermerwe@uct.ac.za/ or call +27 (0)21 650 5895.

IKEY catalytic test unit

The University of Cape Town has designed and manufactured catalytic test units for a number of years with a view to improving the operational efficiency of such units.

Benefits

The streamlined professional units are mobile, skid mounted and modular, with mounting brackets securing the various components in the most favourable operating configuration.

The open layout allows for ease of operation and maintenance by the client, with typical utility tapin points. Single, double or triple reactor tubes can be mounted within the same reactor block for parallel testing. Both manual as well as automated control options are now being offered. Control boxes for manual control can be removed easily for maintenance, whereas the automated control features have the benefit of easier data logging.

The modular construction has allowed a level of standardisation and also the rapid interchange of malfunctioning components, with off-the-shelf spares, minimising research downtime.

Purchase

These units are currently being manufatured within UCT by an incubated company. For more information please contact Cobus vd Merwe on jacobus.vandermerwe@uct.ac.za/ or call +27 (0)21 650 5895.

AfriTox® – poisons information database

Developed and produced by the Red Cross Children's Hospital Poisons Information Centre, AfriTox® is a software system which helps doctors in Southern Africa to diagnose and treat poisoning in adults or children. It contains information on more than 40,000 potential poisons and their treatment. It is one of only a few poison databases in the world and the only source of information on the contents of local South African commercial products.

Although AfriTox® deals with chemicals, medicines and other potential poisons which are encountered worldwide, it has a unique focus on Southern African product names, plants, and poisonous animals, with photographs to help identify them. This local information is not available from sources in other countries, but is essential for treating poisoning in Southern Africa.

AfriTox® underpins the Poisons Emergency Telephone Service at Red Cross and provides poisons information at over 30 treatment centres throughout Southern Africa. AfriTox®, which may only be used under the direction of a medical practitioner, is available in two versions.

- AfriTox® Online : web-based access for doctors on smart phone, laptop or PC, for an annual personal subscription
- AfriTox® Offline : information is stored on a PC or laptop, and regularly updated online. It is designed for treatment centres. It is available to private hospitals/organisations for an annual fee, which varies with the number of sites where the database is installed. It is available free to state hospitals

AfriTox's MinTox website helps members of the public to identify substances that are NOT toxic or that are very unlikely to cause poisoning if taken once.

Benefits

- Graphic user interface allowing for easy and quick access to information
- Quick toxicity data informs doctors if the patient has taken a dangerous quantity of the substance, what symptoms and signs to expect and AfriTox® provides a treatment protocol
- Wealth of treatment protocols, which are easy to use in the event of serious or complex poison cases, more than 600 protocols are available

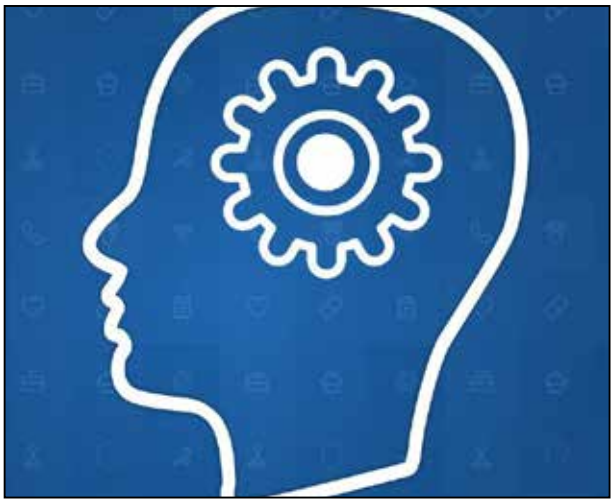
Market

- Hospitals or Emergency Centres
- Health Practitioners

Purchase

For more information and to purchase a license visit www.afritox.co.za/ or call (+27)21 658 5308 (8 AM-4 PM).

Curb Your Addiction app



Curb Your Addiction or C-Ya is an app for smart phone or tablet use (Android, Apple), based on an existing 'cognitive training' program designed to strengthen the area of the brain associated with willpower.

The UCT Department of Psychiatry and Mental Health has conducted a study on people in treatment for methamphetamine addiction using a 'working memory' computer game. The study has proven that cognitive training improves neuroplasticity and brain function. The preliminary data so far collected shows strong results for altered brain function, improved feelings of self-control, and lowered feelings of craving in methamphetamine addicts after 4 weeks (20 daily 30-minute sessions daily) of progressively more difficult training.

Working memory training will therefore assist in strengthening cognitive control, particularly in terms of self-regulation of impulses (e.g. drug taking, excessive eating, other addictions). Relapse for those in treatment for drug addiction is particularly high, and pharmacological interventions are costly, work on widespread brain areas and often cause uncomfortable side-effects. Thus using this training as an adjunct to treatment in order to strengthen cognitive processes underlying 'will-power' could prove beneficial.

Customers

- Researchers collecting data on cognitive training: By running the app on smart phones, many researchers can use this program. It will be easier for participants to conduct the experiment at home (a minimum score of 80% on each level helps to ensure engagement in the task)
- Clinicians treating patients: They will be able to incorporate daily sessions of cognitive training into their treatment programs as an adjunct to boost treatment effects
- Patients in out-patient care: Often patients, particularly those with methamphetamine addiction, relapse into drug use when released back to their home environments. Making the App available to patients when they leave the clinic will ensure that they continue to strengthen the brain processes involved in cognitive control of craving, making it more likely that they will not forget the strategies learned in the clinic
- General public: Nicotine addiction, over-eating, alcoholism, aggressive behaviour, risky sexual promiscuous behaviour etc. are common addictions concerning the general population (particularly in South Africa)

Intellectual Property

Copyright Software.

The IP creator is Samantha Brooks.

Purchase

C-Ya is currently available on iOS.

C.A.T. Rapid application for dementia screening

The C.A.T. Rapid app can be used to screen for a range of neurocognitive impairments. The app is designed to assist all levels of health care personnel, from lay counsellors to physicians to make a quick initial diagnosis. Using an Android phone's interactive touch screen a patient is taken through a number of tests, whereafter an assessment is automatically generated.

C.A.T. Rapid was released in Google App Store in February 2013. An iOS App for Apple devices is currently under development.

Benefits

- Multiple settings allow for the assessment of patients with almost any type cognitive disorder
- Highly portable, and designed for accurate use by a wide range of non-expert health personnel
- The automatically generated assessment saves time and resources

Applications

A screening tool for use by medical practitioners to assess brain disorders. A vast range of disorders can be assessed, such as: early onset dementia; Alzheimer's; vascular-type diseases; HIV-related neurocognitive disorders; and traumatic brain injuries.

Market

Hospitals, medical practices and outpatient centres.

Intellectual Property Status

Copyright software.

The IP creator is John Joska.

Purchase

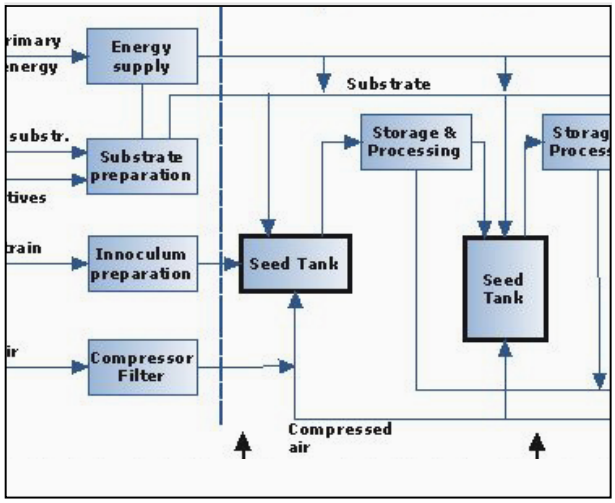
C.A.T. Rapid is currently available on Google Play store.

Bioprocess Modeller for biological processes

The CeBER Bioprocess Modeller is a holistic process flow-sheeting design tool for calculating inputs and outputs of intra- or extra-cellular systems (or for biomass growth), under aerobic or anaerobic conditions.

The Bioprocess Modeller tool is presented in MS-Excel and provides outputs that can be used for optimisation decisions, preliminary costing calculations and calculation of environmental impact, for example in life-cycle assessment.

In contrast to other established, comprehensive design packages, minimal process details are required, making this an ideal tool for users with limited Biochemical Engineering expertise.



Benefits

- Easy to use and accessible to a novice in flow-sheeting design
- The novel built-in database allows for the automatic calculation of unknown parameters based on other inputs made which allows for quick results

Market

Industrial bioprocess companies, consultants, business developers, and researchers who need material and energy balance as well as equipment sizes.

Intellectual Property Status

Type	Region	Application No	Filing Date	Priority Date
Provisional	South Africa	2008/10356	24-Nov-08	24-Nov-08
National Phase	South Africa	2009/08277	23-Nov-09	24-Nov-08

The inventors are Sue Harrison and Kevin Harding.

Purchase

Contact Research Contracts & IP Services for the package.

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