Accepted Abstracts

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Studies on fermentative production of Beta-carotene from *Phaffia rhodozyma*

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Plating of the astaxanthin-producing yeast Phaffia rhodozyma on yeast-malt agar media containing different concentration of Beta-Ionone gave colonies with yellow orange pigment after 6 to 8 days of fermentation. Isolation of Beta-Carotene producing colonies were done, followed by testing for pigment production in shake flasks, demonstrated that pigment concentration were increased two-to five fold for Beta-Carotene content compared with the parental one. It was found from our study that Beta-Carotene production was improved by addition of Beta-Ionone at concentration of about 10^{-4} and 2×10^{-4} after sixth day of fermentation. By using different carbon and magnesium source yield of Beta-Carotene content could be increased to higher level with sucrose 283.01 µg/g, ammonium sulphate (234.80 µg/g) and magnesium sulphate (218.65 µg/g)

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Algae biofuel: A global exploration for green energy

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Our dependence on fossil fuel is not going to last forever and for fulfilling the need for energy, new and renewable resources of energy need to be explored. Till date many feed stocks like sugarcane, maize, Jatropha, palm oil, Linseed oil etc. have been attempted but none of these feed stocks became a sustainable source of energy.

Algae, an autotroph is rapidly growing microorganism even under stress conditions. Besides consuming good amount of Carbon dioxide, it is capable of synthesizing carbohydrates, lipids, fatty acids and pigments through definite metabolic pathways. Use of algal strains as a potential feedstock for the production of green energy and to combat the future requirement of energy is of paramount importance and need to be addressed worldwide. Trouble shooting and hurdles in utilizing algae as feedstock for biodiesel need rectification for initiating commercial production of biodiesel.

Micro-algal biomass has been considered as the potential source of biodiesel production because of high growth rate, appreciable lipid and fat synthesis, carbohydrate etc. Biomass production in a hybrid pond system and its harvesting are of major concern to make biodiesel production cost effective. Postharvest technologies for the extraction of lipids and their trans-esterification are more important and can be executed in consortium mode with the laboratories which are already functional. Besides this, the quality and quantity of product is very important for observing techno-economic feasibility along with the least detrimental impact on the environment.

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From 25 years of inaction to a global transformation for public health

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Climate change and its adverse consequences have already exerted intense effects on diverse aspects of human life including health. The latest report recently published in the prestigious journal of the The Lancet (IF:47.8) reveals some groundbreaking findings to the scientific community for the first time. Some of the key findings presented were as follows:

125 million extra medically vulnerable adults exposed to heatwaves globally between 2000 and 2016. This builds on earlier findings showing that 1 billion additional people each year can be expected to be exposed to heatwaves by 2040.

87% of cities globally are in breach of WHO air pollution guidelines, meaning billions of people worldwide are exposed to unsafe levels of atmospheric particulate matter (PM 2.5). This is significantly higher than previously thought.

Undernutrition is identified as the largest health impact of climate change in the 21st century. Related impacts of climate change on crop production referenced in the report include a 6% decline in global wheat yields and 10% fall in rice yields for each additional 1 °C rise in global temperature.

Over one billion people globally will need to migrate within ninety years due to a rise in sea level caused by ice shelf collapse unless action is taken.

A 5.3% average fall in labor productivity of agricultural workers globally since the millennium, with a dramatic drop of 2% between just 2015 and 2016 as a result of rising temperatures. This trend threatens the livelihoods and ability of subsistence farmers to support themselves and their families.

A 46% increase in weather related disasters since 2000. $129 US billion of economic losses caused by climate related events in 2016 alone. 99% of losses in low-income countries are uninsured.

An increase of 3% and 5.9% in scope for likely transmission of the Dengue virus by just two types of mosquito since 1990. With 50 to 100 million infections of Dengue estimated to occur each year, this will exacerbate the spread of the world's highest growth disease.

It should be highlighted that the core reason behind global warming and some of the aforementioned phenomenon has been the increasing utilization of fossil-oriented energy carriers. In fact, the associated emissions have literally driven the planet Earth to an irreversible point, to an extent that if immediate actions will not be taken, the health-related accomplishments humanity has achieved over the last half a century could be undone. Expansion of the application of renewable energies including biofuels (biodiesel, bioethanol, etc.) could be regarded among the promising solutions which should be implemented to ensure sustainable development and continued health of the next generations.

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Isolation and characterization of cold lactose hydrolyzing enzyme from Psychrophilic bacteria

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Psychrophilic (cold loving) microorganisms are essential microbes for any biotechnological practices. Enzymes produced from those psychrophilic microorganisms are important in food-industry. Nowadays, lactose intolerance is becoming a serious issue around the globe and it is highly required to produce low lactose or lactose free dairy products, in addition to, till now, some psychrophilic bacteria producing beta-galactosidase have been reported, but none of them have been yet used practically in the food industry, meaning that more study is required to find better microbial source. One particularly interesting enzyme to solve such issue is beta-galactosidase which is cold lactose hydrolyzing enzyme, besides, this enzyme is potentially useful for fast lactose digestion below 20ºC, to produce lactose-free milk. Therefore, the aim of this study will be to isolate, identify and characterize beta-galactosidase enzyme from psychrophilic bacterium. Soil samples will be collected from cold areas. To cultivate the psychrophilic bacteria, soil samples will be added to Brain heart infusion (BHI; Difco Laboratories, Detroit, Mich) broth containing 1% (w/v) lactose, and will be incubated at low temperature (4°C) aerobically by shaking. Beta-galactosidase producer bacteria will be isolated by serial dilution and spread plating techniques. The bacterial isolates will be characterized biochemically by indole test, methyl red test, Simmons citrate test, catalase test, oxidase test, urease test, nitrate reduction test, starch hydrolysis test. Lactose hydrolyzing enzyme activity will be screened and determined by measuring the rate of hydrolysis lactose as substrate. The effect of temperature on the activity of cell free extracts for lactose hydrolysis will be analyzed by measuring the enzyme activity at various temperatures.

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Biodegradability of microbial synthesized Poly-β-Hydroxy-butyrate produced from *Pseudomonas aeruginosa* Dw7 local isolate

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The environmental pollution by petro based plastics a cause of concern, which are non-biodegradable. Hence biodegradable and biologically synthesized polymers with similar properties of conventional plastic are sought. Poly-β-hydroxy-butyrate (PHB) is a member of a family of polyhydroxyalkonates synthesized by numerous bacteria as an intracellular carbon and energy storage compound under nutrient-limiting conditions with excess carbon.The use of biodegradable polymers has been increasing in recent years, specifically toward various biomedical applications as these materials not only serve the desired purpose but also get eliminated from the body due to their biodegradable nature. Pseudomonas aeruginosa Dw7 local isolate was identified as PHB producing isolate in a previous study. Important properties of the product were studied.

The biodegradability studies of PHB were concluded in solid, liquid and in soil environment using the fungus Aspergillus niger which was tested for the degradation of PHB in assay agar medium as well as in liquid cultures was concluded using Aspergillus niger isolate. The contribution of A niger to the microbial degradation of PHB film in soil was studied. The clear zone around the colonies was measured to evaluate the activity of this isolate; it was determined by recording 7 mm of clear zone around the fungal colonies in 7 days of incubation at 30°C. Relatively after 12 days, PHB showed a high ability to degrade, since A niger produces the highest biomass 2.03 g/l leaving less residual PHB in the medium which recorded 16%. The results showed that 100% of degradation after 40 days indicating the high loss in PHB content in the soil as an open system. One of the promising and recently applications of PHB are antimicrobial agent. Antibacterial activity test was carried out using disk diffusion method against gram negative and positive bacteria. The results showed that antibacterial compounds of PHB which was extracted by hypochlorite solution and chloroform are active against selected bacterial isolates showed inhibition zone ranging between (8-40 mm) as indicator of antibacterial activity.

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Water purification and potential applications using hydrate gel filtration system

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Filtration plays a crucial role for provision of clean drinking water. However, many people still lack access to clean drinkable water and suffer from preventable water-borne diseases. Filtration through a low-cost ultrafiltration-range separation technology using hydrate gel had been developed which enables simple and high flux production of filtered water. This research focuses on the application of this new filtration technology using a gelatinous layer of aluminium hydroxide polyhydrate. Filtration using aluminium hydroxide hydrate gel allows efficient removal of suspended particles and microbial contaminants of 10 nm or larger in size, while small water-soluble molecules remain in the filtrate. The filter can also have potential applications in separate hydrophobic compounds such as oil, milk proteins and beta carotene effectively. In particular tests are required with the prototype prior to official certification. Flux and microbial testing have been conducted to evaluate the filtration efficiency. Analysis of filtered water with turbidity, UV254 and NPOC/TN analysis demonstrated that the hydrate gel layer worked well when increasing the gel volume and thicknesses. Among different gel types that have been used, autoclaved and aged gel showed highest flux rate and greatest filtration performance. More effort is needed to develop different prototypes and to discover possible applications to enable production of affordable, clean and safe water.

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Bioprospecting for microalgae strains with commercial applications

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The National Research Council (NRC) of Canada is currently conducting applied R&D in the microalgae biotechnology with the longer-term goal of working with industry to develop new and sustainable bioproducts from algal biomass for commercial applications. A library comprised of nearly 430 strains of microalgae, currently held at the NRC's Algal Biorefinery R&D facility in Ketch Harbour, Nova Scotia has been collected and screened for growth rate and biomass production over the past several years. The strain library is a living resource of material with potential applications in many industrial sectors including nutraceuticals/pharmaceuticals, functional foods, agriculture/aquaculture feeds, platform chemicals, soil products/fertilizers among others. With the aim of supporting commercialization of value-added products of microalgal origin, we have undertaken a strain-by-strain biochemical characterization of the library using custom solvent extraction and fractionation methods followed by separation and metabolite analysis by HPLC linked to high-resolution mass spectrometry. These data are processed and compiled into 'factsheets', each one of which provides a high-level overview of the general macromolecular composition of that particular strain and includes amino acid and triacylglyceride profiles, intact lipid class analysis and pigment composition in addition to other primary data. This approach will be discussed within a bioprospecting context in the search for the best 'fit-for-purpose' strains for targeted industrial applications.

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Practical response for volatile fuel spills on water (or land)

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Most published doctrine for diesel, gasoline or jet fuel spills on water is the simple recommendation that nothing can be done because the contaminant is light and spreads immediately, and the volatile compounds vaporize off over the next minutes or hours. The reality is that dispersed fuel like diesel can coalesce into droplets and travel with wave action. It can also adhere to suspended sediments which can then settle to the seafloor. And after the lighter constituents vaporize, compounds left behind are concentrated toxins. In areas where contamination is ongoing like a fuel station near a shoreline where sediment is more prevalent, the contamination can be measurable.The prevalent thinking is that indigenous microbes can remediate residuals in one to two months so damage is not likely to be persistent. This thinking, however, can be countered by the fact that these fuels are exquisitely and acutely toxic to flora and fauna, especially in shallow or shoreline areas. Die-off is fast and furious at a micro and macro level. There is currently a high acceptable level of loss of life by regulatory bodies, yet the authors of this report have proven that die-off can be significantly mitigated with timely intervention.

A broad-spectrum, adequately concentrated hydrocarbon-degrading natural exogenous microbial consortium can be ready for immediate deployment to remediate the spilled volatile contaminant. In addition to protecting a higher percentage of flora and fauna from toxins, health benefits would also be realized by the humans in the vicinity since fumes would be eliminated very quickly.Microbes that eat oil and petroleum distillates work at the surface level – the interface where oil molecules are accessible, and water and oxygen are also readily at hand. Since diesel and gasoline are so light and thin, the microbes easily devour their way right through it. The odors are gone almost immediately after the biotreatment contacts the spill. And the microbes attach to the petroleum molecules and follow them wherever they go – a significant benefit where strong currents spread a plume. The microbes stay attached until the pollutant is consumed – metabolized at the molecular level.

Tactical methods of treatment will be discussed through scenario-based drill examples, including 1) typical spill types (example, ongoing fuel dock drips and spills) 2) application methods (example, surface spreading, and/or mix and spray) and 3) challenging scenarios (example, contaminated water with fast-moving currents, fouled beaches or rocky or vegetated shorelines.) 4) methods for soil and hard surface spills can be addressed as well, given the close parallels.

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Engineering renewable carbon to bio-based products

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Increased use of bio-based products has the potential to accelerate the shift towards a sustainable economy with reduced dependence on fossil based carbon and reduced CO2 emissions. Many countries through International Energy Agency (IEA) Bioenergy Task 42 and Mission Innovation initiatives have targeted development and deployment of integrated bio-refineries for producing sustainable bio-based products using renewable sources of carbon. Renewable carbons can be a combination of first generation (food derived), second generation (non-food derived), third generation (non-land use change) and fourth generation carbon that can be channeled for production of bio-based products for use as food, feed, fuels and materials. The world has substantial amount of under-utilized renewable carbon in the form of non-fodder agricultural wastes and other wastes such as municipal solid wastes, municipal liquid waste and industrial waste that put together have the potential to fully substitute all fossil carbon requirements. Sustainable technology platforms have been designed at DBT-ICT Centre for Energy Biosciences, India using a smart combination of chemical processes and biological routes that can convert different renewable carbons to value added bio-based products. The bio-based products include food and feed products, wellness products, chemicals and polymer precursors. The talk shall address the technological roadblocks that need to be overcome to render the bio-based products techno-commercially viable and environmentally sustainable.

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Innovative enzyme applications in oils & fats processing

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Biotechnology has enabled the cost-effective production of a variety of enzymes that improve processes and final products for a number of industrial producers.

In this presentation, an overview of enzyme discovery and product development from screening of microorganisms in nature to final products will be provided. In the oils and fats industry, enzymes are now a standard processing aid in a number of production processes, this presentation will discuss how:

- Lipases have been and are currently used for specialty fats products, like CBE and infant milk replacers,
- Lipases are used in the production of margarine and shortenings enabling production without the formation of trans-fatty acids,
- Phospholipases remove phospholipids from oils ensuring high processing yields and improved process economy in vegetable oil refining,
- Lipases are aimed to revolutionize the biodiesel industry, and
- Cellulases will improve production yield in palm oil processing

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