Investigate the fibre processing methodology for alpaca Industries for quality products

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ABSTRACT Alpaca fibre has potential uses in textile and fashion field as a specialty luxurious fibre for high end garments. For such applications, the alpaca fleece needs to be processed to produce a clean, high quality, fine, uniformly sized fibres based products such as roving and yarn. Prior to processing mechanically in the mills the fleece were cleaned, washed and dried for further studies. In this processing investigation alpaca fleece washed with consumer detergents combining with dehumidification drying enhanced the fibre processing with respect to opening, carding, and spinning and improved the quality of the roving and yarn in terms color, glossiness, and strength. Alpaca fleeces were processed using Belfast Mini-mills fibre processing equipments. The alpaca was processed through a series five machines to produce the fine, clean, and uniform fibres required for a textile industries. It is also found that proper processing steps reduce the wastage (<10%) of fibre during processing. Impact of the proper fibre handling produces good quality product (roving, yarn). The processing of alpaca fibre is a very important for sustainability of alpaca industries in Canada. The challenges faced by the alpaca producers are due to lack of processing facilities and knowledge

Keywords: Alpaca fibre, storage, fibre processing, environmental stress, Packaging
Dehumidifying drying of alpaca fibre and its impact on processing

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ABSTRACT Drying is very sensitive practice to maintain the proper quality with respect to strength, color, and glossiness of the alpaca fibre. Alpaca fibre needs to be washed and dried prior to mechanical processing. The main component of the alpaca fibre is a protein called Keratin, which is heat sensitive and a biopolymer. It is important to dry the washed fibre in such a way that the internal and external structure of the fibre should not be damaged. It is also important not to dehydrate the fibre by taking out the internal water molecules present in the structure to avoid the shrinkage of the fibre. Many of the processors are adopting a wool drying methodology for alpaca fleece; however, the surface characteristics differ for each other. No information for standard and effective drying process is available for better drying of washed alpaca fibre. Therefore, an attempt has been made to develop a simplified drying system. Alpaca farming is emerging industries in North America, generally taken care by female farmers. Farmers can wash, dry and store their fleece prior to sending for processing to mills in Canada. An attempt has been made to dry the fibre with dehumidifying drying system involving a dehumidifier. It was found that drying temperature in between 35 to 500C is suitable to dry the alpaca fibre without damaging the surface characteristics. The dried fibre was found suitable for processing in Belfast mini mills to produce batting, roving and yarn.
Keywords: Alpaca fibre, drying, fibre processing, dehumidifying
Investigate the shrinkage of polypropylene based biocomposite manufactured through injection molding process

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ABSTRACT Flax fibre reinforced with thermoplastic to form biocomposite. It has high strength and stiffness, non-toxicity, low density and biodegradability. The objective of this work is to investigate shrinkage of polypropylene based biocomposite manufactured through injection molding process. The flax fibre was chemically treated with alkaline and silane and then blended with injection molding grade polypropylene in a twin screw extruder to produce biocomposite granules. The biocomposite granules were processed by using an injection molding machine to make the samples. The injection molded specimens were used to investigate the shrinkage of biocomposite injection molded product. Shrinkage test is to measure shrinkage from mold cavity to molded dimensions of the biocomposite when molded by injection molding processes. Shrinkage also depends on the orientation of flax fibre. Shrinkage mainly happens when thermoplastic injected into a mold it undergoes to high temperature and rapidly cool down by circulating water. This test measures the shrinkage between 24 to 48 hrs. Shrinkage rate of biocomposite has evaluated by lab experiment. 5 % fibre based biocomposite demonstrated (0.01 to 0.042 %) low shrinkage rate which is acceptable composite industries.

Keywords: flax fibre, injection molding, biocomposite, shrinkage
A novel use of a commercial liquid dielectric fixture in investigating temperature dependence of grain permittivity

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ABSTRACT Research on temperature dependence of permittivity (ε) of bulk grains at radio and microwave frequencies is very limited. There is also a need of an accurate but simple dielectric measurement device for the particulate materials. This work exploited a commercial device especially built for dielectric measurement of small volume of liquid for the first time to measure the ε of larger bulk wheat samples at temperatures between 15°C and 75°C. The integrity of the device with increased volume was tested by measuring the ε of regular and increased volume for low loss to lossy media. The percentage difference varied from 3.4% to 7.3% for the dielectric constant (ε′), and from 0% to 5.4% for the dielectric loss factor (ε″), which were well within the measurement uncertainty of the device (≤ 25%). The ε′ of the wheat increased almost linearly with temperature, and varied between 3.82 and 5.95, and the ε″ increased non-linearly with temperature with values between 0.07 and 0.93. Regression models predicted ε′ and ε″ of the wheat with RMSE of 0.14 and 0.03, and R2 values of 0.97 and 0.99 respectively.

Keywords: Permittivity, temperature dependency, dielectric constant, dielectric loss factor
Artificial Neural Network in predicting the extraction yields for anti-cancer compounds

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ABSTRACT Artificial Neural Networks (ANNs) were used to predict the extraction yields for the anti-cancer compounds, Saponins from the particles of Saponaria vaccaria L seeds (particle size = 0.297 mm to 0.840 mm; moisture content = 15.35% to 61.40% d. b.). A total of 120 extractions were prepared from the factorial design with four levels of methanol concentrations (MeOH), 30%, 50%, 70%, and 90% (vol., aq.) and three levels of temperatures (T), 30˚C, 45˚C, and 60˚C at ten extraction interval times (t) between 1 and 180 min. A calibration equation developed as a part of this work using the known mass of the "standard" Saponins, and their corresponding liquid-chromatogram-mass spectroscopy (LC-MS) peaks was used to quantify the extract yields. An ANN based upon error back propagation algorithm and Bayesian regularization with three inputs, MeOH, T, and t predicted the extraction kinetics and the saponins yields, in general, with less than 12% error. It also slightly outperformed the complex diffusional model (DM) in predicting both the yields and the extraction kinetics based upon the MSE and R values making the prediction simple, and faster at the same time eliminating the estimation of the partition coefficient and the effective diffusivity required for DM. Therefore an ANN can be a simple tool to predict the saponins yields, and may have same potential for the predictions of other pharmaceutical and nutraceutical products with satisfactory accuracy and speed, which otherwise would be very time consuming and tedious.

Keywords: Saponaria vaccaria, diffusion model, ANN
Radio frequency selective heating in controlling stored-grain insect at 27.12 MHz

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ABSTRACT Dielectric selective heating of rusty grain beetle in the bulk wheat samples was investigated using a RF heater at 27.12MHz. Temperature non-uniformity was observed. When the temperature at hottest spot (C), TH was at 80°C, all the adult insects were found dead at the coldest spots (B) at 50.7°C to 56.0°C. The larvae placed at C were completely destroyed at temperatures between 55°C and 60°C. The complete mortality of all life stages of the insect was achieved at TH = 80°C. The temperatures of the insect-slurries higher than that of the bulk wheat by 0.8°C to 15.1°C indicated the selective heating of the insects. The wheat MC had only a marginal significance on the mortalities. The delayed mortalities during the quarantine period were almost the same as the immediate mortality. The RF treated wheat kernels at 12% MC exhibited a better germination while it was reduced by 2% to 33% for the kernels at 15% and 18% MCs. The temperatures had no significant effect on the falling numbers, and the yields of flour, bran, and shorts, and the peak-bandwidth and the wheat MC, and the flour protein values. The changes on the means of the mixing-development-time were insignificant for the wheat at 12% MC. The mean-peak-height and the color values varied between 4% and 16%, and 3% and 6%. The uniform temperature of 60°C should be enough to control all life stages of the insect completely with negligible changes in the wheat qualities.
Keywords: Pest insects, mortality, selective heating
Ultrasound-assisted extraction of polysaccharide from dried biomass of Sargassum muticum

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ABSTRACT The study was aimed at ascertaining the various factors and experimental conditions affecting extraction efficiency and polysaccharide yield from dried biomass of Sargassum muticum using ultrasound-assisted extraction. The different factors investigated include sample size, nature of solvent, solid-solvent ratio, sample pre-treatment, particle size, solvent composition, ultrasonic horn types, horn immersion depth, extraction time, electrical acoustic intensity and temperature. Factors positively affecting the extraction outcome were identified as sample size, solvent composition, horn type, horn immersion depth, extraction time and amplitude. Selection of 0.03 M HCl solution as extractant played an important role in improving extraction efficiency. Two-stage extraction is found to have an advantage over single-stage treatment leading to improvement in extraction yields. Pulsed ultrasound treatment was found to be highly effective as opposed to continuous treatment. Optimization of the factors led to the development of a rapid, highly effective, low-solvent consuming, energy-efficient approach, yielding 24.83 ± 1.28 g% (on dry weight basis) of the polysaccharide which is at least 3.5 times higher than the reported yields of 7 g% on dry weight basis. Extraction yields, extraction time and solvent volumes were compared with conventional extraction technique. Conventional extraction technique employing hot reflux yielded 11.08 ± 0.78 g% (dry weight) of the polysaccharide after three cycles of treatment.
Keywords: Ultrasound, polysaccharide, sargassum, pulsed ultrasound, two-stage extraction, efficient
Optimization of ultrasound-assisted extraction of fucoxanthin from dried biomass of Sargassum muticum

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ABSTRACT Factors influencing the yields of fucoxanthin extracted from dried biomass of Sargassum muticum by ultrasound-assisted extraction were investigated, identified and optimized. Particle size and sample size were found to significantly influence extraction of fucoxanthin. GRAS solvent was selected instead of non-polar solvents like ethyl acetate, chloroform and solvent composition of 70% (v/v) ethanol was found to give better yields. Pulsed ultrasound treatment was found to be highly effective in improving fucoxanthin yields. 1:5 (w/v) solid-solvent ratio subjected to two-stage treatment yielded high extraction efficiency over single stage treatment. Optimized extraction conditions are: particle size (1 mm), sample size (2500 mg), solvent composition (70% v/v ethanol), pre-treatment (60°C for 45 min), ultrasonic horn type (H3), horn immersion depth (0.5 cm), temperature (80°C), treatment duration (1 s on -1 s off for 10 minutes), amplitude (78 W) and solid-solvent ratio (1:5 w/v in g/ml). Fucoxanthin obtained from dried biomass of Sargassum muticum using the ultrasound-assisted extraction technique is 613.6 + 9.1 µg/g on dry weight basis. To the best of our knowledge, there are no reports regarding the extraction of fucoxanthin from brown algae using ultrasound-assisted extraction. The optimized method is a novel, simple, economical, energy-efficient and promising approach to
Keywords: Ultrasound, carotenoid, fucoxanthin, pulsed ultrasound, two-stage extraction, energy-efficient
Cassava peeling using a combination of chemical and mechanical methods

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ABSTRACT In an attempt to address the challenge of Cassava peeling, two chemical dips (solutions of a base and an acid) were used to loosen the peels of the root (TMS 30572 variety) and a rotary brushing machine which is expected to remove the loosened peels of the roots was designed. The optimal concentration temperature and time of root immersion in dilute sodium hydroxide (NaOH) were obtained as 15%, 600°C and 20 minutes respectively. The roots were dipped in dilute hydrochloric acid (HCL) also at corresponding concentration, temperature and time to neutralize the effect of the base. The results were used as a basis for the design of the rotary brushing machine. The machine consists of the following: a hopper, a conveyor, a peeling chamber, a rotary brush, a slited and inclined tray, a collection tray a transmission system and a 2Hp engine. The percent moisture content of the roots was obtained as 55.96%. The capacity of the machine based on design calculations employed was estimated as 44,064Kg / day.

Keywords: Cassava, peeling, mechanical, chemical, machine
Monitoring of Moisture and Inorganic Contents of Forest Harvest Residues in Alberta’s Boreal Forest for Production of Fuels and Chemicals

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ABSTRACT In Alberta, the trees are cut in the stand, skidded to the roadside and are delimbed at the roadside. The branches and tops which are generated during delimbing of trees are piled up and burnt to prevent forest fire. These forest residues biomass can be used for production power, fuels and chemicals and substitution of the fossil fuel feedstock. However, high moisture content contributes significantly to the high transportation cost as it increases the bulk density and reduces the calorific value. Inorganic contents present in the forest residues have a detrimental impact on the combustion and gasification, causing slagging and fouling of the furnace walls and heat transfer surfaces. This two year research is aimed at measuring the variation in inorganic and moisture contents of forest harvest residues and development of rigorous analytical models. The models forecasts the inorganic and moisture contents under different combination of climatic variables and helps in determining the optimum time during the year to move the residues from the forest. These experiments are based on monitoring of few forest residue test piles developed in Alberta’s boreal forest for this study. According to the results obtained so far, late September is the best time to transport the residues. Currently, we are developing the data-intensive models to correlate moisture and inorganic contents with time, temperature, humidity, and precipitations.
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Pipeline Hydro-Transportation of Agricultural Biomass: An Experimental Study

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ABSTRACT Pipeline hydro-transport of agricultural biomass (e.g. straw, corn stover) to a biorefinery has a significant potential of reducing the cost of transportation. This concept includes transportation of a slurry of chopped biomass mixed with water through a pipeline. It is a favorable method than trucking as it has lower cost of transportation due to economy of scale benefits and it also helps in reducing traffic congestions. A 25 m long closed-circuit pipeline system with 2 inch diameter pipeline has been designed and fabricated to experimentally study the pipeline transportation of biomass materials. The methodology of this study includes chopping of agricultural feedstock material, classification of the chopped material according to sizes, mixing of the classified material with water to make slurry, pumping of the slurry and measurement of the characteristics of the slurry flow in the pipeline. This paper aims at studying the mechanical behavior of biomass slurry for two types of feedstock (i.e. straw and corn stover) at various slurry concentrations, flow rates and biomass particle sizes. This further involves developing corresponding pressure drop correlations, analysis of the power required to hydro-transport the feedstock and studying the effect of long-time exposure to water on chemical characteristics of agricultural biomass during transportation through pipeline. Outcome of the present research would not only enable the large scale biorefinery to become economically viable, but would also develop a comprehensive mechanical and chemical biomass slurry behaviour database for future applications.

Keywords: Pipeline transport, biomass, agricultural residue, biorefinery, transportation cost
BIOMASS COFIRING WITH COAL: A REVIEW

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ABSTRACT Biomass based energy is slowly becoming an attractive choice as fuel as it helps in mitigating greenhouse gases (GHG), nitrogen oxide and sulphur oxide emissions. Biomass can be used in association with coal in the combustion technology through a process known as biomass cofiring. This process involves the simultaneous combustion of biomass and coal in existing coal-fired boilers or purpose-built combustion systems. Biomass acts as a supplemental fuel, and it can substitute for up to 20% of the coal used in the boiler. Both agricultural and forest-based biomass feedstocks found in abundance in Western Canada can effectively be used for combustion along with coal. This comprehensive review investigated several aspects associated with biomass cofiring alongside coal in coal-fired boilers such as the composition of biomass, its availability and transportation to the power plant, as well as the techno-economic, environmental and social impacts of biomass co-firing. It assessed the cost-saving and energy-saving aspect of the cofiring technology. It also explored the extent of benefits obtainable such as the reduction of GHG emissions and its implications in Canada. Finally, the prospects of biomass as an important fuel source for power generation through co-firing were considered especially in relation to the future of fossil fuels and the policies regulating the entire energy industry in Canada.

Keywords: Biomass, Coal, Cofiring, Combustion, Emission, Power Generation, Renewable Energy, Techno-economic assessment
Investigation of a mini hybrid system of energy renewable solar – biomass for the electricity generation

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ABSTRACT In this work, the mini solar biomass hybrid system for the energy production study was numerically investigated to predict its static behaviour and improve its performances. It was composed of three subsystems including the solar fields, the hot air turbine cycle and the steam turbine cycle. The air-standard Brayton concept was used for the hot air turbine cycle and the Rankine concept was applied for the steam turbine cycle. For the operating of the solar biomass hybrid system, four different periods of the year were selected that include the behaviours of January during the day, January during the night, July during the day and July during the night. Additionally, ten different types of biomass used as a fuel in the combustor were experimentally characterized to determine their rates of humidity, ashes, chemical composition and caloric power. Computer program was developed using the Microsoft excel 2010 to determine different system parameters. The results obtained demonstrate that, among other things, the compressor pressure ratio, the air temperature at the hot air turbine inlet, the steam temperature at the steam turbine inlet, the biomass chemical composition, the mass flow rate of the coolant fluid, the ambient conditions affects the performances of the solar biomass hybrid system in a strong yet different
manner. To valid the developed approach, the results of numerical simulation were compared with the results published in the scientific literature.

**Keywords:** Solar energy; Biomass; Combustor; Hot air turbine; Steam turbine; Modeling and Simulation
Preliminary Results of a Research Program
Evaluating Polyurethane Structural Insulated Panel Load Performance

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ABSTRACT Structural Insulated Panels (SIPs) are an alternative building envelope system to conventional stud wall and roofs in commercial and residential construction. SIPs are considered a composite material as they are made of two Oriented Strand Boards (OSBs), metal, cement or plywood as facings and a foam core. The foam core acts as insulation material and is bonded to the skins to form a structural element. The foam core is usually made of expanded polystyrene (EPS), extruded polystyrene (XPS) or polyurethane (PE). SIPs are made in variety of sizes with 1220 x 2440 mm (4’x’') being the most common size. Panel thickness ranges from 100 mm to 300 mm (4” to 12”). Construction with SIPs is faster, insulation properties are better, their load-carrying capacity is greater than conventional stick-frame construction and a tighter building envelope. Although SIPs have been used in the construction industry since the 1950’s, they didn’t fully attract the construction industry’s attention until the 1980s. Design engineers and regulatory authorities need information on structural capacity, thermal performance and durability. This paper presents results to date of a research program being carried out at the Alternative Village at the University of Manitoba. The focus of this research is on creep performance and the effect of debonding on the structural performance of polyurethane SIPs. The paper will discuss results of full scale structural testing and preliminary results of debonding studies.

Keywords: Structural Insulated Panels (SIPs), polyurethane, creep, debonding
Modeling Effect of Climate Change on Water Resources in Southern Ontario

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ABSTRACT  The growing evidence of climate change has posed challenges to environmentalists and general population around the world. The climate features which could have possibly changed are shorter winter, warmer annual average temperatures, and heavy rainstorms in summer. This study has been conducted to evaluate the effect of climate change on quantity and quality of stream flow by using Soil and Water Assessment Tool (SWAT) for the Silver Creek watershed, Ontario. The historical data (1970-2000) and future climatic data (2015 to 2044) were generated, using future A2 scenario. Techniques of SWAT calibration and validation for stream flow and water quality are developed and discussed, with particular attention paid to snowmelt, land cover factors, and soil type input values. The preliminary results show that future stream flow may have longer low flow periods extending from summer to fall, and severe annual water supply deficits may be possible for portions of the year in the 2030s. As a result, sediment transport capacity of reaches may decrease, and thus in-stream sediment deposition may be a concern causing increased bed levels in streams. Also, the future simulation results indicate that evapotranspiration is expected to increase resulting in reducing the amount of surface runoff. Also, an increase in future base flow shows that stream flow would be more dependent on groundwater contribution. In addition, the summer stream flows are not expected to increase in future due to climate change. The simulation of sediment and nutrient is in process and will be presented in the conference.

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Keywords: modeling, climate, water management, pollutant
Non-invasive quality assessment of agricultural products

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ABSTRACT Pervasive deceases crisis due to pernicious agricultural products make scientists to introduce and develop the modern methods of controlling the quality of food, feed, fiber, and environment that are impressed by agricultural practices and influenced the quality of mankind life. Site-specific management of agricultural inputs, as in-farm stage of quality control, contributes in providing a sustainable and environmental friendly method of production, while post-harvest treatments are the final gates of controlling the supply of the products to the markets and, consequently, consumers. There are a lot of methods that have been innovated to assess the quality of agricultural products which are categorized typically into destructive and non-destructive methods. In this paper, non-invasive methods, as special non-destructive methods of product assessment, are described in details. Methods which are based on application of spectrometry, acoustic and ultrasonic methods are detailed here as non-invasive assessment of agricultural materials.

Keywords: quality assessment, acoustic, agricultural materials, spectrometry, ultrasonic
Innovative Air Treatment Unit for Swine Exhaust Air – Commercial-Scale Tests

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ABSTRACT Swine housing facilities can emit substantial amounts of aerial contaminants, such as ammonia, dust and odour. These emissions can have a significant impact on both the environment and human health. It is also known that by reducing odour emissions, producers can improve their relationship with their neighbors. In this study, a commercial-scale swine exhaust air treatment unit (ATU) was developed and tested under real barn conditions for its effectiveness to reduce the emissions of ammonia, dust and odour. Results from laboratory-scale tests carried out at the IRDA facilities in Québec were used to design the commercial-scale ATUs. Three of these units were then built using recycled shipping containers and retrofitted to three grower-finisher rooms at the barn facility of Prairie Swine Centre Inc. in Saskatoon, SK. Each room was filled with 60 pigs and the exhaust air was ducted to an ATU. During the 12-week trial, samples were taken on a regular basis to monitor concentrations of ammonia, dust and odour before and after each ATU. After a
short start-up period, the commercial-scale ATUs provided robust and consistent performance under real barn conditions. The average removal efficiencies obtained during these tests were 77%, 92% and 75% for ammonia, dust and odour, respectively. However, the results for odour removal were variable with the replicates and with time. The water consumption, used to maintain performance over the duration of the trials, tended to increase as the ATU removed more contaminants from the air.

**Keywords:** air treatment; swine odour; ammonia; biotrickling filter
Innovative Air Treatment Unit for Swine Exhaust Air – Laboratory-Scale Tests

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ABSTRACT The swine industry is important both worldwide and in Canada, but swine production sites can emit substantial amounts of aerial contaminants. Since it is not possible to completely remove the contaminants within the confined animal space, the only remaining option is to treat the exhaust air. Biotrickling filters, such as the air treatment unit (ATU) developed at the IRDA, have the potential to treat these emissions. The main objective of this study was to test the effect of certain operating parameters on the performance of the ATU for the treatment of swine exhaust air. Six cross-flow BTFs were used to treat the exhaust air from bench-scale chambers housing four grower-finisher pigs up to 85 kg over six seven-week trials. The effect of the type of packing material (structured and random), the air residence time (3, 6 and 9 seconds) and the nutrient solution recirculation rate (2.15 and 4.31 m3/m2/h) were tested and replicated three times. Results show that the ATUs were able to reduce ammonia and odour emissions by up to 68 and 82%
respectively. The ATUs had no effect on methane or carbon dioxide, but a little nitrous oxide was produced. The different operating conditions tested had little influence on removal efficiencies indicating that the system was probably oversized. The drop of performance over time was overcome by periodically replacing part of the nutrient solution with fresh water. The results from these experiments were then used to design commercial-scale units.

**Keywords:** air treatment; swine odour; ammonia; biotrickling filter
Use of Swine Manure Dry Matter Content to Predict the Concentration of other Nutrients during Field Application

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ABSTRACT  Proper field application of manure requires precise knowledge of the nutrient composition of the manure. Current legislation in Québec ensures that swine producers determine the composition of their manure before field application. The use of equipment for rapid measurement of the manure composition during field application seems to be gaining in popularity. This type of technology could ensure that the manure is applied in agreement with crop requirements and the capacity of soils. Rapid measurement methods found in the literature are often based on the analysis of a single parameter such as the density of the manure or its dry matter content. The purpose of this research project is to evaluate the possibility of replacing typical laboratory analysis methods used to characterize the manure composition by a simple method for use directly in the field. A literature review was first conducted to identify available methods for determining the composition of manure and to outline possible correlations between physical parameters and the chemical composition of manure. A model was then developed to establish a
correlation between nutrients in manure (nitrogen, phosphorous, potassium and other micronutrients) and the dry matter content. To realize the second objective, 90 manure samples were collected and analyzed. 60 samples were used to establish the relationship between dry matter and different nutrients and the following 30 samples were used to validate the quality of the calibration. This paper will present the results from the literature review and the modeling study.

**Keywords:** manure characterisation, method, field application
Optimization of FT-IR Spectrometer and Sample Preparation to Study the Effect of Microwave Treatment of Pulses

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ABSTRACT Exposure of pulses to microwaves has proved to be a good method for disinfestation and to reduce cooking time. However, not much work has done to determine the effect of microwave treatment on the nutritional changes in pulses. The goal of this research project was to study the effect on nutritional quality of pulses exposed to microwaves as a pretreatment before
cooking. Fourier transform infrared (FT-IR) absorption spectroscopy (using KBr and pelleting method) was selected as the method to determine the nutritional changes in control and microwave treated pulses. FT-IR is one of the sensitive and advanced techniques to determine nutritional changes (protein, lipids, and carbohydrates) in common food products. In this poster, we describe the critical instrumental parameters and optimization of sample preparation to compare control and microwave treated pulses. Different parameters like pellet thickness, sample or KBr particle size, sample concentration, pressure applied during pellet making, and aperture size of IR beam were considered and their effect on the data quality will be discussed.

**Keywords:** microwave, pulses, FT-IR, KBr pellets
Detection of Ochratoxin A in Wheat using Near-Infrared Hyperspectral Imaging

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ABSTRACT Ochratoxin A (OTA) is a toxin produced by the fungus Penicillium verrucosum in cereal grains. Ochratoxin A is potentially carcinogenic, immunosuppressive, hepatotoxic, mutagenic, nephrotoxic, and teratogenic. The detection of contaminated grains as rapidly as possible and with high accuracy is very important to avoid potential food safety issues. A near-infrared hyperspectral imaging system has the potential to differentiate the OTA contaminated grains from healthy grains within a short period of time. The Canada Western Red Spring wheat grains were artificially contaminated by P. verrucosum and analyzed for OTA. Then two different levels of OTA and OTA-free kernels were chosen and subjected to single-kernel imaging using a near-infrared camera in the wavelength range of 1000 to 1600 nm at 60 wavelengths spaced 10 nm apart. The statistical features from the images were obtained using a code written in MATLAB and were classified using linear and quadratic statistical classifiers. The classifiers provided a maximum classification accuracy of 99% for healthy vs. OTA contaminated samples and a misclassification of 20% for the two levels of OTA contaminated samples.
Keywords: Near-Infrared Hyperspectral Imaging, Ochratoxin A, Statistical classifiers
Investigation of Biofilms Using BioNanotechnology

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ABSTRACT The World Health Organization has identified antibiotic resistance as 1 of the 3 greatest threats to human health. Antibiotic resistance of methicillin-resistant Staphylococcus pseudintermedius (MRSP) is a concern in animals, both from animal health and public health standpoints. Understanding cell-cell interaction, cell surface recognition and cell binding is essential for detection and susceptibility profile development, and therapy relating to infectious disease, cancer, and many others. The application of microfluidics in quantifying bacterial parameters is ideal allowing for the analysis of single-cell or population dynamics in laminar flow with high throughput, and efficiency. The in-situ observation of the antimicrobial susceptibility of biofilms using the microfluidic platforms were carried out using a combination of microfluidics and imaging techniques. Investigations of susceptibility of microfluidic biofilms to fosfomycin and clarithromycin and comparison with their minimum inhibition concentrations obtained from the conventional microtitre plate assay reveals fosfomycin is an effective antibiotic candidate for controlling MRSP biofilms. An effective microfluidic wound model was developed using the microfluidic systems. Nanoscale morphology analysis of fosfomycin treated MRSP biofilms using Atomic Force Microscopy reveals surface damage and cell wall disruption. Significant variations in the height of AFM images of the fosfomycin treated biofilm samples in comparison with the control samples attributes to extensive cellular damage and effective diffusion of fosfomycin inside the cells. Single cell bio-analytical microanalysis approach using microfluidics enhances our understanding of the multi-drug resistant cell’s susceptibility to diseases and treatment due to the spatial localizations of cell surfaces and its effect on the antibiotic agents.
Keywords: Biofilms, Microfluidics, Atomic Force Microscopy, MRSP, Staphylococcus, Veterinary Medicine
Performance Evaluation of a Small Agricultural Tractor on Bangkok Clay Soil

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ABSTRACT To improve the prediction of tractive performance of tractor under different surface condition, it is important to find out the best model for specific condition. There have many empirical to theoretical model to predict the performance of a tractor among which most of the models are suitable for dry condition. Moreover there is no specific model for wet condition of soil which is essential for rice production. The aim of this research was to investigate the tractive efficiency of a small agricultural tractor on Bangkok clay soil under wet condition and two different soil surfaces. Four torque transducers were developed and assembled to the four wheel of tractor to measure the wheel force. Furthermore four pulse sensors on individual wheels and load cell on drawbar pull were used to measure wheel speed and drawbar pull. During field test wheel slip was recorded from dynamo, which was attached with the front wheel of loaded tractor. Seven existing models were evaluated with field data to get the appropriate one for the wet field condition. Among these model, test data from drawbar pull match with Gholkar method and test wheel thrust data with GeeClough method. Coefficient of rolling resistance was found higher on the bare surface.
compared to the grassy surface. Net traction ratio, tractive efficiency and drawbar pull was higher on the grass surface.

**Keywords:** Traction, tractive efficiency, rolling resistance, thrust, drawbar pull, Bangkok clay soil
Microbial community shifts during anaerobic co-digestion of ethanol waste and dairy manure

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