
Abstract A novel electrochemical glucose biosensor was developed by depositing an ionic liquid (IL) (e.g., 1-ethyl-3-methylimidazolium trifluoromethanesulfonate; [EMIM][Otf]), ZnO nanoparticles (ZnONPs) and eggshell membrane (ESM) on a modified glassy carbon electrode (GCE) for determination of glucose. Glucose oxidase (GOx) was covalently immobilized on eggshell membrane with glutaraldehyde as a cross-linker. Methylene blue was used as a redox indicator to enhance the electron transfer capacity and to ensure stability of both the oxidized and reduced forms in the reaction of enzyme and substrate. The morphological characteristics of microstructures eggshell membranes, chitosan, GOx/ESM, GOx/ZnONPs/IL/ESM and GOx/ZnONPs-IL/CHIT were observed using scanning electron microscopy (SEM). The effects of scan rate, time and pH on the response of glucose biosensors were studied in detail. Under optimal conditions (pH 6.5, 50 s), cyclic voltammetry showed different glucose concentrations on the range of $1 \times 10^{-12}$ to 0.6 M, with a detection limit of $1 \times 10^{-13}$ M. The GOx/ZnONPs/IL/ESM was found to be more sensitive as compared to GOx/ZnONPs-IL/CHIT. This developed glucose biosensor detection approach has several advantages such as fast, simple and convenient method, sensitivity, low cost, eco-friendly, low concentrations and remarkable catalytic activities of current signals during glucose reaction.


Abstract Objective To find out the effect of wheat grass on aluminum induced Alzheimer's disease in Wistar rats. Methods Memory impairment was induced by aluminum chloride (4.2 mg/kg, i.p.) for 28 d. Memory function was assessed by Morris water maze test. To study the activity of wheat grass (100 mg/kg, p.o.), Wistar rats were administered it for 28 d along with aluminum chloride. Biochemical parameters of oxidative stress were estimated in brain after the treatment. Results The major finding of this study is that aluminum enhanced oxidative stress. Wheat grass showed a significant improvement in reduction of this oxidative stress by reduction of malondialdehyde levels and enhancement of superoxide dismutase and catalase levels. Conclusions The present study clearly demonstrated the beneficial effects of wheat grass that shows good antioxidant properties, and this remarkable effect of wheat grass may act as a key to treat Alzheimer's disease.


Abstract Nanozeolite NaX ion exchanged with different transition metals (Mn2+, Cu2+, Co2+, Zn2+, Ni2+) was used as a solid support for the
immobilization of the lipases of Thermomyces lanuginosus (TLL) and Rhizomucor miehei (RML). The nanozeolite–enzyme complexes were used as heterogeneous catalysts for the transesterification reaction of palm oil to fatty acid ethyl esters (FAEEs). The most relevant results were obtained with the T. lanuginosus enzyme immobilized on nanozeolitic supports ion exchanged with Ni2+. Although these zeolitic supports were able to immobilize a relatively small amount of the enzyme (43.7%) in comparison with the other nanozeolitic supports, the FAEE yields obtained with Nano-X/Ni/0.5 M-TLL complexes were above 94%. These results revealed an unusual synergistic effect between the T. lanuginosus enzyme and the nickel ion-exchanged nanozeolitic support; this effect was not observed for the complexes prepared with the R. miehei enzyme. Bioinformatics calculations were performed for both enzymes by taking into consideration the crystallographic structures of the enzymes and the zeta potential of the surface of the nanozeolitic supports. By combining calculations of the protein electrostatic potential surface and normal mode analyses in a model, we were able to propose an explanation for the synergistic effect between the lipases and the nanozeolitic supports. The synergistic effect could be explained through an allosteric mechanism describing the interaction between aspartic acid residues 102 and 158 of the T. lanuginosus lipase and the positively charged zeolitic support surface. This interaction results in the stabilization of the opening of the enzyme lid and leaves its catalytic triad permanently exposed to the reaction medium.

Abstract The rapidly expanding sector of nanotechnologies has applications in every industrial sector. The production of food of animal origin recognizes several possibilities for technological development through the use of nanomaterials, at animal farming, food processing and product storage levels. Direct use of nanomaterials during these production stages, as well as the uptake from the environment, can lead to the presence of such materials in the final product. In this context analytical methods for the detection and characterization of nanomaterials in complex food matrices and toxicological data are strongly needed to assess the risk for consumers.

Abstract Nanotechnology has relevance to applications in all areas of agri-food including agriculture, aquaculture, production, processing, packaging, safety and nutrition. Scientific literature indicates uncertainties in food safety aspects about using nanomaterials due to potential health risks. To date the agri-food industry's awareness and attitude towards nanotechnology have not been addressed. We surveyed the awareness and attitudes of agri-food organisations on the island of Ireland (Iol) with regards to nanotechnology. A total of 14 agri-food stakeholders were interviewed and 88 agri-food stakeholders responded to an on-line questionnaire. The findings indicate that the current awareness of
nanotechnology applications in the agri-food sector on the IoI is low and respondents are neither positive nor negative towards agri-food applications of nanotechnology. Safer food, reduced waste and increased product shelf life were considered to be the most important benefits to the agri-food industry. Knowledge of practical examples of agri-food applications is limited however opportunities were identified in precision farming techniques, innovative packaging, functional ingredients and nutrition of foods, processing equipment, and safety testing. Perceived impediments to nanotechnology adoption were potential unknown human health and environmental impacts, consumer acceptance and media framing. The need for a risk assessment framework, research into long term health and environmental effects, and better engagement between scientists, government bodies, the agri-food industry and the public were identified as important.


Abstract In vitro oocyte maturation (IVM) protocols can be improved by adding chemical supplements to the culture media. Tretinoin is considered an important retinoid in embryonic development and its association with lipid-core nanocapsules (TTN-LNC) represents an innovative way of improving its solubility, and chemical stability, and reducing its toxicity. The effects of supplementing IVM medium with TTN-LNC was evaluated by analyzing production of reactive oxygen species (ROS), S36-phosphorilated-p66Shc levels and caspase activity in early embryonic development, and expression of apoptosis and pluripotency genes in blastocysts. The lowest concentration tested (0.25 μM) of TTN-LNC generated higher blastocyst rate, lower ROS production and S36-p66Shc amount. Additionally, expression of BAX and SHC1 were lower in both non-encapsulated tretinoin (TTN) and TTN-LNC-treated groups. Nanoencapsulation allowed the use of smaller concentrations of tretinoin to supplement IVM medium thus reducing toxic effects related with its use, decreasing ROS levels and apoptose frequency, and improving the blastocyst rates.


Abstract By reducing the cadmium (Cd2+) content in biomass used for bio-based products such as biogas, a less toxic bio-based fertilizer can be obtained. In this work, we demonstrate how a macroporous polymer can support titanate nanotubes, and we take advantage of its known selective adsorption behavior towards Cd2+ in an adsorption process from real nutrient-rich process water from hydrolysis of seaweed, a pollutant-rich biomass. We show that pretreatment steps involving alteration in area-to-volume ratio performed in aerated and acidic conditions release the most Cd2+ from the solid material. By integrating an adsorption step between hydrolysis and the biomethane, we show that it was
possible to obtain high Cd2+ removal (ca. 94%) despite molar excess (between 100 and 500) of co-present ions (e.g., Mg2+, Ca2+, Na+, K+) and with maintained total phosphorous content. The bio-methane potential did not significantly decrease as compared to a process without cadmium removal and the yielded bio-fertilizer followed Swedish guideline values. This study provides a sound and promising alternative for a novel remediation step, enabling higher use of otherwise tricky and to some extent overlooked biomass sources.


Abstract A novel method for preconcentration and electrochemical detection of zinterol in bovine urine samples was developed. In order to improve the limit of detection, the surface of a screen-printed carbon electrode was modified with electrodeposited metal copper nanoparticles. The experimental electrodeposition optimization was performed using a central composite design (CCD), involving the variables: precursor concentration, potential and time applied. Copper nanoparticles were characterized by transmission electron microscopy, scanning electron microscopy, cyclic voltammetry, and energy dispersive X-ray spectroscopy. Mesoporous shuttle-like copper oxide nanoparticles were used for the preconcentration step to avoid interferences with many compounds present in the sample matrix. The optimal working conditions for the preconcentration approach were found by means of both two-level fractional factorial and CCD designs. The obtained enhancement factor for a sample volume of 30 mL was 35 fold. The calibration curve showed linearity between 0.5 and 45 ng mL$^{-1}$ and the limit of detection was 0.16 ng mL$^{-1}$. The intra and inter assay coefficients of variability were below 4% and 5%; respectively.


Abstract Avian influenza (AI), caused by the influenza A virus, has been a global concern for public health. AI outbreaks not only impact the poultry production, but also give rise to a risk in food safety caused by viral contamination of poultry products in the food supply chain. Distinctions in AI outbreak between strains H5N1 and H7N9 indicate that early detection of the AI virus in poultry is crucial for the effective warning and control of AI to ensure food safety. Therefore, the establishment of a poultry surveillance system for food safety by early detection is urgent and critical. In this article, methods to detect AI virus, including current methods recommended by the World Health Organization (WHO) and the World Organisation for Animal Health (Office International des Epizooties, OIE) and novel techniques not commonly used or commercialized are reviewed and evaluated for feasibility of use in the poultry surveillance system. Conventional methods usually applied for the purpose of AI diagnosis face some practical challenges to establishing a comprehensive poultry surveillance program in the poultry supply chain. Diverse development of new technologies can meet the specific requirements of AI virus detection in various stages or scenarios.
throughout the poultry supply chain where onsite, rapid and ultrasensitive methods are emphasized. Systematic approaches or integrated methods ought to be employed according to the application scenarios at every stage of the poultry supply chain to prevent AI outbreaks.


Abstract Antibiotic resistant bacteria are a serious health risk in both human and veterinary medicine. Several studies have shown that silver nanoparticles (AgNPs) exert a high level of antibacterial activity against antibiotic resistant strains in humans. The aim of this study was to evaluate the antibacterial effects of a combined therapy of AgNPs and antibiotics against veterinary bacteria that show resistance to antibiotics. A microdilution checkerboard method was used to determine the minimal inhibitory concentrations of both types of antimicrobials, alone and in combination. The fractional inhibitory concentration index was calculated and used to classify observed collective antibacterial activity as synergistic, additive (only the sum of separate effects of drugs), indifferent (no effect) or antagonistic. From the 40 performed tests, seven were synergistic, 17 additive and 16 indifferent. None of the tested combinations showed an antagonistic effect. The majority of synergistic effects were observed for combinations of AgNPs given together with gentamicin, but the highest enhancement of antibacterial activity was found with combined therapy together with penicillin G against Actinobacillus pleuropneumoniae. A. pleuropneumoniae and Pasteurella multocida originally resistant to amoxycillin, gentamicin and colistin were sensitive to these antibiotics when combined with AgNPs. The study shows that AgNPs have potential as adjuvants for the treatment of animal bacterial diseases.


Abstract A new magnetic molecularly imprinted polymers (MMIPs) for separation and concentration of ractopamine (RAC) were prepared using surface molecular imprinting technique with methacryloyl chloride as functional monomer and RAC as template. The MMIPs were characterized using transmission electron microscopy, Fourier transform infrared spectroscopy, X-ray diffraction, and vibrating sample magnetometer. The results of re-binding experiments indicated that the MMIPs had fast adsorption kinetics and could reach binding equilibrium within 20 min, and the adsorption capacity of the MMIPs was 2.87-fold higher than that of the corresponding non-imprinted polymer. The selectivity of the MMIPs was evaluated according to its recognition to RAC and its analogues. The synthesized MMIPs were successfully applied to extraction, followed by high performance liquid chromatography to determine RAC in real food samples. Spiked recoveries ranged from 73.60% to 94.5%, with relative standard deviations of &lt;11.17%.

Abstract The aim of this study was to investigate how dietary supplementation of nanosize zinc oxide affect zinc retention, egg production and eggshell quality, immune response and serum parameters of aged layers. In trial 1, twenty white Leghorn laying hens (68 weeks-old) were assigned to the control, ZnO, organic-Zn (Zn-methionine) and nano-Zn (nanosize ZnO) groups. The Zinc was maintained at a 60 mg/kg level in the treatment groups’ diet, while the control group’s diet contained 40 mg/kg Zn to evaluate the nutrient retention and zinc bioavailability. In trial 2, eighty old white Leghorn laying hens (68 weeks-old) were randomly allotted to four dietary treatments (as trial 1) to evaluate the egg production and eggshell quality, immune response and serum parameters. The results of trial 1 indicated that there were no differences in nutrient retention among the groups, but zinc retention was significantly higher in the nano-Zn and organic-Zn groups than that in the control and ZnO groups (P < 0.05). Trial 2 results indicated that eggshell thickness was increased in the nano-Zn and organic-Zn groups compared to the control group (P < 0.05); immune responses parameters, including: PHA (phytohemagglutinin) skin challenge test result, GRBC (goat red blood cells) antibody titer and IgG levels exhibited no differences among the groups; serum growth hormone concentration and carbonic anhydrase activity was significantly higher in the nano-Zn and organic-Zn groups compare to control group (P < 0.05); serum albumin concentration in organic-Zn group was lower than that of the control group (P < 0.05). In conclusion, nanosize zinc for dietary supplementation can increase zinc retention, as well as enhance eggshell thickness, serum carbonic anhydrase activity and growth hormone level of layers. We therefore concluded that nanosized zinc oxide can enhance zinc absorption in the intestine of layers compare to regular zinc oxide.