

Gruppo domande nr. 1

TECNICHE VOLUMETRICHE PER MATRICI AGROALIMENTARI

CLASSIFICAZIONE DEI RIFIUTI PERICOLOSI

Calcolo parametri di statistica descrittiva in MS Excel (media, mediana, deviazione standard, etc.)

In presenza di più criticità contemporanee, come decide priorità e urgenze? Indichi criteri e strumenti (es. impatto, rischio, scadenze, stakeholder).

Portable and in situ rapid detection of benzo[a]pyrene: a review

Benzo[a]pyrene (BaP), a typical polycyclic aromatic hydrocarbon (PAH) pollutant, is widely present in water, atmosphere, soil, as well as smoked, baked, and fried foods. It exhibits carcinogenic, teratogenic, and mutagenic properties. This paper systematically reviews the research progress of portable and in situ detection technologies for BaP, focusing on its sources and hazards, the recognition elements and detection principles of in situ and portable detection technologies, and the pretreatment methods and applicable technical strategies for different matrices. Addressing limitations such as insufficient recognition element performance and the lack of real-time monitoring methods for biological samples, this paper proposes development directions, including the development of new high-affinity recognition elements and the integration of multiple technologies. The paper provides a theoretical reference for developing portable and user-friendly BaP detection technologies. This will improve prevention and control systems for environmental pollutants and ensure food safety and public health.



Gruppo domande nr. 2

TECNICHE VOLUMETRICHE PER MATRICI AGROALIMENTARI

ETICHETTATURA DELLE SOSTANZE E DELLE MISCELE

Creazione di un istogramma per una serie di dati in MS Excel

Deve organizzare un lavoro con scadenza ravvicinata e informazioni incomplete. Come struttura il piano di lavoro, i tempi e le responsabilità?

Food surface characterization by scanning electron microscopy and fractal analysis: A review

Surface characterization of food products is critical for understanding their physical, chemical, and biological properties, which have a direct impact on quality, safety, and consumer acceptability. Scanning electron microscopy (SEM) paired with “fractal analysis” has developed as an effective method for studying food surfaces at the micro- and nanoscales. This review investigated the use of SEM to examine the topographical features of various food items, such as fruits, vegetables, grains, and processed foods, emphasizing the importance of surface morphology in determining texture, moisture retention, and overall product quality during consumption and storage. Fractal analysis, together with SEM, is a quantitative approach for describing the complexity of foods surface structures. Fractal and multifractal analysis using SEM images yields a numerical description of surface roughness, complexity, and heterogeneity. The combination of SEM with fractal analysis not only allows for a more in-depth study of food surface characteristics, but it also helps to optimize food processing procedures. Positive correlations between processing (drying, frying, freezing) time, fractal dimension, and surface openings have been established. Fractal dimension of various food items (fruit, vegetable, crispy product, powder, extrudate product, puffed food, frozen product, fish, etc.) and their characteristics quality attributes have been found expressively interlined. The outcomes of multifractal analysis (Singularity and Rényi spectra) successfully characterized heterogeneity in foods surface micro-structure. SEM image-based fractal analysis, which reveals the subtle links between surface morphology and food attributes, showed potential to significantly expand food science and technology, paving the door for advances in food processing and quality management.



Gruppo domande nr. 3

TECNICHE VOLUMETRICHE PER MATRICI AGROALIMENTARI

PREDISPOSIZIONE LABORATORI DIDATTICI

Calcolo di un modello di regressione in MS Excel

Come gestisce il lavoro quando le priorità cambiano frequentemente? Come comunica i cambiamenti e tutela la qualità del risultato?

Functional protein-based emulsions for dysphagia management in the elderly: stability mechanisms, rheological design, and translational prospects

As the global population ages, the demand for safe, nutritious, and palatable foods for elderly individuals with dysphagia has become increasingly critical. Protein-based emulsions have emerged as a prominent area of research due to their tunable mesoscopic structures and swallowing adaptability. This review systematically examines the design principles and applications of various protein-based emulsions in swallowing-friendly foods, assesses the advantages and limitations of different emulsion preparation techniques, and evaluates the methods used to characterize swallowing-friendly foods. On this basis, it further identifies key challenges that require urgent attention, including the difficulty in harmonizing emulsion stability, functionality, and palatability; the gap between standardization and personalization; the insufficiency of clinical validation, and the limitation of cultural adaptability. Future research should be guided by the coupling mechanism of “Interface–Rheology–Swallowing”, highlighting multidisciplinary innovation, advancing the specialized medical food industry and providing personalized nutritional solutions for elderly individuals with dysphagia.



Gruppo domande nr. 4

TECNICHE SPETTROFOTOMETRICHE PER MATRICI AGROALIMENTARI

TRACCIABILITA' DEI RIFIUTI PERICOLOSI

Creazione di un grafico a torta in MS Excel

Se un collega non rispetta una scadenza che impatta il suo lavoro, come si comporta? Come bilancia assertività e collaborazione?

Predicting heat-induced hazardous compounds in roasted almonds via browning index and moisture using machine learning

While roasting is essential for developing the characteristic flavor of almonds, it can also result in the formation of thermal contaminants that cause potential threats to human health. This study investigated the effects of roasting conditions (110–150 °C, 10–30 min) on precursor degradation, antioxidant activity, and formation of acrylamide (AA) and 5-hydroxymethylfurfural (5-HMF) in almonds. Higher roasting intensity increased browning index (BI) and total phenolic content, while reducing sugars and asparagine declined. AA and 5-HMF contents peaked at 150 °C/30 min. A support vector regression (SVR) model using  $L^*$ ,  $a^*$ ,  $b^*$ , BI, and moisture content accurately predicted the levels of AA and 5-HMF ( $R^2 > 0.94$ , RMSE < 10%). Moderate roasting conditions ( $\leq 130$  °C for  $\leq 15$  min) are recommended to achieve an optimal balance between product safety and quality. These results suggested that machine learning is an effective method for food risk assessment.



Gruppo domande nr. 5

TECNICHE SPETTROFOTOMETRICHE PER MATRICI AGROALIMENTARI

ETICHETTATURA DELLE SOSTANZE E DELLE MISCELE

Grafico a dispersione di una coppia di variabili x e y con retta e sua equazione in MS Excel

In un gruppo emergono conflitti o resistenze (es. "si è sempre fatto così"). Come interviene per mantenere la collaborazione e raggiungere l'obiettivo?

Effect of pH shift on the formation and structural properties of Inca peanut albumin–Dendrobium officinale polysaccharide composite gels

Herein, we investigated the effects of different pH conditions (pH 2–10) on the formation, structure, and properties of heat-induced composite gels composed of Inca peanut albumin (IPA) and Dendrobium officinale polysaccharide (DOP). Results indicated that under acidic conditions (pH 2 and 4), the gelation process of IPA–DOP gels were slow (2530 s) and the resulting composite gels exhibited a rough, porous structure dominated by hydrophobic interactions. By contrast, at pH 6 and 8, the composite gels formed a denser network structure with higher  $\beta$ -sheet content (26.8 % and 26.0 %) and the dominant intermolecular forces were hydrogen bonds. At pH 6, the optimal hardness and water-holding capacity were observed to be 84.608 g force (gf) and 85.92 %, respectively. These findings indicate that the combination of DOP along with pH modulation can effectively influence the structural and functional characteristics of IPA gel, offering a promising strategy to enhance its performance.



Gruppo domande nr. 6

TECNICHE SPETTROFOTOMETRICHE PER MATRICI AGROALIMENTARI

SICUREZZA NEI LABORATORI

Ordinamento di variabili per ordine crescente, decrescente e in maniera casuale in MS Excel

Quali aspetti del lavoro la motivano di più e dove ritiene di poter dare il maggior contributo come Funzionario Tecnico?

Copper ions modulated growth of TiO<sub>2</sub>/Bi<sub>2</sub>S<sub>3</sub> heterojunction in-situ: An enhanced photoelectrochemical immunosensor coupled with headspace strategy for chloramphenicol determination

In this study, CuO functions as a signaling modulator that precisely regulates the formation and concentration of H<sub>2</sub>S through the release of Cu<sup>2+</sup> under acidic conditions. The mechanism involves the reaction between Cu<sup>2+</sup> and S<sup>2-</sup> to form CuS, which consumes part of the S<sup>2-</sup> introduced via Na<sub>2</sub>S. This process effectively modulates the in situ deposition of dark brown Bi<sub>2</sub>S<sub>3</sub> on the surface of TiO<sub>2</sub>/Bi<sup>3+</sup> electrodes. Owing to the well-matched band structures of Bi<sub>2</sub>S<sub>3</sub> and TiO<sub>2</sub>, the resulting heterojunction exhibits excellent photoelectric performance. The photocurrent intensity of the TiO<sub>2</sub>/Bi<sub>2</sub>S<sub>3</sub> heterojunction shows a concentration-dependent relationship with the level of Cu<sup>2+</sup>. Based on this principle, we developed a novel photoelectrochemical (PEC) immunosensor integrated with a headspace strategy for the detection of chloramphenicol (CAP), using CuO as an immunomarker. The detection range extended from 1.0 to 5000 pg/mL, and the detection limit was as low as 0.57 pg/mL. This innovative sensor leverages the in situ generation of colored Bi<sub>2</sub>S<sub>3</sub>-sensitized TiO<sub>2</sub>, enabling both qualitative photocurrent-based detection and semi-quantitative visual analysis by the naked eye.



Gruppo domande nr. 7

TECNICHE CROMATOGRAFICHE PER MATRICI AGROALIMENTARI

CLASSIFICAZIONE DEI RIFIUTI PERICOLOSI

Formattazione di un grafico a dispersione in MS Excel

Quali strumenti utilizza per l'organizzazione del lavoro? Faccia un esempio concreto di applicazione (es. pianificazione, monitoraggio, scadenze).

The impact of storage conditions on quality and shelf life of fresh-cut jackfruit: a metabolomics perspective

Jackfruit, valued for its unique flavor and rich nutrients, suffers from quality postharvest deterioration in fresh-cut products. This study links intact fruit storage duration to fresh-cut jackfruit shelf life and quality, defining four distinct states ('Lignification', 'Unripe', 'Perfectly-ripe', and 'Decay') via firmness and total soluble solids profiling. Through metabolomics analysis, we identified 1067 volatiles and 1571 non-volatiles, with relative odor activity value analysis pinpointing 2-phenylethyl 3-methylbutanoate as a key aroma marker varying across states. Fruits stored 3–6 days were optimal for fresh-cutting, exhibiting 'Perfectly-ripe' flavor through ester-phenylpropanoid metabolic synergy while retaining amino acids and phenolics. In contrast, 'Unripe' and 'Lignification' showed impaired flavor precursor conversion, while 'Decay' accumulated abnormal phospholipids, reducing nutritional and flavor quality. This study provides a metabolomic basis for optimizing fresh-cut jackfruit processing timing and preservation, supporting commercial circulation, quality control, and the standardized large-scale development of the jackfruit industry.



Gruppo domande nr. 8

TECNICHE CROMATOGRAFICHE PER MATRICI AGROALIMENTARI

SICUREZZA NEI LABORATORI

Calcolo di pendenza, intercetta e coefficiente di correlazione tra due serie di dati in MS Excel

Le viene segnalato "il sistema non funziona" senza altri dettagli. Quali domande fa e quali passi segue per trasformare una segnalazione generica in un problema gestibile?

Correlation analysis of monosaccharide composition and in vitro antioxidant and hypoglycemic activities of Tremella fuciformis spore polysaccharides

Tremella fuciformis polysaccharides have diverse bioactivities and beneficial physicochemical properties, enabling broad use in pharmaceuticals and food. This study analyzed intracellular and extracellular polysaccharides (IPs and EPs) from three T. fuciformis spores, assessing their monosaccharide composition and in vitro antioxidant and hypoglycemic effects. Results showed that TWW01-AX and TWW02-TMS had significantly higher biomass and polysaccharide yields than TYH-SD1. IPs were predominantly composed of Glc, exceeding 60 mol%, whereas EPs were primarily composed of Man, accounting for over 64 mol%. Monosaccharide percentages served as key discriminators between IPs and EPs. EPs exhibited stronger DPPH, hydroxyl radical scavenging, CUPRAC, as well as  $\alpha$ -glucosidase and  $\alpha$ -amylase inhibition, while IPs showed superior ABTS radical scavenging activities and FRAP. Ridge regression showed key monosaccharide percentage variations notably influence bioactivities. This study provided a theoretical basis for the functional evaluation of high-quality T. fuciformis polysaccharides and the efficient screening of superior strains.



Gruppo domande nr. 9

TECNICHE CROMATOGRAFICHE PER MATRICI AGROALIMENTARI

PREDISPOSIZIONE LABORATORI DIDATTICI

Confronto di due serie di dati con grafici a dispersione e grafici a linee in MS Excel

Deve fornire assistenza agli studenti durante un laboratorio didattico. Come organizzerebbe il supporto per garantire sicurezza, continuità dell'attività e l'apprendimento? Quali strumenti e modalità di lavoro utilizzerebbe?

Influence of pea protein- $\kappa$ -carrageenan composite microgel particle interfacial structure on lipid digestibility in O/W Pickering emulsions

The impact of interfacial structure on lipid digestion of emulsions remains controversial, presenting a key limitation in developing technologies for precise regulation of nutritional characteristics through rational food structure design. This study employed pea protein isolate (PPI) microgel particle (PPM) and PPI- $\kappa$ -carrageenan ( $\kappa$ -CG) composite microgel particle (PPCM) as a model system. The mixing ratio of these macromolecules was adjusted, which changed the interaction of protein and polysaccharide molecules, as well as the interfacial structure of PPCM. Subsequent analysis of structural changes and emulsion digestion in an in vitro simulated digestion model elucidated the regulatory mechanism of interfacial structure on lipid digestion of Pickering emulsions (PPM-E and PPCM-E). The results demonstrated that free sulfhydryl and hydrophobic groups embedded in PPI became exposed during the heat-shearing process of microgel preparation, facilitating disulfide bond formation. The  $\kappa$ -CG gel associated with PPI gel through non-covalent bonds, effectively shielding the exposed hydrophobic groups of PPI. Based on the thickness of the interface, the amount of adsorbed protein, and the protein concentration at the interface, and the surface dilatational modulus, it was found that the deformability of microgel particles at the interface varies. This variation leads to differences in the interfacial structure: PPM formed thick but sparsely distributed interfacial layers due to its limited interfacial deformability; PPCM1 and PPCM2 formed thinner and denser interfacial layers with exposed  $\kappa$ -CG gels on the surface owing to because of their greater deformability compared to PPM; PPCM3, PPCM4, and PPCM5 exhibited the thinnest and densest interfacial layers among the microgel particles, with the exposed  $\kappa$ -CG interconnected to form a polysaccharide network surrounding the oil droplets. Compared with PPM-E, the  $\kappa$ -CG outside the interfacial layer of PPCM1-E and PPCM2-E promoted the expansion of the interfacial microgel in the simulated intestinal fluid and enhanced the hydrolysis by trypsin and lipase, resulting in higher free fatty acid (FFA) release than PPM. In contrast, the  $\kappa$ -CG network outside the interfacial layer of PPCM3-E, PPCM4-E, and PPCM5-E impeded the trypsin and lipase activity, thereby inhibiting the lipid digestion and resulting in lower FFA release than PPM.



Gruppo domande nr. 10

TECNICHE DI ESTRAZIONE

TRACCIABILITA' DEI RIFIUTI PERICOLOSI

Utilizzo della funzione filtro in MS Excel

In laboratorio viene introdotto un nuovo strumento che richiede nuove procedure e cautele. Come accompagnerebbe il gruppo (studenti/collegghi/docenti) nel cambiamento, garantendo sicurezza e continuità? Indichi analisi dei rischi, organizzazione della formazione, coordinamento e comunicazione (ascolto attivo e assertività).

Enhanced functionalities of cassava starch-based films incorporating berberine nanoparticles for sustainable food packaging

Cassava starch is a biodegradable polymer with limited functional properties for packaging. To enhance its performance, cassava starch was complexed with berberine to form a nano-berberine-starch complex and cast into active films. Modeling indicated favorable binding (score 23.88) via hydrogen bonding and  $\pi$ - $\pi$  interactions. The complex showed a bimodal size distribution (81 nm, 44.3 %; 318 nm, 32.7 %). Incorporation at suitable loadings improved film surface uniformity, mechanics, and bioactivity: antioxidant capacity reached 63.12 % and 56.4 % for both radicals, antibacterial efficacy increased, and biodegradation reached 57.2 % after 30 days versus native starch films. In a sausage model, the films suppressed microbial growth and lipid/protein spoilage, maintaining Thiobarbituric Acid Reactive Substances (TBARS) at 1.7 mg MDA/kg and Total Volatile Basic Nitrogen (TVB-N) at 8.50 mg/100 g over 15 days at 4 °C, outperforming commercial packaging. These findings highlight nano-berberine-starch as a promising strategy for multifunctional, biodegradable films that extend meat shelf life.



Gruppo domande nr. 11

TECNICHE DI ESTRAZIONE

ETICHETTATURA DELLE SOSTANZE E DELLE MISCELE

Blocco dei riferimenti di cella nelle equazioni in MS Excel

Come organizzerebbe il supporto ai docenti in un laboratorio di ricerca, utilizzando competenze trasversali come problem setting e problem solving, affidabilità operativa, organizzazione del lavoro, cooperazione e coordinamento?

Fabrication and characterization of high internal phase Pickering emulsions (HIPPEs) of  $\omega$ -3 algal oil stabilized with seaweed-derived particles

This study investigated high internal phase Pickering emulsions (HIPPEs) of algal oil stabilized with particles from red seaweed. The particles featured a favorable contact angle ( $81.5^\circ$ ), 43.2 %  $\beta$ -sheet content, and irregular morphology with rough surfaces. These features enabled the formation of HIPPEs at 0.5–2.0 % particle concentrations in the aqueous phase. All formulations had highly negative zeta potentials ( $\sim -70$  to  $-74$  mV), indicating strong electrostatic stabilization. Droplet size decreased significantly with increasing concentration ( $p < 0.05$ ) and plateaued at 1.5–2.0 % on day 1 ( $D_{3,2} 2-2.7 \mu\text{m}$ ). Emulsions with 1.5 % and 2.0 % particles (E-1.5 and E-2.0) exhibited higher physical stability (Turbiscan Stability Index: 3.63 and 2.12, respectively) and dominant elastic behavior. Higher particle loads enhanced viscosity, microstructural resistance, and oxidative stability, with E-2.0 maintaining the lowest peroxide value (21.06 meq/kg oil) and reduced  $\alpha$ -tocopherol degradation and oxidation volatiles. These findings support seaweed-derived particles as natural Pickering stabilizers in  $\omega$ -3-rich emulsions.



Gruppo domande nr. 12

TECNICHE DI ESTRAZIONE

PREDISPOSIZIONE LABORATORI DIDATTICI

Funzione riempimento automatico (autofill, trascinamento) in MS Excel

Qual è la differenza tra problem setting e problem solving? Descriva come li applicherebbe in un caso pratico di laboratorio, indicando le soft skills utilizzate nelle due fasi.

Sensitive SERS sensor for convenient and rapid determination of vanillin in foods

Sensitive food additive detection is vital for food safety. We developed a flexible nitrocellulose membrane-based SERS substrate modified with silver nanoparticles, enabling additive detection through analyte separation/enrichment and SERS signal enhancement. Integrated with the novel probe 4-(methylthio)benzohydrazide (4-MTBH), the sensor selectively captured vanillin (VA) and ethyl vanillin (EVA) via specific aldehyde-hydrazide interactions, enabling highly sensitive detection. The substrate demonstrated exceptional performance with an enhancement factor of  $2.62 \times 10^6$ , RSD of 3.98 %, and stability maintaining SERS activity for over 30 days with nitrogen protection. It achieved a detection limit of  $10^{-7}$  mol L<sup>-1</sup> for both vanillin flavors, meeting practical requirements, and reliably quantified total vanillin flavorants in diverse real food samples. This work establishes a portable, rapid-response SERS platform for ultrasensitive vanillin detection and introduces a new probe system to the SERS methodology, demonstrating significant potential for analyzing diverse analytes in complex matrices.



Gruppo domande nr. 13

ISOLAMENTO E CRESCITA DI SPECIE MICROBICHE

TRACCIABILITA' DEI RIFIUTI PERICOLOSI

Uso della formattazione condizionale in MS Excel

Le viene segnalato un problema in modo generico (“non funziona” / “i dati sono strani”). Come imposta il problem setting per chiarire obiettivo e vincoli? Una volta definito, come passa al problem solving e con quali strumenti (ascolto attivo, assertività, coordinamento)?

Effects of ultrasound on zein-procyanidin composite nanoparticles: Interaction force, structure, emulsifying properties and interfacial behaviors

Given the growing demand for natural emulsifiers in the food and pharmaceutical industries, this study investigates how ultrasonic treatment affected the structural properties, emulsification performance and interfacial behavior of zein-procyanidin (PC) composite nanoparticles (Z/PC-NPs). The ultrasound-induced cavitation effect significantly enhanced the hydrogen bonding and hydrophobic interaction between zein and PC. Spectroscopic analyses showed that ultrasound increased the  $\beta$ -sheet content to 21.90% and decreased the  $\beta$ -turn content to 49.0%, which enhanced the bonding stability between PC and zein. Compared with Z/PC-NPs, the emulsification activity and emulsification stability of the ultrasonically treated Z/PC-NPs-U were increased by 22.84% and 44.13%, respectively. After ultrasonic treatment, the elastic modulus rose 41% to 52.94 mN/m, while interfacial mass reached 350.09 ng/cm<sup>2</sup>, confirming improved interfacial layer thickness and elasticity. Ultrasound provides a new technical approach and theoretical support for the development of efficient functional emulsifiers by modulating the structure and interfacial behavior of nanoparticles.



Gruppo domande nr. 14

ISOLAMENTO E CRESCITA DI SPECIE MICROBICHE

CLASSIFICAZIONE DEI RIFIUTI PERICOLOSI

Conteggio di celle non vuote e di celle contenenti numeri in MS Excel

Durante un'attività di laboratorio nota comportamenti non conformi alle procedure di sicurezza. Come interviene usando ascolto attivo e comunicazione assertiva per garantire il rispetto delle cautele?

Preparation of methyl salicylate nanoemulsion and its application in sprouting inhibition on potato tubers

Sprouting of potato tubers is accompanied by the accumulation of toxic solanine. In this study, a methyl salicylate (MeSA) nanoemulsion was prepared using ultrasonic emulsification, and its effect on potato tuber sprouting was investigated. Results showed that the optimum preparation conditions of MeSA nanoemulsion were as follows: surfactant concentration, 5.02 %; MeSA concentration, 9.79 %; ultrasonic power, 428.03 W; and ultrasonic time, 3.79 min. The results of Fourier transform infrared spectroscopy and rheological properties of the emulsion showed that MeSA was successfully embedded in the nanoemulsion with a good stability. After treatment with MeSA nanoemulsion at 25 °C, the initial sprouting time of potato (Favorita) was effectively delayed for 9 d, with sprouting rate of 20.95 %, whereas other treatments had sprouting rate of 100 %. In addition, the MeSA nanoemulsion maintained the quality of potato tubers. This indicated that the preparation of the nanoemulsion enhanced the sprouting inhibition effect of MeSA.



Gruppo domande nr. 15

ISOLAMENTO E CRESCITA DI SPECIE MICROBICHE

SICUREZZA NEI LABORATORI

Calcolo di un polinomio di secondo grado in MS Excel

Nel ruolo di supporto tecnico a docenti e studenti, come usa la comunicazione assertiva per garantire sicurezza, tracciabilità e corretto uso delle strumentazioni?

Protein-stabilized gold nanoclusters for colorimetric/fluorescence dual-mode detection of organophosphorus pesticides

The residue of organophosphorus pesticides (OPs) poses a serious threat to the environment and human health. Therefore, there is an urgent need to develop sensitive, accurate, and environmentally friendly detection methods for OPs. Herein, we constructed a colorimetric/fluorescent dual-mode detection platform based on natural protein human serum albumin (HSA)-stabilized gold nanoclusters (HSA-Au NCs), combining the intrinsic fluorescence properties and peroxidase-like activity for OPs detection. The dual-mode detection strategy enhanced the accuracy and reliability of detection by mutual verification of signals. Moreover, benefiting from the biocompatibility of protein materials, HSA-Au NCs were environmentally friendly, allowing OPs detection in real samples. By integrating acetylcholinesterase, choline oxidase, and HSA-Au NCs on a cellulose acetylation membrane, a smartphone-assisted sensor with high sensitivity, low limit of detection, and environmental friendliness was developed. The sensor demonstrated a low detection limit of  $0.476 \text{ ng}\cdot\text{mL}^{-1}$  for parathion methyl, which was suitable for real fruit and vegetable detection.

