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Food Safety Briefs

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Food Packaging

A Natural Component-Based Oxygen Indicator With In-Pack Activation for Intelligent Food Packaging

Won K, Jang NY, Jeon J. *J Agric Food Chem*. 2016 Dec 28;64(51):9675–9679. doi: 10.1021/acs.jafc.6b04172. Article Link

Significance: The development of this novel colorimetric oxygen indicator may contribute greatly to intelligent packaging for healthier and safer foods.

Intelligent food packaging can provide consumers with reliable and correct information on the quality and safety of packaged foods. One of the key constituents in intelligent packaging is a colorimetric oxygen indicator, which is widely used to detect oxygen gas involved in food spoilage by means of a color change. Traditional oxygen indicators consisting of redox dyes and strong reducing agents have two major problems: they must be manufactured and stored under anaerobic conditions because air depletes the reductant, and their components are synthetic and toxic. To address both of these serious problems, the authors have developed a natural component-based oxygen indicator characterized by in-pack activation. The conventional oxygen indicator composed of synthetic and artificial components was redesigned using naturally occurring compounds (laccase, guaiacol, and cysteine). These natural components were physically separated into two compartments by a fragile barrier. Only when the barrier was broken were all of the components mixed and the function as an oxygen indicator was begun (i.e., in-pack activation). Depending on the component concentrations, the natural component-based oxygen indicator exhibited different response times and color differences. The rate of the color change was proportional to the oxygen concentration.

Predicting Diffusion Coefficients of Chemicals In and Through Packaging Materials

Fang, Vitrac O. *Crit Rev Food Sci Nutr.* 2017 Jan 22;57(2):275–312. doi: 10.1080/10408398.2013.849654. Article Link

Significance: This review article summarizes the classical and last mechanistic descriptions of diffusion in polymers and discusses the reliability of semi-empirical approaches used for compliance testing both in the EU and US.

Most of the physicochemical properties in polymers such as activity and partition coefficients, diffusion coefficients, and their activation with temperature are accessible to direct calculations from first principles. Such predictions are particularly relevant for food packaging as they can be used (1) to demonstrate the compliance or safety of numerous polymer materials and of their constitutive substances (e.g. additives, residues…), when they are used: as containers, coatings, sealants, gaskets, printing inks, etc. (2) or to predict the indirect contamination of food by pollutants (e.g. from recycled polymers, storage ambiance…) (3) or to assess the plasticization of materials in contact by food constituents (e.g. fat matter, aroma…). This review article summarizes the classical and last mechanistic descriptions of diffusion in polymers and discusses the reliability of semi-empirical approaches used for compliance testing both in EU and US. It is concluded that simulation of diffusion in or through polymers is not limited to worst-case assumptions but could also be applied to real cases for risk assessment, designing packaging with low leaching risk or to synthesize plastic additives with low diffusion rates.

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Food Pathogens

Characterization of Nonpathogenic Listeria Species Isolated From Food and Food Processing Environment

Korsak D, Szuplewska M. *Int J Food Microbiol.* 2016 Dec 5;238:274–280. doi: 10.1016/j.ijfoodmicro.2016.08.032. Article Link

Significance: To elucidate the adaptation strategies and ecology of Listeria spp., a better understanding of its resistance to antimicrobials and environmental toxicants such as heavy metals and disinfectants is needed.

A total of 127 Listeria isolates from food and food processing environments, including 75 L. innocua, 49 L. welshimeri, 2 L. seeligeri and 1L. grayi were tested for susceptibility to eight antimicrobials, benzalkonium chloride (BC), cadmium and arsenic. The isolates were also screened for the presence of extrachromosomal genetic elements - plasmids, and their restriction pattern types were determined. All strains were susceptible to ampicillin, ciprofloxacin, erythromycin, gentamicin, rifampicin, trimethoprim and vancomycin. Two of the L. innocua isolates showed resistance to tetracycline and minocycline. The resistance was determined by the presence of chromosomal localization of tet(M) gene, which was not integrated in the transposon Tn916-Tn1545 family. Of analyzed isolates, 18.11% and 55.91% isolates were resistant to BC and cadmium, respectively, but all were susceptible to arsenic. Resistance to BC was correlated with resistance to cadmium - all BC resistant isolates were also resistant to cadmium. On the other hand, 67.61% of cadmium-resistant isolates were susceptible to BC, suggesting that cadmium and BC resistance were not always concurrent in Listeria species. 48.03% of isolates contained plasmids. The size of most of the identified replicons was in the range of 50-90kb. All plasmids were classified into 12 groups with identical restriction pattern (I-XII). Interestingly, plasmids belonging to the same group were determined in isolates of the same species. Only in one case, plasmids with I-type profile were identified in L. innocua and L. welshimeri. There was an association between resistance to BC and plasmid DNA presence: all resistant isolates carried a plasmid. A correlation between resistance to cadmium and plasmid carriage was also observed in L. innocua and L. seeligeri isolates, but among resistant L. welshimeri, 23.08% of isolates did not have plasmids. This may suggest that resistance is associated with determinants located within the chromosome.

A Risk Modelling Approach for Setting Microbiological Limits Using Enterococci as Indicator for Growth Potential of Salmonella in Pork

Bollerslev AM, Nauta M, Hansen TB, Aabo S. *Int J Food Microbiol.* 2017 Jan 2;240:102–107. doi: 10.1016/j.ijfoodmicro.2016.05.007. Article Link

Significance: By use of the risk model, it was estimated that the majority of salmonellosis cases, caused by the consumption of pork in Denmark, is caused by the small fraction of pork products that has enterococci concentrations above 5 log CFU/g.

Microbiological limits are widely used in food processing as an aid to reduce the exposure to hazardous microorganisms for the consumers. However, in pork, the prevalence and concentrations of Salmonella are generally low and microbiological limits are not considered an efficient tool to support hygiene interventions. The objective of the study was to develop an approach which could make it possible to define potential risk-based microbiological limits for an indicator, enterococci, in order to evaluate the risk from potential growth of Salmonella. A positive correlation between the concentration of enterococci and the prevalence and concentration of Salmonella was shown for 6640 pork samples taken at Danish cutting plants and retail butchers. The observations that both Salmonella and enterococci are carried in the intestinal tract, contaminate pork by the same mechanisms and share similar growth characteristics (lag phase and maximum specific growth rate) at temperatures around 5–10 °C, suggest a potential of enterococci to be used as an indicator of potential growth of Salmonella in pork. Elevated temperatures during processing will lead to growth of both enterococci and, if present, also Salmonella. By combining the correlation between enterococci and Salmonella with risk modelling, it is possible to predict the risk of salmonellosis based on the level of enterococci. The risk model used for this purpose includes the dose–response relationship for Salmonella and a reduction factor to account for preparation of the fresh pork. The limit for enterococci can then be used for development of a process hygiene criterion in cutting plants and retail butcher shops, with the purpose of reducing the risk of Salmonella for the consumer.

Carcinogen Classification

Threshold and Non-Threshold Chemical Carcinogens: A Survey of the Present Regulatory Landscape

Bevan RJ, Harrison PT. Regul Toxicol Pharmacol. 2017 Jan 21 [Epub ahead of print].
doi: 10.1016/j.yrtph.2017.01.003. Article Link

Significance: Differentiation between threshold and non-threshold carcinogens must be made to prevent inappropriate risk management measures being put into place.

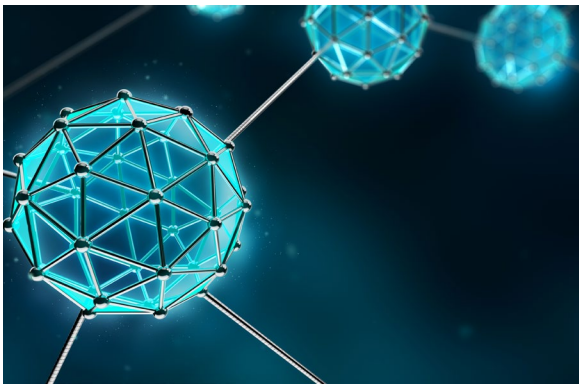
For the proper regulation of a carcinogenic material it is necessary to fully understand its mode of action, and in particular whether it demonstrates a threshold of effect. This paper explores our present understanding of carcinogenicity and the mechanisms underlying the carcinogenic response. The concepts of genotoxic and non-genotoxic and threshold and non-threshold carcinogens are fully described. The authors provide summary tables of the types of cancer considered to be associated with exposure to a number of carcinogens and the available evidence relating to whether carcinogenicity occurs through a threshold or non-threshold mechanism. In light of these observations the authors consider how different regulatory bodies approach the question of chemical carcinogenesis, looking in particular at the definitions and methodologies used to derive Occupational Exposure Levels (OELs) for carcinogens. The authors conclude that unless proper differentiation is made between threshold and non-threshold carcinogens, inappropriate risk management measures may be put in place - and lead also to difficulties in translating carcinogenicity research findings into appropriate health policies. The authors recommend that clear differentiation between threshold and non-threshold carcinogens should be made by all expert groups and regulatory bodies dealing with carcinogen classification and risk assessment.

Nanotechnology

Advances in Nanotechnology as They Pertain to Food and Agriculture: Benefits and Risks

Sadeghi R, Rodriguez RJ, Yao Y, Kokini JL. *Annu Rev Food Sci Technol*. 2017 Jan 25 [Epub ahead of print].
doi: 10.1146/annurev-food-041715-033338. Article Link

Significance: This article reviews the recently developed technology techniques as well as potential product applications and possible risks posed to the consumer.



Nanotechnology is an emerging and rapidly developing toolbox that has novel and unique applications to food science and agriculture. Fast and impressive developments in nanotechnology for food and agriculture have led to new experimental prototype technologies and products. Developing various types of nanodelivery systems, detection tools, nanoscale modifications of bulk or surface properties, fabrication of wide-range bionanosensors, and biodegradable nanoplatforms can potentially improve consumer health and safety, product shelf life and stability, bioavailability, environmental sustainability, efficiency of processing and packaging, and real-time monitoring. Exposure to nanomaterials may be harmful to the consumer and the environment and might increase the potential of risk. For this reason, evaluation of the potential risks resulting from the interaction of nanomaterials with biological systems, humans, and the environment is also reviewed.

Scientific Integrity

Discrepancy Between Financial Disclosures of Authors of Clinical Practice Guidelines and Reports By Industry

Andreatos N, Zacharioudakis IM, Zervou FN, Muhammed M, Mylonakis E. *Medicine (Baltimore)*. 2017 Jan;96(2):e5711. doi: 10.1097/MD.0000000000005711. Article Link

Significance: These findings indicate that the current process of disclosing COIs may be suboptimal and a proactive approach should be adopted in order to minimize COI reporting discrepancies.

There is a substantial effort to increase the accuracy of conflicts of interest (COI) reporting, and reduce the influence of COI between physicians and industry, especially as it relates to clinical practice guidelines. The authors used the newly implemented Open Payments dataset to evaluate the accuracy of COI disclosures of authors of clinical practice guidelines that were either newly

published or revised within 2014 and were included in the National Guideline Clearinghouse (NGC) website (maintained by the U.S. Department of Health and Human Services). Authors were considered as having inaccurate COI disclosure if they had not reported all companies from which they had received funds >$5000 in the 12 months preceding the guideline's publication. The authors identified 223 guidelines that were either newly published (109/223; 48.9%) or revised (114/223; 51.1%) within 2014 and were included in the NGC website. Among the 1329 guideline authors with available Open Payments data, 523 received >$5000 from at least 1 healthcare-associated entity. However, only 56 out of the 523 authors (10.7%) were found to have accurate COI disclosure. The percentage of authors with accurate COI disclosure in revised guidelines was significantly lower than in newly published guidelines (6.8% vs 14.3%; $P<0.01$) and was also found to differ between specialties. Furthermore, authors were less likely to inaccurately disclose "research payments" (37/49, 75.5%) compared to "general payments" (488/559, 87.3%, $P=0.02$) as well as "other/associated research funding" (430/506, 85.0%, $P=0.08$). No statistically significant association was detected between funding amount and disclosure accuracy.