

Peer Review

Review of: "Thermal and Packaging-Related Nanoparticles in Food: Formation Pathways, Migration Mechanisms, and Toxicological Considerations"

Abayeneh Girma¹

1. Ambo University, Ethiopia

General comments

This review article provides a comprehensive and timely overview of the formation, migration, detection, and potential health impacts of nanoparticles (NPs) in food, with a focus on both food-derived nanoparticles (FDNPs) from thermal processing and engineered nanoparticles (ENPs) from packaging materials. The topic is highly relevant given the increasing use of nanomaterials in the food industry and growing consumer awareness of food safety. The author demonstrates a strong command of the literature and synthesizes a wide range of studies effectively. The manuscript is well-structured, clearly written, and addresses a significant research gap. However, there are several areas where the review could be strengthened to enhance its originality, analytical depth, and practical utility. Major revisions are recommended before the manuscript is suitable for publication in a peer-reviewed journal.

- 1. Lack of critical synthesis and original insight:** While the review thoroughly summarizes existing studies, it often reads as a descriptive catalog of findings rather than a critical synthesis. The author should provide more original insight into the implications of the reported findings, identify consistent trends or contradictions across studies, and offer a more nuanced interpretation of the data. For example, the section on biodistribution lists results from various studies but does not sufficiently explain why different FDNPs (e.g., from pork vs. chicken) exhibit different organ accumulation patterns. A deeper discussion of the physicochemical properties (size, surface charge, functional groups) that influence biodistribution would be valuable.

2. **Inconsistent depth across sections:** The sections on FDNPs from cooking are detailed and well-supported, but the sections on ENP migration (e.g., nanosilver, TiO₂) are comparatively superficial. The author should expand the discussion on ENPs to match the depth of the FDNPs sections, particularly regarding mechanisms of migration, factors influencing release, and comparative risk assessment.
3. **Overreliance on in vitro and animal studies:** The review appropriately highlights the limitations of current toxicological models (e.g., in vitro systems, zebrafish, mice) but does not sufficiently address the translational relevance of these findings to human health. The author should more critically evaluate the extrapolation of doses and effects from animal models to realistic human exposure scenarios.
4. **Regulatory and risk assessment gaps:** While regulatory frameworks are mentioned, the review does not critically evaluate the adequacy of current regulations for FDNPs and ENPs. The author should discuss specific regulatory challenges (e.g., distinguishing FDNPs from ENPs, setting exposure limits for unintentional NPs) and propose concrete recommendations for policymakers.
5. **Structural and editorial issues:** The manuscript contains numerous formatting inconsistencies, incomplete sentences, and referencing errors (e.g., references 52 and 59 are duplicated; some citations are missing from the reference list). Again, some sections (e.g., Section 5 on "Applications of Nanotechnology") are underdeveloped and seem out of place in a review focused on unintentional NP formation and risks. Moreover, Figure 1 is referenced but not included in the provided manuscript, limiting the ability to evaluate its usefulness.
6. **Finally, I have some minor comments.** (i) The abstract could be more concise and better highlight the review's key contributions. (ii) The introduction provides a broad overview of food contaminants but could be more focused on NPs specifically. (iii) The table (Table 1) is useful but could be improved by including more consistent data (e.g., size ranges for all NPs) and a column on "Key Findings" or "Toxicological Endpoints." (iv) The conclusion section includes practical recommendations for consumers, which is a strength, but these should be better integrated with the scientific evidence presented earlier.

Declarations

Potential competing interests: No potential competing interests to declare.