Journal of Nanomedicine & Nanotechnology
ISSN: 2157-7439
OPEN ACCESS Freely available online
Editorial

Toxicity of Nanoparticles that have been created so far: A Review

Kevin Jacobs*

Department of Pharmacy, UCL College of Pharmacy, London, United Kingdom

INTRODUCTION

Nanomaterials that have been manufactured and have unique qualities have been widely used in a variety of industries, agriculture, and medicine. Some of the features, however, have been linked to the toxicity of nanomaterials. Concerns over the use and growth of nanotechnology have arisen as a result of the "nano-paradox," making it difficult for regulatory authorities to regulate nanomaterials. The ability to comprehend the impact of nanomaterial qualities on nano-bio interactions is crucial to proper nanomaterial regulation. To that purpose, we begin by giving a quick overview of nano-bio interactions at various levels [1]. The impact of key toxicity-related properties of manufactured nanomaterials (i.e., size, shape, chemical composition, surface properties, biocorona formation, agglomeration and/or aggregation state, and biodegradability) on toxicokinetics, cellular uptake, trafficking, and responses, as well as toxicity mechanisms, is investigated in depth. Advanced analytical methods for analysing nano-bio interactions are also discussed. The current regulatory and legislative frameworks for nanomaterial-containing products in various areas and/or nations are also discussed. Finally, in order to shed light on the safety evaluation of nanomaterials, we offer numerous issues facing the area of nanotoxicology and possible solutions. Nanomaterials or nano-enabled goods have seen rapid growth and widespread use in a variety of industries, including energy, aerospace, agriculture, industry, and biology, over the last few decades. Despite nanotechnology's great contributions to human society, there is still widespread concern about nanomaterial toxicity in a variety of organisms, from environmental species to humans. Nanotoxicology is the study of the harmful effects of nanomaterials or nanoproducts on living creatures over the course of their lives, with the goal of ensuring reliable safety assessments and adequate regulation of nanomaterial manufacture, usage, and deposition. Obtaining a thorough understanding of the underlying toxicological knowledge of nanoparticles is a precondition for achieving these objectives. Nanotoxicological research aims to better understand how nanomaterials interact with organisms at the organ/tissue, cellular, and molecular levels, with a focus on toxicokinetics (absorption, distribution, metabolism, excretion (ADME)), cellular uptake and trafficking, toxicity, and underlying mechanisms [2].

Interactions between nanotechnology and biology at the organ, cellular, and molecular levels: Humans can be exposed to manufactured nanomaterials at various times of their lifecycles and for various purposes, such as pulmonary inhalation, oral uptake, skin contact, and intravenous injections, among other methods. Various nanomaterial transformations, such as aggregation/agglomeration, dissolution, and the formation/evolution of biocorona, can occur at their entrance portals, affecting their toxicokinetics and biological consequences. The bulk of nanoproducts inhaled, orally ingested, and topically applied to the skin become lodged in complicated bioenvironments and end up in the exposed organs, where they might cause further harm before being eventually removed out of the body. While a small percentage of these nanomaterials can be absorbed into the blood and/or lymphatic system, the majority cannot. Non-intravenously injected nanomaterials have a more broad and even dispersion over the body because to the delayed dosage rate, unique absorption routes, and distinctive biocorona acquired/evolved, as well as their migration from exposure portals to absorption sites. Intravenously injected equivalents, on the other hand, are swiftly removed from the bloodstream and accumulate mostly in MPS-rich tissues like the liver and spleen. Furthermore, circulating nanomaterials may penetrate the blood-brain barrier, blood-testis barrier, and placental barrier to reach the central nervous system, reproductive system, and progeny, and have biological effects on these organs, regardless of the source of exposure. Nanomaterials have different breakdown, metabolism, and excretion patterns depending on their characteristics, which primarily occur in the liver and kidney. Nanomaterials can potentially target a range of organs, including the lung, intestine, liver, spleen, and kidney, according to their toxicokinetic process [3]. Inflammation, granulomas, and fibrosis of the lungs, gut and microbiota dysfunction, liver damage and malfunction, spleen inflammation, and kidney injury are all examples of pulmonary toxicity. Following that, nano-bio interactions at the cellular, subcellular, and molecular levels provide more fundamental reasons for organ/tissue toxicity as well as helpful guidelines for nanomaterial safety assessment. Membranes can bind to, pierce through, embed in, and/or internalise

*Correspondence to: Kevin Jacobs, Department of Pharmacy, UCL College of Pharmacy, London, United Kingdom, E-mail: kevinjacobsers@yandex.com

Received: 05-Jan-2022, Manuscript No: jnmnt-22-15972, **Editor assigned:** 7-Jan-2022, PreQC No: jnmnt-22-15972(PQ), **Reviewed:** 14-Jan-2022, QC No: jnmnt-22-15972, **Revised:** 17-Jan-2022, Manuscript No: jnmnt-22-15972(R), **Published:** 24-Jan-2022, DOI: 10.35248/2157-7439.1000600

Citation: Jacobs K (2022) Toxicity of Nanoparticles that have been created so far: A Review. J Nanomed Nanotech. 13: 600. doi: 10.35248/2157-7439.22.13.600.

nanomaterials in general. Nanomaterials can be internalised by cells in a variety of ways, affecting their intracellular location, destiny, and cytotoxicity in the process. The chemical nature of core nanomaterials, impurities, functionalization techniques, surface qualities (surface charge/hydrophobicity/ligands), size, shape, agglomeration, and biocorona are all factors that influence nano-bio interactions at various levels. Despite significant advances in the science of nanotoxicology, determining the safety of various nanomaterials remains a daunting task. As previously said, a wide range of nanomaterial physicochemical features can work with or against one another to produce complex effects at various levels of nano-bio interactions [4]. Because of the overlapping impacts of numerous nanomaterial qualities on diverse toxicological processes, validating the causal linkages between ultimate nanotoxicity and nanomaterial physicochemical properties is extremely difficult. To this purpose, careful material design and accurate production of nanomaterials, which provides a library of nanomaterials with only one different property from each other yet encompassing a large range of properties of interest, is highly valued and urgently required. Furthermore, many toxicological researches ignore realistic conditions of nanotoxicity induction, resulting in the investigation of exaggerated nanotoxicity toxicity pathways [5].

REFERENCES

1. Pawelczyk E, Arbab AS, Chaudhry A, Balakumaran A, Robey PG, Frank JA. In vitro model of bromodeoxyuridine or iron oxide nanoparticle uptake by activated macrophages from labeled stem cells: implications for cellular therapy. Stem cells. 2008; 26:1366–1375.

2. Ge Y, Zhang Y, He S, Nie F, Teng G, Gu N. Fluorescence modified chitosan-coated magnetic nanoparticles for high-efficient cellular imaging. Nanoscale research letters. 2009; 4:287–295.

3. Trouiller B, Reliene R, Westbrook A, Solaimani P, Schiestl RH. Titanium dioxide nanoparticles induce DNA damage and genetic instability in vivo in mice. Cancer research. 2009; 69:8784–8789.

4. Bhattacharya K, Davoren M, Boertz J, Schins R, Hoffmann E, Dopp E. Titanium dioxide nanoparticles induce oxidative stress and DNA-adduct formation but not DNA-breakage in human lung cells. Partical and fiber toxciology. 2009; 6:17.

5. Liu H, Ma L, Zhao J, Liu J, Yan J, Ruan J, et al. Biochemical toxicity of nano-anatase TiO2 particles in mice. Biological trace element research. 2009; 129:170–180.