Nanotoxicity: a major concern nowadays

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Presentation of the domain

✓ Mechanism which allows nanoparticles to pass through cells and membrane walls is not fully understood

✓ About 800 consumer products containing Nanoparticles or Nanofibres existing on the market in 2008 and is continuously growing **(Project on Emerging Nanotechnologies, 2008).**

✓ The most common materials mentioned on the market: Carbon (nanotubes&fullerens-29 products); silver (25); SiO2 (14), TiO2 (8), ZnO (8), CeO2 (1) **(The Nanotechnology Consumer Products Inventory"-2006)**,

✓ Current production: nanoTiO2 ≈5000 t/y, nano Ag ≈500 t/y, C nanotubs ≈ 350 t/a. Strong growing and moving from bulk TiO2 to nano expected to end 2025;

✓ Due to growth of synthetic nanoparticles, exposing of workers and public is expected to grow dramatically with their release in the environment **(A. Kahru, H.-C. Dubourguier , "From ecotoxicology to nanoecotoxicology" Toxicology 269 (2010) 105–119)**

Presentation of the domain

- ✓ The first forum related to toxicity and risks determination associated with nanoparticles use took place in 2007, Stockholm, Sweden
- ✓ 7 June 2005, Action Plan “Nanosciences and nanotechnologies: An Action Plan for Europe 2005–2009”: was adopted
- ✓ Regulation (EC) No. 1907/2006 (REACH) at the beginning did not include nanomaterials and nanotechnology
- ✓ New EC Regulation 1272/2008 and REACH (which is related to substances in any shape, dimension or physical state) ask the manufacturer, importer and end user to ensure that nano-materials do not have adverse effects on human health and environment
- ✓ Presently the needs of different ETPs related to nanotoxicology and regulations are collected by the joint initiative NANOFUTURE

Publications

Global distribution of Nanotoxicology Scientific Literature

USA	China	Germany	UK	Japan	France	India	Italy	South Korea
768	191	116	103	101	80	74	56	56
Canada	Spain	Taiwan	Swisstzerland	Brazil	Netherlands	Austra-lia	Russia	Belgium
42	34	34	30	21	21	20	17	12
Israel	Denmark	Poland	Romania					
11	11	10	10					

1935 items of peer reviewed literature on nanotoxicology (journals, letters, reviews) for the period of year 2000 to year 2007 were analysed.

Source: Alexis D. Ostrowski , Tyronne Martin, Joseph Conti, Indy Hurt, Barbara Herr Harthorn Nanotoxicology: characterizing the scientific literature,2000–2007, J Nanopart Res (2009) 11:251–257

Publications

Distribution of Scientific Literature in the field of toxicology, biocompatibility in Romania

UPB	52	Alex.I.Cuza Univ	7	National R&D Instit. Chem.Pharmaceutical	2	Carol Davila Med&Pharm. Univ. Bucharest	4
National R&D Mechathron	1	National R&D Instit. For Non-ferrous and Rare Metals	6	SC METAV R&D SA	4	Univ.Agr. Sci & Vet.Med, Ion Ionescu de la Brad	1
IMT	3	National R&D Instit. Lasers, Plasma &Radiation	10	Univ. Transilvania Brasov	5	National R&D Instit. Tech.Phys.	2
National R&D Instit.Biol.Science	6	National R&D Instit. Textile&Leather	4	Univ.Babes Bolyai	2	Instit.Phys. Chem. Ilie Murgulescu	1
Petru Poni Macrom. Chem. Instit	12	ICPE CA	4	National R&D Instit. Patho.Biomed.Sci. Victor Babes	1	National R&D Instit. Isotop&Mol. Tech	2
ICECHIM	2	National R&D Instit. Mat.Physics	10	National R&D Instit. Tech.Phys.	1	INOE 2000	1

Source ISI Web of Knowledge Web of Science: Topic=(toxicology OR toxicity OR biocompatibility)
With the support of ICCF-Bucharest, dr. Radu Albulescu

Publications

Distribution of Scientific Literature in the field of toxicology, biocompatibility in Romania

Gr.T. Popa Univ Med&Pharm	6	Univ.Oradea	2
Lucian Blaga Univ	4	Univ.Petrol Gas Ploiesti	2
Ovidius Univ. Constanta	1	BIOMAT Centre Bucharest	1
SC INCERPLAST SA	1	SC Prelucrari Met.Prod.SRL Bucharest	1
SC R&Consulting& Serv.SRL	1		

Observation related to Web of Science data base: the authors did not used nanotoxicology, but they reported “toxicological tests”, biocompatibility evaluation and other formulae.

Source ISI Web of Knowledge Web of Science: Topic=(toxicology OR toxicity OR biocompatibility), latest data
With the support of ICCF-Bucharest, dr. Radu Albulescu

Education (an example)

University California, USA: a program entitled " The Nanotoxicology Research and Training Program" was elaborated.
The new discipline of Nanotoxicology is currently being built to ensure safe development of nanotechnology and develop guidelines for testing of all nano scale materials where human and ecosystem health can be affected.
The objectives of the lectures are:
- Introduce students to commonly used vocabulary in NanoScience that will required to appreciate the biological interactions and potential toxicity of nanomaterials
- Discuss synthesis and physical-chemical characterization of engineered nanomaterials
- Develop an understanding of unique properties of engineered nanomaterials and how these properties contribute to biological interactions
- Relate properties of engineered nanomaterials to their potential for transport, reactivity, uptake, and toxicity in natural environments and in the body

Instead of conclusions

Toxicology of non-nano chemicals is a well established procedure. Unfortunately, Nanotoxicology is quite more complicated and standard protocols in Toxicology can not be used. Nanomaterials have to be investigated in detail for different parameters like size, size distribution, shape, charge, etc. Furthermore, interaction with different matrices like blood, interstitial fluid, buffers, etc.influences significantly nanomaterials like, agglomeration, size distribution, charge, etc. In consequence, nanotoxicology needs new standardised protocols which are able to deal with the extreme complexity of nanomaterials and their toxicological behaviour!

In Romania, in this context, we have to answer to the following questions:

1. Safety evaluation of nanoparticles- do they do harm?
2. Standardisation – meet the actual standards the needs of Nanosciences and Nanotechnologies applications including their toxicological behaviour?
3. Education – does the actual curricula ensure the necessary knowledge to understand Nanomaterials and to develop safe Nanotechnologies?
4. Are we prepared for technological transfer of Nanomaterials and Nanotechnologies?
5. Is the civil society informed about the benefits and potential risks of nanomaterials and nanotechnologies?

THANK YOU FOR YOUR ATTENTION !