Nanosafety and Critical Raw Materials Strategic Dependence For The Development Of Nanotechnology

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Abstract

Without doubt one of the most difficult challenges faced in the exploitation of nanotechnology for the benefit of European society (and beyond) has been the uncertainty surrounding the potential associated risks. Moreover, as in all industrial applications, the potential exposure of humans and the environment to these materials is inevitable. As these new materials go through their life-cycle – from development, to manufacture, to consumer usage, to final disposal – different human groups (workers, bystanders, users), environmental compartments (air, soil, sediment, water), and species (e.g. worm, fish or human through secondary exposure) will be exposed to them. Consequently, Nano Materials (NMs) safety is of great societal concern and raises many questions for the general public, governments, industry, scientists and regulators. Identifying and controlling the hazards associated with NMs is required to ensure the safety of the general public, workers and the environment in parallel to exploiting the technological benefits.

Our institute answers this challenge by fostering a timely key action joining industry and academy to create a collaborative excellence-based knowledge exchange network pushing forward and training scientists in new methodologies to assess long term nanosafety, test and pre-validate them, and finally discuss their relevance and suitability for standardization and inclusion in present and future EU regulations. This effort (NANOGENTOOLS [1]) is funded by the EU Commission H2020 under the MSC-RISE work programme.

Given the great variety and number of NMs, it is impossible to study their toxicity using conventional toxicological and risk assays, as this would require dozens of years and would cost millions of €s. Indeed for the US Choi et al. (2009) [2] showed that costs for testing existing NMs range from $249 million for optimistic assumptions about NM hazards to $1.18 billion for a more comprehensive, precautionary approach, and would require 34-53 years to cover all existing NMs threats and much longer as new NMs are discovered.

Our Center is making progress in the innovation of new genomic and biophysical methodologies capable to detect and address long-term risk of NMs in a fast and efficient way. In particular, we are fostering new microarray-based tests as a potentially rapid and cost-effective approach for identifying and assessing potential hazard, characterizing NM mode of action, and assessing human health risk [3].

On the other hand, we would also like to analyze the importance for the technology development strategy and country dependence of critical raw materials. In particular their role in nanotechnology-based value chains.

Difficulties in the access to Critical Raw Materials (CRMs) are expected to depress industrial sectors vital to Europe. As a response, Europe has established the Resource-Efficiency Roadmap and the European Innovation partnership (EIP) Raw Materials (RM). Moreover, the European Institute of Innovation and Technology (EIT) has warded in December 2014 a knowledge and innovation community (KIC) on raw materials.

In this context, the Nanotechnology, as a strong pillar of the present and future EU industrial value chains, is expected to play a key role.

Our Center is coordinating the efforts within EU-NANOFUTURES [4] aiming at meeting two fundamental needs in the field of CRMs: On the one hand, the creation of a collaborative network of expertise to develop new materials, products and technologies based on nanotechnology, by connecting fundamental and applied research with the aim of substituting or reducing the need of CRMs in strategic

EU industrial value chains. Such a research alliance focusing in Nanotechnology as a vehicle of substitution is totally new in Europe, and has the opportunity to take the lead internationally with the main actors in the context of the EIP-Raw Materials and the KIC (EIT) in Raw Materials. On the other, the establishment of a platform of knowledge and technology transfer within EU- NANOFUTURES common to scientists, engineers, technologists, and European industry. The combination of different expertise can be expected to give rise to beneficial synergistic effects along the whole value chain in Nanotechnology involving CRMs, which could result in a significant scientific, technological and economic progress for EU.

Main activities in this context and possible synergies will be presented

References

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