European Perspective on Nanotechnology in the Context of Food and Feed Production

Scientific Symposium on Food Safety, Nutrition and Nanotechnology

University Parma, 4th October 2007

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Scientific Panel on Food Additives, Flavourings, Processing Aids and Materials in Contact with Food - AFC Panel European Food Safety Authority, Parma, Italy

Outline of Presentation

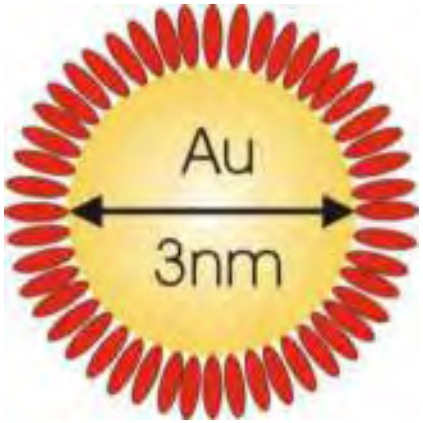
- Definitions
- Actual and potential Application Areas
- Implications for Risk Assessment
- EFSA Role in the Risk Assessment

Definition

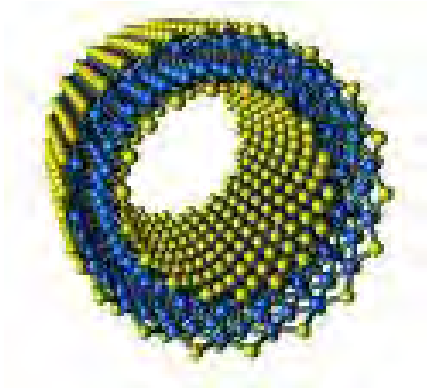
Although there is presently no international agreement on the definition of terms, a general consensus prevails that **nanoparticles** are elements which measure less than 100 nanometers (nm)

Origin: Nano (Greek) – dwarf

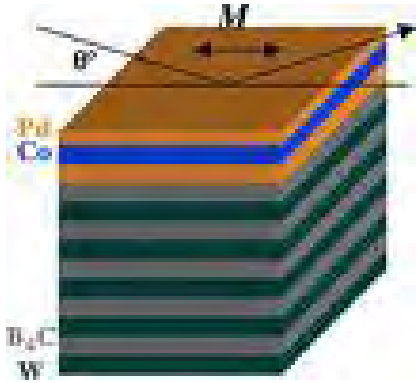
What does that mean?!



3D: Quantum dot



2D: Nanotube

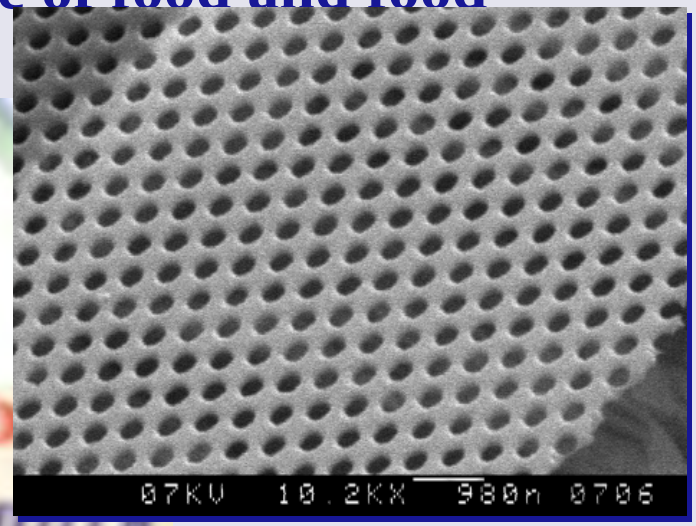


1D: Nanolayer

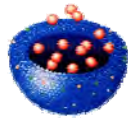
Image source: http://www.nanotechstate.com/wp-content/uploads/2006/11/gold-nanoparticle.jpg
http://www.esi.umontreal.ca/~grofnum/img/nanotube_gase.gif
http://www.als.lbl.gov/pics/50magneticfig1a.jpg

Nanotechnology

- What is nanotechnology?
- Is nanotechnology necessary to produce nanoparticles?
- Certainly not added to food
- BUT: might have an impact on food, e.g. could change the properties and nutritional value of food and food ingredients



NP or NT?



‚Nanomicelle' ?

Image source: Presentation from Frans Kampers, BioNET, Wageningen, The Netherlands

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Potential Application Areas

- **Food packaging**, e.g. improved packaging materials with superior physical characteristics intended to extend the shelf life of food or use of sensors to monitor the freshness (e.g. smart or intelligent packaging)
- **Functional foods**, e.g. nanocapsules incorporating nutrients into the food (”nano-ceuticals”),
- **Taste and texture**, e.g. spreads and ice creams with nanoparticle emulsions to improve the texture and reduce the fat content
- **Pesticides**, e.g pesticides enclosed in nanocapsules which can be more easy taken up by plants
- **Animal health**, e.g. vaccines incorporated into nanoparticles aiming for a more efficient absorption and a dosed release

Application Principles

1) **Nanoparticulated substances** which improve physical properties such as gas permeability of food packaging (e.g. metal oxids, nano-clay), or act as antimicrobials (e.g. silver, ZnO) in food contact materials

2) **Micelles** which protect the incorporated substance from the environment (e.g. oxidation sensitive vitamins) and/or release them on command at the lieu of need (e.g. by change of pH)

3) **The technology** which could lead to manipulations of food ingredients on a molecular basis (e.g. gel formation) and could be used for monitors and sensors

Actual Applications on the Market[1)]

[1)] Woodrow Wilson International Center for Scholars: Nanotechnology Consumer Products Inventory http://www.nanotechproject.org/index.php?id=44

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Need for Risk Assessment

1) **Nanoparticulated substances** might exhibit different physical and chemical properties in contrast to the respective bulk material (e.g. different colour, chemical reactivity!) but are also discussed to cross cell membranes
2) **Micelles** might increase e.g. the delivery/ bioavailability of nutrients hence could lead to a debate on upper levels
3) **The technology** itself could lead e.g. to changes in nutritional properties of food ingredients

Implication for Risk Assessment

Open Questions and Challenges…

- Definition and distinction (NP, NT, manufactured vs natural NM)
- Methods of analysis/detection (distinguishing between natural and manufactured, nano and bulk form, detection in a complex matrix such as food)
- Applicability of current Risk assessment paradigm
- Need of toxicological data
- What and how do we communicate – establish trust?

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EFSA Role in the Risk Assessment

EFSA's mission is

- Provision of **scientific advice** and **scientific and technical support** in all fields which have a direct or indirect impact on food and feed safety to European Commission, Parliament and MS
- Provision of **independent information** on all matters within these fields
- **Risk communication** within its remit
- **Networking and collaboration** with Member States

Future and current Requests

Requests for risk assessment of nanoparticles or products of nanotechnology can be expected in the future in the following areas:

1) Authorisation of regulated substances
2) General requests, e.g. application of NT in food production → change in nutritional value, bioavailability, etc.
3) Contaminants in food and feed

Authorisation of regulated substances

EFSA was asked to evaluate the safety of a silicon dioxide coating in situ on the inner surface of PET articles

The coating is intended to provide gas barrier properties and the maximum thickness is 100 nm.

EFSA has given a scientific Opinion in February 2007[1)]

- Restriction: 0.05 mg/kg of food (measured as hexamethyldisiloxane)
- Only to be used as a surface treatment agent on PET

1) http://www.efsa.europa.eu/etc/medialib/efsa/science/afc/afc_opinions/ej452-454_14list.Par.0001.File.dat/afc_op_ej452-454_14thlist_op_en.pdf

Authorisation of regulated substances

Recently EFSA has received a request for a safety evaluation of a Food Contact Material additive:

Titanium nitride (TiN), nanoparticles

(EFSA-Q-2006-323)

Currently under Evaluation:

http://www3.efsa.europa.eu/register/qr_dateofreceipt_29_en.html

General requests

EFSA has received a request of the European Commission (EC) for **an initial scientific opinion on the risks arising from nanoscience and nanotechnologies** on food and feed safety and the environment (EFSA-Q-2007-124).

General requests

The proposed strategy to answer this request is

- To take into account the various documents recently generated by **scientific advisory committees** at European level (e.g. SCENIHR opinion, work in progress by OECD, CEN)

- To assess the **need for specific risk assessment approaches** for nanomaterials and identify the nature of the possible hazards associated with the actual and foreseen applications of nanoscience and nanotechnologies in the food and feed area.

- To consider **currently used methods in EU Member States** and third countries for risk assessment in relation to materials produced with and processes based on nanoscience and/or nanotechnologies in the food and feed area (e.g. UK COT statement).

EFSA´s Role in the RA

The Scientific Committee dealing with the request has as a basis the report of the Internal WG summarising the current knowledge relevant for risk assessment

The Internal WG follows closely the activities and progress of other organisations (OECD, ISO, European Commission, research) and the European Member States (Joint statement of the UK COT, COM, COC, German consumer conference, etc.)

Summary

- Nanotechnology and its related products are likely to have a big impact on the production of food and feed in the future and have potentials to offer benefits for consumers
- Uncertainties and concerns are raised in the context of the safety but also on the current use of NT/NP in food and feed
- A dialogue has to be established involving consumers but also food and feed producing industries

Thank you for your interest!

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http://www.efsa.europa.eu/de/about_efsa.html