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## DSM position on nanotechnologies

### Key messages

DSM sees nanotechnologies as a very important development. Nanotechnologies present new opportunities to improve our products and offerings, and thus contribute in certain cases to our mission to support a healthier, more sustainable and more enjoyable way of life for people today and generations to come.

Nanotechnologies are not new: materials in the nano scale and nanoscale processes are a natural part of the environment and surround our lives every day. New is the increasing technical ability to take advantage of the nano scale to create improved products.

As with all new technologies and products, good understanding of potential risks is required. DSM aims to mitigate risks through proper control measures, followed by regular risk assessments that take into account known and potential hazards. Adequate information exchange with suppliers, employees and customers across the value chain helps to ensure safe handling and use of nanotechnologies, nanomaterials and products containing nanomaterials.

### DSM and nanotechnologies

As a science-based company that creates innovative products and services, DSM contributes to and benefits from new developments in science and technology. DSM sees nanotechnologies as a very promising development for our business.

With our strong know-how base and wide range of technological competences in both life sciences and materials sciences, we are well positioned to explore the potential of nanotechnologies in both these fields as well as at the highly promising interface between the two. At the same time, we are aware of safety and regulatory questions as well as societal concerns surrounding nanomaterials.

Nanotechnologies are not yet well understood. As with all new technologies nanotechnologies often find themselves linked to troubling public risk perceptions. When this happens, the fate of those technologies can be cast into doubt, together with their expected benefits. We are aware that consumer acceptance of nanotechnologies cannot be taken for granted, and we therefore make safety and other consumer concerns a priority. In all application areas we are committed to dealing with nanomaterials in a safe and responsible way. We ensure that all DSM products and processes can be safely used as intended and are also in compliance with applicable regulatory requirements. Furthermore, we encourage scientific research of nanotechnologies to be underpinned by complementary activities exploring the ethical, legal and social aspects of nanotechnologies, as well as efforts to improve dialogue with a wider audience.



What are nanotechnologies?

'Nanotechnology' is not a single technology but rather a diverse set of technologies which aim to master matter at extremely small dimensions. 'Nanotechnology' is the application of scientific knowledge to master and utilize matter at the nanoscale, where size-related properties and phenomena can emerge. The nanoscale is a size range from approximately 1 nm to 100 nm (1 nanometer = one billionth of a meter).

The precise structuring of matter at this small scale enables the design and production of new materials with improved and/or new properties, which are not mere extrapolations of properties that exist at a larger scale.

Are nanotechnologies new?

The term 'nanotechnology' was introduced in 1974 by Japanese professor Norio Taniguchi (the term 'nano' is much older). However, nanostructured materials have been known for quite some time. All of nature is structured at the nano scale and the important processes in nature are controlled at the nano level. Nature is in fact the source of inspiration for nanotechnologies research.

What are nanomaterials?

Nanomaterials are generally defined as materials that have structures in the range between 1 nanometer and 100 nanometers. For example, there is an ISO (International Organization for Standardization) standard (ISO TS27687 (2008-08-15)) that defines nanoscale as the "size range from approximately 1 nm to 100 nm".

What are the main potential applications and benefits of nanotechnologies?

Material at the nanoscale can have different and novel properties compared to its bulk form. The larger surface area increases the material's interaction with the surrounding environment. As a result, materials change their color or transparency; their electrical conductivity; their basic physical properties (e.g. hardness, melting point) or their chemical properties (e.g. reactivity). These changes then lead to different behavior, such as increased strength and much less weight. Materials may absorb more heat, become fire-resistant, or gain self-cleaning qualities. By working with materials at the nanoscale, we are able to harness these unique properties to our advantage in many different applications. These applications have rightly been identified as having huge potential in terms of solving issues of global concern including improved and accessible healthcare, clean water, energy and climate change related solutions.

Some current examples include: anti-reflective and self-cleaning coatings; self-repairing materials; smaller and faster electronics components; sun screens and medical diagnostics; systems enabling the precise targeting of medicines to reduce the amount of active compound needed as well as to reduce undesired side-effects; and future solar energy systems based on the mimicking of nature's energy generation via artificial photosynthesis.

Do DSM products based on nanotechnologies already exist?

Some DSM products make use of nanotechnologies. For instance, KhepriCoat® is our unique anti-reflective coating technology for solar glass. The nanostructured single-layer coating results in an increased transmission of sunlight thus improving the efficiency of the solar panels.



Are there any risks involved in handling nanomaterials?

As with all new technologies and new products, good understanding of potential risk is required. Studies have indicated that certain nanostructures reveal toxicological properties that are different from those which the same materials exhibit at larger or at molecular scales. Societal concerns also relate to the exposure risk associated with nanoparticles. DSM believes that by conducting risk assessments that take into account known and potential hazard factors, including a substance's form and structure and exposure factors, risks can be mitigated through proper safety measures.

How does DSM guarantee the safety of products incorporating nanomaterials?

All DSM products are safe for their intended use and utilization in the down-stream value chain, and we recommend precautionary measures to our customers in order to ensure that these products are safe when used. We provide product information that is comprehensible to stakeholders. We require our suppliers to provide us with up-to-date product safety information, and we inform our employees, customers and other value chain partners about potential risks and safe handling procedures.

Does DSM participate in societal debates surrounding 'nano'?

In line with our tradition in the field of safety, health and environmental management, we continue to exercise all due care in dealing with nanomaterials and nanotechnologies, and engage in dialogue on both the potential opportunities and the potential risks of their use.