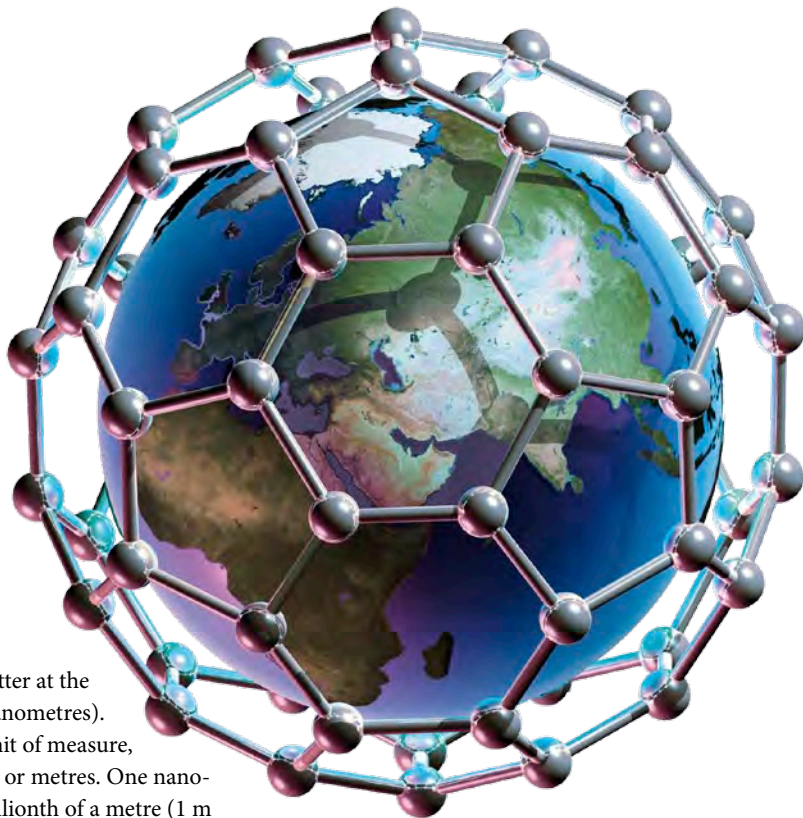


NANO – A small small science with BIG possibilities



Nanotechnology is one of the most exciting developments of the 21st century. These days nanotechnology features in everything from sunscreen and tennis rackets to medicine and even water and wastewater treatment. But what is nanotechnology?

The word 'nano' refers to something that is very small. Nanotechnology deals with materials so small they cannot be seen with even normal microscopes. Basically, nanotechnology is the art and engineering

of manipulating matter at the nanoscale (1-100 nanometres). A nanometre is a unit of measure, just like millimetres or metres. One nanometre equals one billionth of a metre (1 m = 1 000 000 000 nm). That is a lot of zeros!

So what do we measure in nanometres? Well, atoms and molecules – the smallest things around us are measured in nanometres. For example, a water molecule is less than one nanometre. A typical germ is 1 000 nanometres, and a hair is 100 000 nanometres wide. The best way to illustrate it is this: take a ruler and flip it to the centimetre side. See how long 1 centimetre is? Now imagine you can fit a million points into that one centimetre. The space between two of those points will be a nanometre.

At this small size, materials often take on unique and sometimes unexpected properties. The small size affects their physical properties, like their surface area, magnetic properties, melting point and electrical conductivity. Nano-sized gold, for example, can appear red rather than metallic yellow. Nano-sized carbon tubes are many times stronger than the same weight of steel, while bulk carbon can be very brittle.

This means that at the nanoscale, materials can be 'tuned' to build faster, lighter, stronger and more efficient devices and systems, as well as new classes of materials. In the water sector, nanotechnology can be applied to develop more cost-effective and high-performance water treatment systems as well as instant and continuous ways to monitor water quality.

Nanomaterials may also be used to develop new and enhanced sensors which can detect biological and chemical contaminants at very low concentrations in

water. In addition, nano-enhanced materials may be used to remove, reduce or neutralise water contaminants that threaten human health and/or ecosystems. There are already thousands of products on the market benefiting from nanotechnology, and new products incorporating nanotechnology are launched around the world every day.

NANO AND WATER

- **Water treatment:** Nanomaterials can already be harnessed to enhance existing water treatment processes. Replacing existing materials and equipment such as activated carbon and reverse osmosis and nanofiltration membranes by nanotechnology modified or produced materials can lead the way for more advanced nanotechnology processes.
- **Water pollution:** There are several new techniques being investigated for the remediation of water pollution. One of the most promising examples is zero-valent, nano-iron which is being tested for use in removing solvents from pumped groundwater.
- **Diagnostic tools:** Great potential exists for the development of nanotechnology-based diagnostic tools that can be used for real-time drinking water quality assessment. Detection of viruses, bacteria and parasites in real-time is needed rather than culture-based techniques that could provide information in days.



Modern products already making use of nanotechnology.



In the water sector, nanotechnology can be applied to develop more cost-effective and high-performance water treatment systems as well as instant and continuous ways to monitor water quality.

THE SIZE OF NANO

One nanometre = one billionth of a metre

One DNA molecule = 2 nanometres (nm)

Virus = 50 nm

Visible colour = 400-700 nm

E. coli = 5 000 nm

Hair diameter = 75 000 nm

www.rqbstock.com



A water bottle that can purify water? That is only one of the possibilities being explored by nanotechnologists.

The Water Research Commission is currently funding a number of existing projects in the field of nanotechnology. One of these studies involves the fabrication of nano-fibre membranes to treat water for drinking purposes. Another is looking at the use of polymer beads, containing nano-magnetic particles, to clean (or defoul) membranes used in the desalination process.

Nanotechnology is an interdisciplinary field, which means it involves many people from different sectors working together, such as biologists, chemists, physicists and engineers, to create new and wonderful things. South Africa is one of the first countries in the world to have an official nanotechnology strategy, focusing on water, energy, chemical and bioprocessing mining and minerals and advanced materials and manufacturing.

Modern nanotechnology is still a very new science, and researchers are discovering new things every day. This means we do not know nearly enough as we want to about what nanomaterials can and cannot do. Like all chemicals and materials, scientists have to be sure they know all there is to know (i.e. benefits

and disadvantages) about these products before they can be used safely. There are still a lot of unanswered questions about the health and safety aspects of nanomaterials to humans and the environment, and scientists are working hard to answer all of these questions.

In the end, it is all about creating exciting new products and technologies to make the world a better, safer world to live in. ☐

USEFUL WEBSITES

- <http://science.howstuffworks.com/nanotechnology.htm/>
- <http://en.wikipedia.org/wiki/Nanotechnology>
- http://en.wikipedia.org/wiki/Nanotechnology_in_water_treatment
- http://wrcwww/Knowledge%20Hub%20Documents/Water%20Wheel/Articles/2008/01/WaterWheel_2008_01_Nanotechnol%20p%2010-13.pdf
- www.trynano.org
- www.crnano.org/whatis.htm
- www.nanoandme.org/home/

