

Executive Summary

Nanotechnology is the art, science and engineering for manipulating objects at the 1 - 100 nm scale. It involves design, synthesis, manipulation, characterization and exploitation of materials and devices with structures defined in terms of nanometers. Nanotechnology is not a single science but includes aspects of chemistry, physics, biology, material science, etc. Chemists, physicists, biologists, medical doctors, engineers and computer scientists typically form part of teams that work in the nanotechnology field.

Nanotechnology is generally regarded as a new generation of technology with the potential to revolutionise most facets of the world we live in. This includes virtually all aspects of our daily lives, including health and health care, the materials and equipment we use and the way they are manufactured, our environment and protection thereof. However, the 'revolution' will not happen overnight and very large investments in research and development and production will be required in the process.

Nanotechnology is an enabling technology that, potentially, could lead to cost-effective and high-performance water treatment systems. It has the scope and performance potential to generate technically and environmentally appropriate solutions to water related problems over a wide spectrum. In addition to improved treatment technologies, it offers the promise of cleaning up historic pollution problems. It has the potential for instant and continuous monitoring of water quality, but its biggest impact on the environment could be in pollution prevention through improved clean technologies for better conversion of materials and elimination of waste production.

Challenges that need to be resolved before nanomaterials could be successfully used on large scale in water treatment include safety evaluation, large scale production facilities, safe disposal of wastes and energy efficiency. These are major challenges that might cause major delays in the large scale application of nanotechnology in water treatment.

The main findings of an investigation into nanoscale research in South Africa (Pouris, 2007) is that it is driven by individual researchers' interests and it is in its early stages of development; the country's nanoscale research is below what one would expect in light of its overall publication output; the country's nanoresearch is distributed at a number of Universities with a sub-critical concentration of researchers.

From an initial survey of nanotechnology developments in the water field and problems in the South African water industry, the authors have compiled the following preliminary list of areas in which research on water-related nanotechnology could be initiated and existing South African efforts possibly be coordinated to address South African problem areas. Three general areas have been identified: (i) water treatment technology including development of improved membranes and development of activated filter media, (ii) development of real-time diagnostic tools for water quality assessment, (iii) development of membrane-based wastewater treatment technology.