Nanotechnology-Enabled Water Treatment for improved Food Safety and Public Health

Ensuring reliable access to affordable and safe sources of water is critical to both global health and economic development. This challenge is rapidly growing as the world's population increases; global climate change threatens to take away already scarce fresh water resources; municipal and industrial wastes pollute water supplies; the aggravating agricultural and industrial contamination further limits the availability of adequate water supply; and the aging water/wastewater infrastructure falls short on reliability, energy efficiency and public health safety.

These critical issues urge us toward both technology reform and a paradigm shift in water management.

Among the various technological innovations for water treatment, nanotechnologies are emerging with great potential for water treatment and recycle. Accordingly, the International Conference - NANOAGRI 2010 that FAO organized in collaboration with the Government of Brazil, identified nanotechnology based systems for water treatment among those applications with the greatest potential benefits for developing countries. It is therefore important to understand and overcome potential scientific, technical and socio-economic barriers to capitalize on the opportunities offered by nanotechnologies to improve water quality. At the same time it is important to proactively assess and mitigate potential unintended impacts of nanotechnology in the early stages of its development.

In light of this, FAO is collaborating with Rice University (Houston, USA) in a study to assess the feasibility of applying in low-income communities in Swaziland an innovative nano-based water treatment in a safe, cost-effective and easy to implement manner. The technology to be assessed in this study was developed by Rice University and is based on photocatalytic nano-materials that can inactivate water-borne viruses and bacteria and also break down persistent chemical contaminants. The idea behind this innovative technology is to decontaminate water to be used in food production, in a cost-effective manner that is readily implementable, and requires minimal infrastructure and very limited maintenance. A similar technology developed by Rice University which has been implemented at pilot scale in Mexico was selected by Forbes magazine as one of the top five nanotechnology breakthroughs of 2006.

The first phase of FAO collaboration with Rice aims to assess the feasibility of applying the technology in Swaziland by assessing relevant factors and in refining the technology according to the local conditions in Swaziland. If good results are obtained at the end of this phase, the technology could be field tested in a pilot in a second phase. The specific objectives of the study are:

- Define local conditions including:
  - socio- cultural context
  - volume of water to be treated
  - water quality characteristics and other relevant parameters

- Generate performance data of the nano-based treatment unit by
  - Evaluating treatment efficiency for the identified priority water contaminants,
  - Evaluating treatment efficiency under local climatic conditions
  - Evaluating the potential food safety and environmental risks arising from the technology
  - Defining best operating conditions of the demo unit

- Engage with the local stakeholders to
  - Discuss the technology and its potential, and issues related to its use and maintenance
  - Assess the economic feasibility and socio-cultural acceptability of the technology