Access to Safe Water for the Bottom of Pyramid : Strategies for Disseminating Technology Research Benefits

Consultation Workshop
8th March 2011
IIT Bombay

Development Alternatives

Development Alternatives

- Mission : to promote sustainable national development
- Vision : to innovate and disseminate the means for creating sustainable livelihoods on a large scale, and thus to mobilise widespread action to eradicate poverty and regenerate the environment
  - Innovation, through design, development and dissemination of Appropriate technologies
  - Effective institutional systems
  - Environmental and resource management methods
  - Sustainability, through commercially viable approaches
  - Scalability, through partner organizations and networks

The Context

- One in eight persons in the world lack access to safe water supply
- 3.5 million people die each year from water-related disease; 84 % are children. 98 % occur in the developing world
- Sixty five million people are at risk of arsenic poisoning
- 30 % of the rural population had access to safe drinking (tap) water in the country
- Poor people living in the slums often pay five to ten times more per liter of water than wealthy people living in the same city
- Waterborne diseases cost the Indian economy 73 million working days a year

The Concept

- Research has a key role in anticipating and responding to future trends
- New and emerging cutting edge technologies are being developed that could have a real relevance to the needs of poor people.
- Translational research is required to support the longer term development agenda to ensure the benefits are derived by the poorest
- What are the most effective, safe and affordable approaches to new technology that might benefit poor people, and what research is needed to turn these benefits into reality?
- Focus on Nanotechnology for water purification

The Project

- The current study seeks to identify key challenges and barriers that may reduce the impact of technologies such as nanotechnologies for providing clean drinking water reaching the under privileged in developing countries
  - Possible environmental implications and remedial measures
  - Successful service delivery models
  - Absorptive capacities of the population

Nanotechnology

- Dimensions and tolerances are in the range of 0.1-100 nm
- Application of these nano structures and principles behind them to make nano scale devices and to produce new materials
- Offers more affordable, effective, efficient and durable ways of purification

Nanotech For Water Purification

- A range of water treatment devices that incorporate nanotechnology are already on the market, with others either close to market launch or in the process of being developed
- Though many technologies are still in the research phase, they are also looking at low cost material and manufacturing options to be able to cater to the needs of the developing world.
- Research suggests that materials suitably treated or impregnated with nanotechnology-based methods can filter more effectively and thereby increase the health benefits.
- There is also anxiety over how used filters and media containing nano materials might affect the environment
- No international regulation or internationally agreed definitions or terminology for nanotechnology,
  - No internationally agreed protocols for toxicity testing
  - No standardized protocols for evaluating environmental impacts

Workshop Objectives

- Arrive at a consensus on market and policy barriers affecting large scale roll out of nanotechnologies in the water sector to the bottom of pyramid market in India
- Prioritise Action and Initiatives to promote nanotechnologies in the water sector while attaining poverty alleviation and MDGs in India

Key Questions

- What parameters enhance the acceptability of a technology?
- What are the main barriers/ gaps / challenges that impede widespread market dissemination of nanotechnologies in the water sector?
- What market drivers can fast track acceptance of nanotechnologies in the water sector?
- Perceived roles of different stakeholders – public and private sectors, and Donors

THANK YOU

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Potential of Nanotechnologies for BoP Markets

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BoP Markets

- Population living on less that $ 2 a day
- Referred as BoP by organisations / individuals developing models that specifically target the poorest strata of society
- Majority of Indian BoP Population does not have access to clean drinking water

Indicators of Potential for BOP Markets

- What are the awareness levels of the population with regard to clean drinking water?
- How can a greater awareness of its need be created?
- What are market possibilities for Nanotechnologies in the water sector?
  - Usability
  - Reach
  - Affordability
  - Effectiveness

Examples of Indicators

- Durable and Inexpensive
- Runs without power
- Simple usage instructions

Nanotechnologies in the Water Sector

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NANOFILTERATION

- Nanofiltration membranes' removal of monovalent ions varies between 50% to 90%
- Nanofiltration is a pressure driven separation process.
- The filtration process takes place on a selective separation layer formed by an organic semipermeable membrane.
- NF requires less energy than conventional filtration techniques for separation.
- NF can reject only ions with more than one negative charge, such as sulfate or phosphate, while passing single charged ions.

Carbon Nanotubes

- Emerging technology in water purification system, particularly with respect to its potential for the removal of arsenic, fluoride, heavy metals and toxic organic components.
- The opening of the nanotubes is only a few nanometers, so that water molecules can pass through them, while bacteria, biological material and other impurities can not. Thus, the water obtained after passing through the nanotube is clean of impurities.
- While traditional membranes in dirt are stored within the membrane, in these membranes such impurities are kept out of the nanotubes, facilitating cleaning.

Nanoceramics

- Ceramic materials fabricated from nanoparticles
- Large physical pore size of the media (2-3 microns) so filters are able to offer flow rates significantly higher than conventional technologies
- High flow rates with low pressure drop so high efficiency
- Hydrotalcite is low cost synthetic clay for arsenic removal
- “Teabag” package that can be dipped into household water supplies for about 15 minutes before drinking - HT percolation of water containing 500-1000 microgram/L as produced leachate with as levels well below 10 microgram/L.
- Leaching through porous pots and filter candles.

Nanocomposite Membrane

- Nanomembranes can be used to remove a diverse range of pollutants
- Nanocomposite membranes comprising a water-permeable thin film polymerized on a porous support membrane
- Thin film nanocomposite membrane technology may offer new degrees of freedom in tailoring RO membrane separation performance and material properties

NANOCATALYSTS

- Nano catalysts owe their better catalytic properties to their nanosize or to being modified at the nano scale.
- They can chemically degrade pollutants instead of simply moving them somewhere else

Metal Nanocatalysts

- Titanium dioxide functions as both a photocatalytic reducing agent and an adsorbent.
- Nano titanium dioxides are more potent disinfectors - free radicals that decompose a variety of contaminants into less toxic carbon compounds
- Nanoscale titanium dioxide provides larger surface area and faster photo-catalysis than larger titanium dioxide particles.
- Nanopowder form for use in suspensions or granular media filters, coatings for fixed membranes, nanocrystalline microspheres, and composite membranes with silica.

Nobel Metal NanoCatalysts

- Silver nanoparticles are emerging as one of the fastest growing product categories in the Nanotechnology industry
- Leverage its known antimicrobial properties as an effective means of infection control.

Magnetic Nanoparticles

- Magnetic nanoparticles are a class of nanoparticle which can be manipulated using magnetic field.
- Such particles commonly consist of magnetic elements such as iron, nickel and cobalt and their chemical compounds.
- Magnetic nanoparticles like Iron Oxide can be used to bind with contaminants like arsenic or oil.

Thank You

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Market Gaps / Barriers

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Identifying Market Barriers / Gaps

- Majority of the Indian population does not have access to clean drinking water
  - 80 percent of Urban Slum Dwellers
  - Low Awareness of what potable water means
- Need for a Water Purifier is not realised
- To realise the potential of BoP Markets – identify the key gaps and barriers impeding the growth of the sector

Key Questions

- What are the factors with regard to the technology applied in Nano water filters which impede its uptake and usability?
- Is the current policy environment and implementation structures adequate for reaching the BoP Market?
- What is obstructing the maximum reach of water purifiers in terms of affordability, safety and effectiveness?