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Low-cost technology for arsenic-poisoned water treatment

A low cost method of decontaminating groundwater laced with high levels of arsenic is a key challenge for the sustainable agriculture in South Asia. A team of scientists led by Dr. B. Sen Gupta of Queen's University Belfast have sucessfully implemented an 'in-situ' treatment method in India that answers this problem. A trial plant is in operation and the technology is available for implementation.

Country
India
Implementation period
2004-2006

EC co-financing
€ 438.905,87

Partners
- Queen's University Belfast
- National Metallurgical Laboratory, India
- University of Stuttgart, Germany
- University of Miguel Hernandez, Spain
- Leiden University, The Netherlands
- Fermanox GmbH, Germany
- Institute of Environmental and Management Studies (IEMS), India

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Arsenic poisoning in Eastern India and Bangladesh may be termed as the worst case of mass poisoning in modern times. A rough estimate shows that more than 70 million people are affected in both countries due to involuntary arsenic exposure through drinking water and rice, the main staple food in the region.

The main objective of this project, *"Development of a low-cost technology for in-situ treatment of groundwater for potable and irrigation purposes – TIPOT"*, is to offer a simple and chemical free groundwater treatment technology to the rural communities for use in irrigation and potable purposes.

Groundwater treatment for rural populations

This project aims to provide with arsenic-free water millions of people in South Asia who are exposed to high levels of arsenic in ground water, including farmers who have no choice but to use contaminated groundwater for agriculture that is provided by the minor irrigation schemes.

The technology is based on recharging a part of the groundwater after aeration into the aquifer. Increased levels of oxygen in the groundwater slow down the arsenic release from the soil and at higher oxygen levels, soil micro organisms, iron and manganese reduce the dissolved arsenic level significantly.

Since agriculture is the backbone of economy in Eastern India, the direct beneficiaries from the project are both rural and urban communities, as well as poor and marginalized people having limited or no access to safe potable water and small and medium enterprises that cannot afford expensive treatment methods. Other stakeholders are local councils (panchayats), government departments such as Rural Welfare, Irrigation and Health, and financial institutions including rural banking networks and insurance companies, who can also benefit from the new groundwater treatment system proposed by TIPOT.

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While there are some techniques available for treating relatively small quantities of water for potable use, there is no viable technology available for decontaminating groundwater on a large scale that can ensure safe irrigation water. Since small irrigation schemes in South Asia (Bengal delta) depend primarily on groundwater resources, use of contaminated water in irrigation poses a serious health risk to the population. The method proposed by this project appears, therefore, to be the only eco-friendly and easy to use solution that can be delivered to the rural user community at an affordable cost.

The project has produced so far several concrete positive results:

- Construction of a demonstration plant, operating successfully since May 2005, with the involvement of the local technicians;
- Collection of the operating data for scaling up the system – the project team has designed rural water distribution for 500 families and calculated the water requirement for five main local crops apart from rice (wheat, maize, onion, potato and sesame);
- The risk of arsenic ingestion to the health associated with rice consumption has been calculated by field experiments and all the constraints in delivering the technology to the recipient society have been identified;
- Production of a socio-economic study, to be completed shortly, for identification of the benefit to the most vulnerable sections of the community such as the children, women and the aged and for the assessment of the social, economic and political basis for technology transfer.

Lessons Learnt

The involvement of local technical expertise and of local stakeholders like local village councils, various governmental agencies, NGOs and a local financial institution has contributed to the success of the project implementation so far. It has created a local ownership sentiment, which has by far determined the overall acceptance of the project idea by the local population.

In this sense, especially important was the involvement of the local councils, as the authorities who monitor the water supply and distribution in rural areas, and of rural financial institutions that provide micro-credit to the farmers. Both stakeholders have serious interest in the project. The ministry of health that has to deal with a rising number of cancer patients as a consequence of their direct exposure to contaminated water is deeply interested to eradicate the problem as well and its support to the project will be most beneficial.

Not only good expertise and relevant experience of the partners was important, but also their complementary strengths and knowledge to meet the scientific and technical requirements of the project played a fundamental role in the results' achievement.

Although all project partners were well committed to the project, it became evident that good communication and openness among the partners is a basic requirement. A well established previous common understanding of the project philosophy is necessary for the establishment of a good partnership.

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The choice of the geographical location for the set up of the treatment plant, near Calcutta, where high levels of arsenic in ground water were identified, proved to be essential for the findings of the study, enabling the plant of being replicated and commissioned anywhere in South Asia, in areas with similar conditions.

Outreach and Dissemination

The project's action plan includes dissemination activities to be carried out during the last phase of the project's implementation. However, some outreach effects can already be identified as a consequence of the project, namely involving one of the partners from TIPOT, Fermanox GmbH from Germany, who will start negotiations for a probable partnership with an Indian company for technical consultancy services in the region.

As a way of guaranteeing the sustainable dissemination of the project experience, five students from the European and Indian Universities were involved in the project and have made excellent progress in their technological research work.

The dissemination activities foreseen include the project's participation in international conferences, namely the European Groundwater Conference, to be held in Vienna, in June 2006 and an International Congress in Mexico on Natural Arsenic in Ground Waters in Latin America. The technical development of this project has been presented in IIT Delhi and to the Groundwater Board of Thailand.

Apart from the socio-economic report under preparation, the project will also produce manuals on water conservation and on technology use and a website in English and Bengali for a broader dissemination.

Sustainability

The plant was commissioned by local technicians with help from engineers from Stuttgart University, the National Metallurgical Laboratory in India and Queen's University Belfast using the components available locally and has been designed in a manner such that it can be operated and maintained by the village technicians, increasing, in this way, its sustainability beyond the project's duration. The user communities are, therefore ready to absorb the technology in its current form, which has been tailored for easy adaptation to the local conditions.

Although the partners will continue to collaborate informally after the project is over, the treatment plant will be operated by the Indian partners.

As part of the sustainability strategy foreseen in the project, there are activities for the transfer of knowledge to the local stakeholders, through training activities and workshops, to be implemented in September 2006.

Due to similarity of groundwater conditions in Bangladesh, there is a strong possibility that the technology proposed by TIPOT will be replicated in many other areas in the South Asian region. In this context, a new proposal has been submitted to the World Bank by one of the partners for replication of the plant in six more villages.

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Recommendations

Considering the groundwater situation in Eastern India and Bangladesh and the related health and environmental problems, the implementation of similar projects, particularly the ones that can be easily maintained and continued by the local populations, is essential to enhance the environmental sustainability in the region.

Photos

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