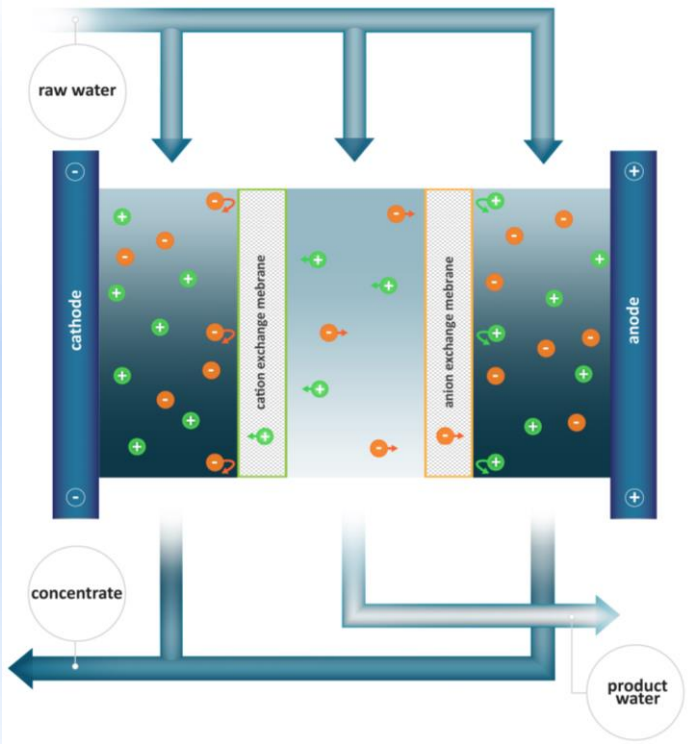
ASTRA Newsletter - #3

Dear Water Expert, Welcome to the third edition of the ASTRA newsletter. In this issue we introduce the evaluation of emerging, new technologies for arsenic removal for potential application in Bangladesh. With remarks, suggestions (or to unsubscribe), please mail us at info@astradst.info

What's new in ARTs (arsenic removal technologies)?

The past decades, the Bangladeshi water sector has gained extensive experience in water treatment technologies for arsenic removal. Household and community systems, such as Sidko, SONO and Read-F, have been implemented around the country. Unfortunately the performance of most systems was often inconsistent, where both long-lasting removal and short-term breakdown was observed for the same system. This makes prediction of the efficiency of a technological intervention difficult. New, innovative arsenic removal technologies may contribute to effective mitigation strategies, but there is a natural skepticism regarding their sustainable application. In order to create insight in the their potential for Bangladesh and other emerging markets, the ASTRA project has evaluated these technologies based on seven screening criteria groups (Box 1). The technologies have been clustered based on their removal principle, and include: Advanced Oxidation (SORAS, TiO_2), Electrocoagulation, Geological and Organic Adsorbents, Forward Osmosis, Membrane Distillation, Capacitive Deionization, Electrodialysis Reversal (see image on the right), Phytofiltration, Microbial-assisted Removal and In-Situ Remediation. Safe application of these technologies in Bangladesh may not be clear-cut or, in some cases, even desirable. Nevertheless, knowledge of the technological options for intervention will ultimately lead to the smartest engineering decisions.



Evaluating ARTs for emerging markets

Many aspects have to be taken into account when it comes to the selection of the technology. The population to be served and its condition in terms of health and economical status, lack of safe water, and other socioeconomic parameters are also important aspects to be considered. Expensive techniques cannot be applied in the populations of low income as in emerging markets, because such techniques require monitoring and maintenance which can make the process even more expensive and thus not sustainable in the long term. In a recent study Etmannski and Darton (2013) indicated cost, trust, distance between home and the clean water source (an indicator of convenience), and understanding the health effects of arsenic as the 'most important' issues as specified by the technology users.

From a technical point of view, the water matrix composition (i.e., its physicochemical and microbiological characteristics) together with the availability of materials and infrastructures in the area will be essential in the decision of the As removal technology to implement. Within the ASTRA project, innovative technologies have been evaluated for their potential application in

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emerging markets, categorizing the various processes accordingly to their remediation principle. For this purpose, an evaluation framework has been applied to each technology based on specific screening criteria (Box 1). The proposed criteria include natural-context factors (unchangeable aspect of an affected area that comprise the physical framework of technology implementation, i.e., Water Matrix), human-context factors (socio-economic and infrastructural aspects, i.e., Scale of Implementation, Energy Requirements, and Sustainability), and technical factors (the technological and economic issues related to the deployment of a treatment method, i.e., Availability of data, Implementation Costs, and O&M) which, in combination, are proposed to determine the applicability of each technology group in specific contexts.

1) Water Matrix – The composition of the water to be treated can affect the treatment at various degrees.
2) Energy requirements – The level of energy infrastructure in the area can be a limiting factor for the choice of an As-remediation technology.
3) Scale of Implementation - The scale of sustainable dissemination makes each technology specific to certain settlement type and population density.
4) Sustainability - All arsenic removal systems, except in-situ remediation, generate solid or liquid waste. A first distinction has to be made between spent sorbents and sludges on the one hand, and concentrated liquid wastes on the other.
5) Availability of data – The technologies discussed in this paper are mainly innovative and not all of them have been proven efficient at full scale. This criteria indicates the level of embeddedness of each of such technologies, specifying whether financial and time efforts have to be addressed to further test its efficiency.
6) Expected Implementation costs – Qualitative estimation of the investments needed for the physical installation of the technology.
7) Operation and maintenance (O&M) – Costs and required level of skills needed to operate and maintain the technology.

Box 1: Evaluation criteria of innovative technologies for emerging markets (specifically Bangladesh)

International experts review the (online) ASTRA tool

International experts from the Netherlands, India and Bangladesh reviewed the ASTRA source book and the online decision-support tool. The scientific and practicing water experts have a background in hydrology or hydro-geology, water supply and treatment or social research (focusing on water management in emerging sectors). These external reviewers were selected based on their type of expertise, to gain an as broad as possible feedback on the tool quality regarding its benefits for policy makers, practicing water experts and water project beneficiaries. The comments and suggestions offered by the reviewers are currently being processed to improve the tool. Once the review comments are addressed, both the source book and the decision aid will be translated into and made available in Bangla. In case of the academic reviewers, their network will be called upon to support the future application of the ASTRA tool in education.

Project ASTRA (Aiding Sustainable Water Technology Realization in Arsenic-contaminated Areas of Bangladesh), concentrates on the evaluation of low-cost, appropriate water supply technologies for the mitigation of arsenic- and salt-problems in Bangladesh. The project is part of the BRAC WASH II program that aims to improve access of the Bangladeshi rural poor to water, sanitation and hygiene services. The program is funded by the Embassy of the Kingdom of The Netherlands (EKN/DGIS) & the Bill and Melinda Gates Foundation (BMGF).

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