Environment

Water Community

Poverty

Work and Employment Community

Solution Exchange for the Water Community
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Consolidated Reply

Query: Low Cost Effluent Treatment Plants for Small Scale Industries - Experiences; Referrals

Compiled by Nitya Jacob, Ranu Bhogal and Radhika Desai, Resource Persons and Sunetra Lala and Warisha Yunus, Research Associates

Issue Date: 26 June 2009

From Nupur Bahl, All India Artisans and Craftworkers Welfare Association (AIACA), New Delhi

Posted 1 June 2009

I work for the All India Artisans and Craft Workers Welfare Association (AIACA, please visit www.aiacaonline.org for more details). AIACA carries out a range of activities including policy advocacy and market access initiatives to help expand the market for craft products and explore new and more sustainable models of livelihood promotions.

AIACA in partnership with Traidcraft, UK's leading fair trade organization is working on a four year project - Switch Asia Project to explore environment, health and safety issues in the craft sector in India. The overall objective of the project is to promote sustainable production and consumption of environment friendly textiles in Rajasthan that positively impact the lives of poor artisans as well as their communities.

The textile industry involves water intensive processes that require large volumes of good quality water under various stages of production. The volume of wastewater released is also huge. The industry uses a lot of process chemicals generating about 3773 metric tons per annum (MTA) of hazardous waste of which only 3.25% is recyclable. Some of the small scale textile units are connected with Combined Effluent Treatment Plants (CETP). These CETPs have storage facilities for such hazardous waste; however, proper disposal facilities are not available.

Dying and printing (wet processes) emit volatile organic compounds (VOCs). These VOCs contaminate water sources, are harmful to the environment and cause grave risk to the health of

local communities. The risk is aggravated with the pollution of drinking water sources. This is common in Rajasthan as these textile units are set up by small households and the artisans and their families live and work in these conditions. This makes the situation of these artisans and their families particularly vulnerable. It also goes against the decent work principle since they come in direct contact with harmful chemicals through touch, inhalation and intermixing with drinking water. The most effective way to resolve this situation is to reduce the effluents at source.

Within this context, AIACA seeks specific inputs from members on the following:

- What are the various technologies available for establishment of low cost effluent treatment plants (ETPs) for small scale industries?
- Information and contact details of organizations that are currently working in this area and would be interested in working with us.

The Switch Asia project will immensely benefit from the inputs of members. Suggestions and recommendations from members will help us to create a model of small scale effluent treatment as a best practice model. This can then be replicated by other SME's in various textile clusters elsewhere in the country.

Responses were received, with thanks, from

1. **D. Chandrasekharam, Department of Earth Sciences, Indian Institute of Technology Bombay, Mumbai**
2. **Ramakrishna Nallathiga, Centre for Good Governance, Hyderabad**
3. **Raj Jani, Asian Heritage Foundation, New Delhi (Response 1) (Response 2)**
4. **Padma S. Vankar, Indian Institute of Technology, Kanpur (Response 1) (Response 2) (Response 3*)**
5. **Muhammad Mukhtar Alam, Centre for Ecological Audit, Social Inclusion and Governance, New Delhi**
6. **Sumita Ganguly, Independent Consultant, New Delhi**
7. **Ajit Seshadri, The Vigyan Vijay Foundation, New Delhi**
8. **Depinder Kapur, India WASH Forum, New Delhi**
9. **Arjun Kant Jha, Narisanstha, Jaipur**
10. **H. S. Sharma , Dr. K. M. Modi Institute of Engineering, Ghaziabad**
11. **G. Misra, Directorate of Economics and Statistics, Port Blair**
12. **Abhishek Mendiratta, Consultant, New Delhi**
13. **R. K. Srinivasan, Centre for Science and Environment, New Delhi**
14. **Saurabh Singh, Innervoice Foundation, Ballia, Uttar Pradesh***
15. **Sunil Vishwakarma, CRS India Programme, Bhopal***
16. **Vijay Kumar, Chartered Environmental and Water Resources Exploration and Development Geophysicist, New Delhi***
17. **V.G.M. Nair, National Institute for Interdisciplinary Sciences Technology, Thiruvananthapuram***
18. **Arunabha Majumder, Jadavpur University, Kolkata***

**Offline Contribution*

Further contributions are welcome!

Summary of Responses

Comparative Experiences
Related Resources
Responses in Full

Summary of Responses

The household sector dominates block printing in Rajasthan. Families usually live in the same building that houses the block-printing unit. The process emits large quantities of volatile organic compounds (VOCs) that artisans inhale. In addition, most of the dyeing in the state is in the hands of small units, who also release most of the waste untreated into drains.

As the industry is made up of small scale units, usually located in clusters, their effluents are best treated through small, common effluent treatment plants. Earlier approaches to set up such plants have failed because of the high cost of running a plant, lack of electricity, non-payment of user charges and shortage of reagents to treat the effluents.

Before designing a treatment system, an agency has to survey the units to determine the mix of the effluents. For example, the National Productivity Council, with GTZ support, has surveyed the Sanganer dyeing and printing units outside Jaipur. In this case, the All India Artisans and Craft Workers Welfare Association could work with a technical agency to map the units and their effluents. This step is necessary as the composition of effluents from each unit is different and this has a bearing on the choice of effluent treatment process.

There are several alternatives available to treat wastewater from dyeing units. All use a mix of physico-chemical processes, followed by biological treatment. However, the selection of chemicals and their dose is critical. Effluent treatment plants fail when their operators do not add chemicals at the right time and in the right quantity. Some examples of wastewater treatment methods are:

1. The Botany Department of the University of Rajasthan, Jaipur, **Rajasthan** set up an effluent treatment plant that uses micro-organisms in Sanganer, outside Jaipur. This is cheap to set up and run and has the additional advantage of being organic.
2. Another solution is using biofilters to treat malodorous compounds and volatile organic compounds used in synthetic dyes. Biofilters use living material to capture and biologically degrade pollutants. These can be used in a common treatment plant.
3. Decentralised Water Treatment Systems (DEWATS) uses a combination of natural methods to treat wastewater. Part of the process is anaerobic and part, aerobic. The drawback is existing DEWATS systems treat mostly household wastewater that has a different chemical composition from dyeing units. It uses certain plants to fix the nitrates with their roots, while the anaerobic treatment converts soluble organic compounds into methane and carbon dioxide. The final state of treatment is a settling pond, where the last of the impurities are removed. The process is natural and therefore, slower than chemical remediation. It also needs a large area and takes around 15 days to fully process the waste.
4. Ozone-based oxidation is ideal to detoxify wastewater, if used at the primary stage. In the secondary stage, it reduces sludge production, and in the tertiary stage, it disinfects, removes micro-pollutants, the Chemical Oxygen Demand (COD) load, and colour. The process is particularly useful to remove colour and compounds that cause bad odour, such as those based on aniline.
5. In Thiruvanthanpuram, the Environmental Technology Section of the National Institute for Interdisciplinary Science and Technology has developed several biological treatment

systems. The laboratory also offers some of these options and consultancy for pollution control.

In addition to these end-of-pipe solutions, switching to organic dyes can considerably reduce production of toxic waste water. They emit fewer VOCs and are easier to treat using non-chemical processes.

Sometimes, centralized effluent treatment systems fail. In many towns such as Pali, Rajasthan, that have a high concentration of textile dyeing units, the State Pollution Control Board installed common effluent treatment plants in the 1980s. However, the units inject effluents into the ground instead of sending them to the treatment plant; this has rendered the groundwater unfit even for agriculture. In Kanpur, some 354 tanneries discharge effluents with high levels of chromium. The state pollution control board ordered them to install chromium recovery units, but less than a quarter complied. The result is the groundwater and the Ganges remain heavily polluted.

The final point is getting a buy-in from the owners of the dyeing and printing units to ensure they use the facilities. The Association can work with them to ensure this happens. This will improve the working conditions, reduce environmental pollution and prevent contamination of the sources of drinking water. There are virtually no technical options that individual household units can afford to use, as even the smallest treatment plants are too expensive to install and maintain. A cluster approach, where a group of household units pools its resources to use a treatment facility, appears to be the only affordable system.

Comparative Experiences

Rajasthan

Eco-friendly and Low Cost Effluent Treatment Technology, Sanganer *(from Raj Jani, Asian Heritage Foundation, New Delhi; response 2)*
To reduce the health risks to artisans working in dyeing industries as a result of harmful chemical wastes, the Rajasthan University developed an efficient and low cost phytoremediation technology for degradation of reactive azodyes in wastewater. As a result, a common effluent treatment plant for 3 dyeing units has been set up, with a capacity to treat 35000 litres of textile wastewater per day. This has also been adopted by the Shyam Dyeing Company, Sanganer.

New Delhi

Household Effluents Can be Recycled using DEWATS *(from Ajit Seshadri, The Vigyan Vijay Foundation, New Delhi)*
In order to the deal with the problem of household wastewater, the Vigyan Vijay Foundation started using the Decentralized Wastewater Treatment Systems (DEWATS) to recycle water. In this, water is first retained in an anaerobic chamber and then taken for filtration through a Baffled Reactor. The processed water is then taken to the gravel filter for phyto-remediation. The water thus treated is now being used to water parks in Vasant Vihar, New Delhi.

Related Resources

Recommended Documentation

Green Power Technology to Clean the Husain Sagar Lake and Support its Neighbourhood Energy Utility (*from D. Chandrasekharam, Department of Earth Sciences, Indian Institute of Technology Bombay, Mumbai)*
Article; by D. Chandrasekharam, Keyan Zheng and Varun Chandrasekharan; Environment Pollution Control Journal; July-August 2008;
Available at http://www.solutionexchange-un.net.in/environment/cr/res01060901.pdf (PDF; Size: 106KB)

Builds a case for the use of heat pumps and heat exchanger to be integrated with wastewater treatment plants in cities for implementing clean development mechanisms

Toxic Water Kills Rajasthan Kids (*from Sumita Ganguly, Independent Consultant, New Delhi)*
News Report; by Sudhanshu Mishra; Mail Today; 3 June 2009;
Available at https://www.sarcajc.com/June_09-Newspaper_Watch.html

Reports the death of children in Sanganer, Rajasthan due to consumption of toxic water, which occurred as a result of industrial wastes from dyeing units seeping into the ground

Modular USAB for Anaerobic Treatment of Soluble Wastewater *(V.G.M. Nair, National Institute for Interdisciplinary Sciences Technology, Thiruvananthapuram)*
Paper; National Institute for Interdisciplinary Science and Technology; Thiruvananthapuram;
Available at http://www.solutionexchange-un.net.in/environment/cr/res01060902.pdf (PDF; Size: 508 KB)

Describes how the UASB reactor is an economical solution for the treatment of industrial effluents, which have substantially dissolved pollutants

From Warisha Yunus, Research Associate

Printers' Devil
Article; by Kushal P. S. Yadav; Down to Earth; 14 April 2003;
Available at http://www.indiaenvironmentportal.org.in/node/3787

Documents the predicament of the printers' in Sanganer, Rajasthan due to the Supreme Court's order to shut down the polluting dyeing and printing units in the area

Treatment of Wastewater Containing Azo Dye Reactive Brilliant Red X-3B Using Sequential Ozonation and Upflow Biological Aerated Filter Process
Paper; by Xujie Lu, Bo Yanga, Jihua Chena and Rui Suna; College of Environmental Science and Engineering, Donghua University; Journal of Hazardous Materials; Amsterdam; 22 March 2008;
Available at http://cat.inist.fr/?aModele=afficheN&cpsidt=20986509

Presents an experiment that demonstrates a combination of ozone oxidation and upflow biological aerated filter as a promising technique to treat wastewater containing azo dye

Advances in Textile Waste Water Treatment: The Case for UV-Ozonation and Membrane Bioreactor for Common Effluent Treatment Plants in Tirupur, Tamil Nadu, India
Paper; by S. Eswaramoorthi, K. Dhanapal and D. S. Chauhan; Environment with People's Involvement and Co-ordination in India;
Available at http://www.scribd.com/doc/2608600/Advances-in-Textile-Wastewater-Treatment

Builds a case for the use of Membrane Bioreactors (MBRs) for better treatment of wastewater in printing and dyeing units

Reactive Dye House Wastewater Treatment - Use of Hybrid Technology: Membrane, Sonication Followed by Wet Oxidation
Paper; by Atul D. Dhale and Vijaykumar V. Mahajani; University of Mumbai; April 3 1999;
Available at http://pubs.acs.org/doi/abs/10.1021/ie980615t

Documents the experiment of using membrane separation followed by sonication and wet oxidation to treat industrial wastewater for reuse and discharge

Recommended Contacts and Experts

K. P. Sharma, University of Rajasthan, Jaipur *(from Raj Jani, Asian Heritage Foundation, New Delhi; response 2)*
Botany Department, University of Rajasthan, Jaipur 302055, Rajasthan; Tel: 91-141-2521502; sharma-kp@uniraj.ernet.in; http://www.uniraj.ernet.in/

Professor of botany, who has played an instrumental role in setting up eco-friendly micro-organisms technology based effluent treatment plant at Sanganer, Rajasthan

Padma S. Vankar, Indian Institute of Technology (IIT), Kanpur *(from Radhika Desai, Resource Person)*
Indian Institute of Technology, Kalyanpur, Kanpur 208016; Tel: 91-512-2597844; psv@iitk.ac.in

Works on issues such as estimation and remediation of pesticide, heavy metal contaminations and polyhalogenated compounds occurring due to industrial pollution

Recommended Organizations and Programmes

From Ramakrishna Nallathiga, Centre for Good Governance, Hyderabad

Tirupur Exporters' Association (TEA), Tamil Nadu
62 Appachi Nagara, Main Road, Kongu Nagar, Tirupur 641607, Tamil Nadu; Tel: 91-421-2220500, 4338500; Fax: 91-421-2220505; support@tea-india.org; http://www.tea-india.org/portal/pages/supplier.aspx?ID=36; Contact: A. Sakthivel; President

Established in 1990, an association particularly for cotton knitwear exporters who have world-class production facilities in Tirupur, Tamil Nadu

Ahmedabad Textile Industrial Research Associations (ATIRA), Gujarat
P.O. Ambawadi Vistar, Ahmedabad 380015, Gujarat; Tel: 91-79-26307921, 26307922; Fax: 91-79-26304677, 26301969; http://www.atira-rnd-tex.org/Facilities.htm; Contact: A. K. Sharma; Director; Tel: 91-7926307921, Extension No. 350; atiraad1@sancharnet.in

An industrial research institute for textiles set up to support and guide Indian textile industries to achieve international working standards and become globally competitive

International Development Research Centre (IDRC), New Delhi
208 Jor Bagh, New Delhi 110003; Tel: 91-11-24619411; Fax: 91-11-24622707; saro@idrc.org.in; http://www.idrc.ca/saro/ev-83010-201_103274-1-IDRC_ADM_INFO.html

Provides funding for research inter alia on issues of rural and urban poverty reduction, environment protection and cleaner technologies in hazardous industrial sectors

From Warisha Yunus, Research Associate

Tamil Nadu Water Investment Company Limited (TNWICL), Tamil Nadu
Tamil Nadu Water Investment Company Limited, "Anurag" 15, Murray's Gate Road, Alwarpet, Chennai 600018, Tamil Nadu; Tel: 91-44-24997912, 24997913, 24997914, 24997915; Fax: 91-44-24993377; http://www.twic.co.in/scripts/TirupurCommonEffluentTreatmentProject.aspx

A developer of water projects, the company's expertise lies in urban water and sewerage systems, desalination, and industrial effluent management and recycling

The Tamil Nadu Pollution Control Board (TNPCB), Tamil Nadu

100, Anna Salai, Guindy, Chennai 600032, Tamil Nadu; http://www.tnpcb.gov.in/objectives.html

Works for prevention and control of pollution of water bodies, land and the environment by enforcing pollution control legislations

From Raj Jani, Asian Heritage Foundation, New Delhi; response 2

National Productivity Council (NPC), New Delhi
Utpadakta Bhavan, 5-6 Institutional Area, Lodhi Road, New Delhi 110003; Tel: 91-11-24690331/0332/0333/5447; Fax: 91-11-24615002; info@npcindia.org; http://www.npcindia.org/index2.htm

Autonomous organization set up to promote an industrial productivity culture in India; provides training, consultancy and undertakes research in the area of productivity

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), New Delhi
Indo-German Environment Programme, A-33 Gulmohar Park, New Delhi 110049; Tel: 91-11-26528840, 26611021; Fax: 91-11-26537673; info@asemindia.com; http://www.ecoindustrialparks.net/new/index.php?option=com_content&view=article&id=80&Itemid=92

Provides technical and financial cooperation in India in the areas of energy, environment, health and natural resource management

Rajasthan State Pollution Control Board (RSPCB), Rajasthan
4, Institutional Area, Jhalana Doongri, Jaipur, Rajasthan; Fax: 91-141-2710647, 2709980; http://rpcb.nic.in/Guidelines.htm; Contact: V. S. Singh; 91-141-2700601, 2701801, 2711263, Chairperson; Tel: 91-141-2709980; chairperson@rpcb.nic.in

Established with the objective of preventing and controlling water and air pollution; fixes norms for permissible limits of contamination by industrial units

Rajasthan State Industrial Development and Investment Corporation Limited (RIICO), Rajasthan
Udyog Bhawan, Tilak Marg, Jaipur, Rajasthan; Tel: 91-141-5113200; chairman@riico.co.in; http://www.riico.com/; Contact: Alok; Managing Director; Tel: 91-141-5113208; md@riico.co.in

Set up to facilitate industrial development in Rajasthan by providing various services including technical and financial services for industries

National Institute for Interdisciplinary Science and Technology, Kerala *(from V. G. M. Nair, National Institute for Interdisciplinary Sciences Technology, Thiruvananthapuram)*
Industrial Estate, P.O. Pappanamcode, Trivandrum 695019; Tel: 91-471-2490674, 24900811; Fax: 91-471-2491712, 2490186; contact@niist.res.in; http://w3rrlt.csir.res.in/wwt/ver1.0_ped_wwt_mandate.htm

Works to provide knowledge-based services for environment management and develops new industrial technologies for dealing with region-specific environmental problems

Recommended Communities and Networks

Transition U. S. Social Network *(from Muhammad Mukhtar Alam, Centre for Ecological Audit, Social Inclusion and Governance, New Delhi)*
http://transitionus.ning.com/

A grassroots initiative that aims to bring together like-minded people and 'transitioners' to connect and learn from the development of local communities and resources

Carbon Neutral Neighbourhood Discussions/Leisure for Mitigating Climate Change
http://ecostrategiccommunicators.ning.com/

Networking site for environmentally conscious citizens to discuss and share measures to create carbon-free neighbourhoods to mitigate the impacts of climate change

Recommended Portals and Information Bases

Capacity.Org - A Gateway for Capacity Development *(from Muhammad Mukhtar Alam, Centre for Ecological Audit, Social Inclusion and Governance, New Delhi)*
http://www.capacity.org/

A web magazine-cum-portal for development practitioners and policy makers working on capacity development issues for development cooperation in the global South

Related Consolidated Replies

Bio-technology Enzymes Process for Wastewater Treatment, from B. Harisubramanian, TWAD Board, Chennai (Comparative Experiences). Water Community, Solution Exchange India,
Issued 10 January 2006. Available at http://www.solutionexchange-un.net.in/environment/cr/cr-se-wes-10010601.htm (HTML)

Provides experience in adopting bio-technology enzymes process for waste water treatment

Promoting Sustainable Production through Cleaner Technologies, from Iqbal Ahmed, Jagran Pehel, New Delhi (Examples; Experiences). Work and Employment Community Solution Exchange India,
Issued 14 April 2009. Available at http://www.solutionexchange-un.net.in/emp/cr/cr-se-emp-14040901.pdf (PDF; Size: 102 KB)

Seeks examples of cleaner technologies used in brass, parboiling rice & handloom sector; experiences of marketing strategies to be adopted for increased sale of 'green' products

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Responses in Full

D. Chandrasekharam, Department of Earth Sciences, Indian Institute of Technology Bombay, Mumbai

Please read http://www.solutionexchange-un.net.in/environment/cr/res01060901.pdf (PDF; Size: 1.03MB) for a paper that may be of interest to you. It is titled, Green Power Technologies to Clean the Hussain Sagar Lake and Support its Neighbouring Energy Utility.

Ramakrishna Nallathiga, Centre for Good Governance, Hyderabad

Tirupur is one of the major textile export hubs in India, which I understand, has a CETP designed and run by the Textile Industry Association. I understand that the waste coming out from various units has heterogeneous characteristics but the plant has been designed to take care of these variations to a certain limit. The main concern is about the BOD/COD to be treated in the process, which keeps fluctuating. The disposal facility at the plant and off-site details may be with the association. However, the risks of VOC and other long term persistent dye waste to water and land as well as people are real.

Ahmedabad Textile Industrial Research Associations (ATIRA) and other Textile Industrial Research Associations in India have been working in this area for a very long time and I am sure they have some scaled down solutions for the problems of waste disposal at cottage industrial

unit level. Also, IDRC Canada was implementing some of these projects in parts of Gujarat (quite some time ago), which may have experiences with low cost effluent treatment plants as well.

Raj Jani, Asian Heritage Foundation, New Delhi *(response 1)*

Let me first congratulate AIACA for taking up this project. It is not only timely and relevant for saving the entire craft belt of Sanganer and Bagru, but there is also a huge felt-need for this. This is because the social costs associated with water effluents are enormous, especially for the user community and the local residents in these clusters.

I had the opportunity to work towards the establishment of the first-of-its-kind eco-friendly micro-organisms technology based effluent treatment plant at Sanganer, which unfortunately ran into ownership versus multi-user conflicts after some time. The Rajasthan Chamber of Commerce and Industry had outsourced the services of Professor K. P. Sharma, Botany Department, University of Rajasthan to set up the plant. Prof. Sharma had obtained a patent through his department for the technology, which had many advantages in terms of lesser set-up costs, low recurring costs and virtually a maintenance free organic model.

Other than this, while conducting research to find the right technology, we also came across a few interesting options at TERI's Mehrauli-Gurgaon centre, where they have demonstrated these, including their own ETP, which has been installed at their guest house here.

Padma S. Vankar, Indian Institute of Technology, Kanpur *(response 1)*

In continuation with all that is being written about the textile effluents of Rajasthan I have a few suggestions and strategies available to combat the problem if not fully then at least partially. Within this context, AIACA was seeking specific inputs from members on the following:

What are the various technologies available for establishment of low cost effluent treatment plants (ETPs) for small scale industries?

I have developed some very low cost biofilters for colour and metal removal (separately) and these could be installed at unit level rather than at the CETP level where the volume of water is huge. If there are organizations who wish to get these installed on a trial basis it may not be a bad idea.

Muhammad Mukhtar Alam, Centre for Ecological Audit, Social Inclusion and Governance, New Delhi

I would like to take this opportunity to comment on the work undertaken by the Switch Asia project for transforming consumption and production patterns. I was involved in ensuring that concerns for ecologically sustainable consumption and production patterns get integrated into the project. This was also the essential component in our discussions with UNDP on the theme. Please visit www.capacity.org for more details.

I believe that this initiative is indeed timely; we also need to focus on habitats which are ecologically hostile habitats with petro-modern transports, which need to be transformed to ecologically sustainable habitats. This would require halting acquisition of farm land around major towns. I also wish to inform you about two networks that are working for ensuring transition to ecologically sustainable consumption and production: http://transitionus.ning.com and http://ecostrategiccommunicators.ning.com

Addressing the issue of cost efficient plants, I would like to suggest that we move towards the use of organic colours produced through flowers in order to reduce hazardous chemicals used for processing textiles. With the exhaustion of mine-based chemicals, it will make sense to move towards conventional ecologically sustainable modes of production. For now we require to adopt carbon-neutral processes.

Sumita Ganguly, Independent Consultant, New Delhi

The issues raised by Nupur Bahl need to be addressed very urgently. Mail Today on June 3, 2009, reported on the drinking water scarcity and toxicity in Rajasthan with the screaming title "Toxic water kills Rajasthan kids". Reportedly 20 children died on the outskirts of Jaipur in the past fortnight after consuming contaminated water. 3,500 water tankers have been pressed into service and the number is likely to go up to 4000 in order to supply fresh water to distant and vulnerable areas - 8000 villages and 52 towns. For Bhilwara and Pali which are textile towns, water is being carried in trains.

The root of the contamination leading to 20 child deaths is apparently the waste from dying and block-printing units located in the suburban town of Sanganer. Similarly, small scale operations such as leather tanning (e.g. in Kanpur area) requires huge amounts of water and uses chemicals that are hazardous with effluents that are scarcely treated.

These issues are not new - repeatedly over the past two decades these have been raised by different organizations sensitive to the magnitude of negative health and social impact with lasting effects that these small-scale employment activities can cause. With a new government formation that wishes to make a mark for its pro-poor and pro-environment vision, there needs to be representation to the appropriate authorities to formulate policies and programmes that can combat these practices. It will require firstly an accurate mapping exercise to determine which type of cottage operation results in what type of hazard, the degree of it, followed by suitable technologies to address each, keeping in mind the cost effectiveness. Undoubtedly, this will require a team of scientists, development workers and communicators (all multi-taskers) to take stock of the situation rapidly and then frame recommendations with a time line. This country has the skills, the technologies, often tried and tested - but to bring it all together into a mission like operation that will give results is the challenge.

Each state has a department of science and technology - many have done innovative work in different fields. Active collaboration with them and other partners should be sought to find answers and apply them on scale so that 5 years from now the active players should be able to see perceptible change.

Ajit Seshadri, The Vigyan Vijay Foundation, New Delhi

We have read with interest the responses regarding the SME textile units. We are propagating a simple concept of natural methods - DEWATS for use in STPs with household effluents. The stages used in this method are anaerobic, part aerobic with some plantations such as typha, cayhna-indica and then polishing in a settling pond. The entire process is natural and hence it is slow, and more space is required, and the retention of water in the wastewater process would at best be 10 to 15 days.

We are not sure how this type of natural treatment can help in processing effluent from chemicals dyes used in textile industries, however if you come across tolerant plants species in the water channels with these textile units' effluent (most unlikely), then these plants can do the

function of phyto-remediation i.e. they can take up the role of sacrificial plants who would fix the pollutants in their rhizome roots. We request you to advice us about this. If this is possible, then we could use these plants, find a remedy for wastewater treatment, and some design prospects for this will also be possible.

Padma S. Vankar, Indian Institute of Technology, Kanpur *(response 2)*

In response to what Muhammad Alam has mentioned, if natural/vegetables dyes have to be reintroduced for ecological sustenance of water, biodegradable dyes and auxiliaries should be practically demonstrated. I am ready to take up this task initiated by Switch Asia as I have been working in the area of innovative industrial natural dyeing for the past 14 years.

Depinder Kapur, India WASH Forum, New Delhi

I would like to thank Sumita Ganguly for sharing this news. The problem of groundwater and surface water contamination is very serious in many places in India. Like the farmer suicide deaths, these are ignored by the national media. I believe that both mapping of the hazard and technologies to address it, exist. It is only a case of affordability - the very small scale industry that is essentially unorganised – is unable to afford it. And, the state is not willing to subsidise it.

Raj Jani, Asian Heritage Foundation, New Delhi *(response 2)*

Further to Sumita Ganguli's posting, where she has aptly mentioned about an alarming situation in and around Jaipur outskirts because of textile effluents, I want to present a few facts for the benefit of the community besides raising another pertinent issue of dwindling water availability both for cottage and industrial textile applications:

a) A lot of work has gone in the field of finding an appropriate solution to Sanganer's water pollution in terms of National Productivity Council's mapping of entire printing area, its water sources and effluent flow. GTZ has helped NPC is carrying out this exercise. Shyam Agarwal, an entrepreneur has worked closely with these organizations and possesses relevant information.

b) Rajasthan Pollution Control Board has fixed certain norms for the allowed contamination based on which all the units were supposed to be issued NOCs for the subsequent registration with Government authorities. The board was supposed to work with RIICO, another state government authority to install CETPs in Sanganer, for which a lot of progress has been made.

c) Prominent industry associations including Calico Printers' Society and Sanganer Rangai-Chhapai Sansthan have worked closely with all of these bodies and held extensive discussions with government to work out solutions to avert displacement/relocation from Sanganer in the wake of a PIL filed in Rajasthan High Court, which is dormant for the time being but its a matter of time before it is brought again for consideration.

In view of the above developments, it would be appropriate if instead of reinventing the wheel, quick action on the most feasible available solutions can be made. In this case the onus lies on facilitating agencies like AIACA to bridge the differences between multiple support agencies and achieve a common ground to put things on a fast track, otherwise it would be too late to avert a disaster.

Also alarm bells are ringing to find a sustainable solution to water availability for treatment of textile effluents as in almost all the major textile clusters including at Pali, Balotra, Jodhpur, Sikar-Jhunjhnu, Sujangarh-Churu and Jaipur, the biggest challenge is to find fresh water than to

treat water, which is posing a great threat to continuation of textile operations in these traditional clusters. Time is running out to first save water and then treat it to save the heritage crafts of block printing, daboo, bandhej, leheria and so forth before they are lost in oblivion.

Arjun Kant Jha, Narisanstha, Jaipur

In the context of the query, on Friday, 5 June 2009, Sanaganer Kapad Rangai Chhapai Association published a tender in this regards, and they may have the answers to the questions raised by you. Please read Dainik Bhaskar, Jaipur edition, 5 June 2009.

H. S. Sharma, Dr. K. M. Modi Institute of Engineering, Ghaziabad

I wish you were aware of the ground realities in India. The effluents from factories are no longer discharged outside the factory due to restrictions placed by the Pollution Control Boards. A hole is dug with in the factory and an 8 inch pipe inserted in the hole. A low cost boiler feed pump (available in the market at about Rs. 20,000) is made use of to pump the effluents into the pipe and the factory is shown as a zero discharge factory. What is the result? When people living nearby draw water from their handpumps they only get contaminated, coloured water, depending on the colour of the effluents. This is the ground reality and you can visit Ghaziabad, Pilakhua, Sanganer or any other textile town to witness this.

G. Misra, Directorate of Economics and Statistics, Port Blair

Unnao and the road connecting Kanpur to Lucknow are polluted. Earlier only the tanneries of the JAJMAU area were polluting the Ganga. Now the industrial area being developed near Unnao towards Kanpur and Lucknow are discharging untreated effluents in the open on the nearby fields, and there is nobody to check the same. The poor are left to deal with the foul odour and the effects of pollution. Members of the Water Community ought to visit Lucknow from Kanpur via road to see this, and to ensure that this discussion forum can be utilized in the best possible way to solve a problem. Only then will this forum truly provide "Solution exchange".

Abhishek Mendiratta, Consultant, New Delhi

Ozone finds use in wastewater treatment as different stages. In the primary stage it is used to detoxify waste water. In the secondary stage it is used for sludge reduction and in the tertiary stage, for disinfection, micro-pollutant removal, COD reduction and decolourisation. In each of these cases the uses of ozone are found to be very productive:

Ozone-based oxidation is an ideal technology to remove colour. It also destroys organic odour-causing compounds. These are the reasons that ozone finds immense use in municipal drinking water plants and chemical industries discharging effluents that containing odorous compounds such as H_2S etc. Ozone technology in waste water treatment is a residual free treatment technology.

R. K. Srinivasan, Centre for Science and Environment, New Delhi

The Public Accounts Committee (PAC) during its visit to Jajmau, Kanpur, in 2003-04 pointed out the high levels of pollution in the Ganga, but things have not changed over the period. In fact, the high chromium level in the groundwater has increased leading to disease like cancer. In its sixty second report, the PAC mentions that 360 MLD of sewage flows into the river Ganga from Kanpur city. The existing sewer systems built under the first Ganga Action Plan can trap only 171

MLD which includes 9 MLD of tannery waste water from Jajmau. Since the tannery effluents have a COD level, its treatment technology has to be selected very carefully.

The Committee during its study visit to the site learnt that due to various operational snags in the 130 MLD capacity Jajmau sewage treatment plant (STP), only 55 MLD was being treated. Common problems are choked sewers, erratic power supply, and O & M problems of STPs. The city has 354 tannery units, which discharge high levels of chromium.

Though the state government has asked 210 of them to install chromium recovery plants only 57 had implemented the directions in 2004. Though the state pollution control board has asked closure of 93 tanneries, none of them have been closed so far. The Public Accounts Committee (PAC) expressed concern over the fact that the tannery-owners were not complying with the orders of the Supreme Court for bearing 50 per cent of the operation and maintenance cost of the 36 MLD CETPs, causing unabated pollution in the river. The Kanpur electric crematorium commissioned in May 1991 under GAP at a cost of Rs. 77.22 lakh has been closed since March 1997 due to technical faults and lack of power.

Saurabh Singh, Innervoice Foundation, Ballia, Uttar Pradesh*

I would like to request Padma Vankar to suggest an ETP model for a small unit of confectionery. It should be able to treat 1500 litres of wastewater/day.

Padma S. Vankar, Indian Institute of Technology, Kanpur *(response 3)**

It is difficult to suggest an ETP model without knowing the composition of the effluent but nevertheless I would suggest a USAB. The details are given below:

An upflow anaerobic sludge blanket (UASB) might be a feasible alternative as the primary reactor for treating the confectionery's wastewater. To achieve high-rate anaerobic treatment, the UASB reactor retains biomass through settling of granular sludge that typically occupies the bottom of the reactor. Upflow anaerobic sludge blanket reactors are designed so that the upflow velocity of wastewater is much lower than the settling velocity of the granules; in anaerobic treatment processes the volatile acids concentration is usually the process control variable which is measured off-line. Soluble organic compounds are converted to volatile fatty acids by fermentative bacteria in an anaerobic system. The volatile acids are ultimately converted to methane and carbon dioxide by syntrophic acetogens and methanogenic bacteria.

Changes in the volatile acid concentration have traditionally been used as one of the main indicators of the need for corrective action. The measurement of volatile acids is usually conducted by analysis using gas chromatography. But this determination is not easily applicable to full-scale plants because of the cost of purchase and maintenance of the equipment. However, a simple, two end-point alkalimetric method has been reported where the alkalinity can be titrated to pH 5.75 as a partial alkalinity (PA) and suggesting the measurement of an intermediate alkalinity (IA) by further titration from pH 5.75 to 4.3. An IA/PA ratio can be used as for the follow-up and control of anaerobic reactors. It is an easy, inexpensive and sensitive monitoring technique which allows quick detection.

Sunil Vishwakarma, CRS India Programme, Bhopal*

I fully agree with H.S. Sharma's observation and concern on low cost effluent treatment plants and the current practices of treatment. The situation is same everywhere - wherever water is manually inserted into the ground the only difference is the level of contamination. No doubt

industries are contaminating the groundwater. I feel there is a need to undertake a detailed research and based on the findings we need to come up with a mass awareness programme as well as put corrective measures in place so as to avoid manmade disasters.

Vijay Kumar, Chartered Environmental and Water Resources Exploration and Development Geophysicist, New Delhi*

First, should we not share the concern raised by H. S. Sharma with the Central Pollution Control Board Team regarding injection of effluents in sub-surface through bore-hole in his e-mail?

Secondly, the proper term used should be appropriate technology instead of Low Cost Effluent Treatment Plants.

V.G.M. Nair, National Institute for Interdisciplinary Sciences Technology, Thiruvananthapuram*

The Environmental Technology Section of the National Institute for Interdisciplinary Science and Technology is conducting R&D on biological treatment systems for environment pollution control and consultancy services on environmental management. Some technologies on pollution control are available at the laboratory. I could collect a brief write-up on these technologies, please read the same at http://www.solutionexchange-un.net.in/environment/cr/res01060902.pdf (PDF; Size: 508 KB)

Arunabha Majumder, Jadavpur University, Kolkata*

Selection of process technology depends on wastewater characteristics. Normally we consider Physico-chemical as well as biological processes for effluent treatment. For example, in the case of distillery effluents a three-stage biological treatment could be an appropriate option. In case of dye effluents, physico-chemical treatment followed by biological treatment is preferable. Again selection of chemicals and the chemical dose is very important.

Plug flow biological reactor may perform better than conventional ones. I feel that the operation of ETPs requires meticulous attention. Many ETPs do not running properly; operators do not add chemicals at proper dosage and the proper pH is not maintained. At times the arrangements of rapid and slow mixing systems are very poor. In biological reactors, minimum operational parameters are not maintained. You may contact me for further assistance, if required.

Many thanks to all who contributed to this query!

If you have further information to share on this topic, please send it to Solution Exchange for the Water Community in India at se-wes@solutionexchange-un.net.in and Work and Employment Community in India at se-emp@solutionexchange-un.net.in with the subject heading "Re: [se-watr] [se-emp] Query: Low Cost Effluent Treatment Plants for Small Scale Industries - Experiences; Referrals. Additional Reply."