

The realistic approach with the applicable devices SSCM

Japan Water Agency



NARBO is the platform for information sharing on the realistic approach.

In Asia, there are various stages of countries. All members of RBO always need to consider how expenses for water management could be reduced with keeping and improving the service quality.

Some donors and foreign companies have recommended and promoted to install the high spec facilities and regulation for management.

But, in general case, the malfunction of facilities and difficulties of sustainable management have been seen because of shortage of budget and capacity. \rightarrow There are no one rule for water management and standardized facility

In this view, some information on issue at the site and local approach are shared.

Think Globally, Act Locally

JWA doesn't deny the installation of the high spec devise/facility for enhancing water management if is operates sustainably, but recommend to develop the appropriate devise to meet the real situation of site.

SSCM (Low cost and easy for water purification

- General Solution (SSCM)" is an low cost and simple water purification facility developed by Dr Kiji of Yonden Consultants Inc., Japan JWA has performed verification of SSCM in the past for wastewater in Nepal and for sewage in Vietnam This presentation shows verification experiment targeting groundwater which contained metallic composition such as arsenic, iron and manganese. The experiment sites are as shown below and there locations are shown later:
 - (1) Ashrafpur village, Kachua Upazila, Chandpur;
 - (2) Arsenic Centre in Krishnobati village, Jessore; and
 - (3) Narayanpur village, Chowgachha Upazila, Jessore

Groundwater in Bangladesh



Bangladesh

 \star Groundwater pollution of geological origin •Arsenic: toxication, cancer, noncommunicable diseases • Iron: taste like blood when drinking •Manganese: bland and innocuous, health risk pointed out by WHO \rightarrow No alternative water, even though the water is polluted The residents say "We use the water that God gives us" \star Various measures are be taken • Equipment which are high priced, mechanically complicated, using non-human power, and not locally procured are not suitable. (However, sales of arsenic removal devices from Japan and others are booming) \bigstar Sewage treatment is not yet common (It has just started in large cities) In this stream, it was decided to check the applicability of inexpensive and easy to use SSCM.

Myanmar

 \star AAN: Asia Arsenic Network *Constantly accepting members

Until the start of the field experiment



Skin of a arsenic poisoning patient







Color changed jar caused by groundwater containing iron in Chandpur District

Simple sand filtration device

Groundwater has been used for the drinking.

AAN Filter

Sand filtration unit planned and installed by AAN



Surface water use for safety reasons

Pond used as a water source instead groundwater

Brown-colored water. Iron content of 8mg/l.

The iron content of water from the tap under the filter decreases to 0.5mg/l.

The raw water has metallic composition and tastes bad. But after it is filtered, it is somehow drinkable.

About 200 people use this facility.

Cost of 1 unit is 100 thousand taka (130 thousand yen). The cost of well pump (70 thousand taka) is high, and other costs including labor force is 30 thousand taka.



Pumping up well water (to the green pipe line)





Water contains too much iron (blood like taste)

Water is poured into the top of the sand filtration unit



Hard to maintain the clogged sand! Low cost but not lowest because of size! Less effect if DO is small!

Trial towards installation of Slanted Soil Chamber Method (SSCM)



(लसुत्रे मेंत्रे क्रांत्र क्या) नामे मेंत्र मेंत्र मेंग्रंट आर/मंत्री मेत्रा एसुस्य क्या। 200 व्हार वह

The first design

One of the features of SSCM is the long length of the filtration media the water flows through, which is the reaction portion of SSCM equivalent to sand filtration. It is also strongly oxidative because air (oxygen) is supplied timely. In addition, SSCM has a function of both aerobic and anaerobic.



Wooden mock-up for well understanding

After testing other chambers, a polystyrene foam box was found at last.

Production of Locally applied SSCM



Using things locally available and easy to prepare

External size: 66.2cm × 49.0cm × 42.2cm Internal size: 54.3cm × 37.1cm × 30.4cm * Because the boxes are used ones with distortion, the sizes differs by box





The connection is made with silicon and tape. The connection face is cut in a concave shape to secure the adhesiveness.

Internal size of the chamber: approx. 15cm × approx. 37cm × approx. 121cm (concave shape in the center)



Cut the box into half

with a cutter

Sponge

Size: $1m \times 2m \times 5cm$, $800 \text{ taka} \approx 1,040$ yen /piece Cut into cubes with scissors and knives

1 set is about 4,500 yen to 15,000 yen (The cost varies on the procured material, and is expected to be reduced when mass-produced.)

Trial and error period (for about 1 year since the SSCM was installed in the field)



Chamber was ruptured and broken (but the ANN staff figured out a way and repaired it by themselves)







SSCM installed in the field (Chandpur) (in end of March 2014)



Slanted chambers

Dr. Shamim of AAN explaining the points to pay attention to when using the SSCM



Targeted well \rightarrow

Insect net fitted on the chambers (Trials in the fields) Deflection of the chamber already occurred due to the weight of the chamber

 \rightarrow Afterwards, changed to horizontal installation



Trial : Arsenic Centre, AAN in Jessore , Bangladesh (Remaining 2 sets out of 4 sets were installed)

Rearranging the SSCM on 6th March, 2015



Starting to stuff the sponge closely



Mr. Wali of AAN laboratory in charge of water quality examination and Mr. Sawahashi of JOCV (at that time) working together.

(Source of this page: presentation of Mr. Wali of AAN)

Enabling local production Some Features of SSCM filter at Arsenic Centre

- Originally, sand is used as filtration media as the "Slanting Sand Chamber Method" implies.
- Sponge is used after cut in small pieces here as filtration media.
- Two tiers of chambers were added to the SSCM filter on 27 August 2015 (now six tiers).
- Chambers are placed flat instead of slantwise for slower filtration.
- Around 50 liter water per one time is poured into SSCM filter.

(Source of this page: presentation of Mr. Wali of AAN)



Result of water quality monitoring (Manganese removal ratio by Arsenic Centre, AAN)



The change in manganese removal ratio at Arsenic Centre, AAN (from May 2015 to July 2016) measured by atomic absorption photometer

Upazila, Jessore Distr Parameters		ict Arsenic (砒素) (mg/L)		Phosphate (リン酸) (mg/L)			Iron(鉄) (mg/L)		Manganese8マンガン) (mg/L)				
Bangladesh Standard (バングラデシュ基準)		0.05			6			0.3 - 1.0			0.1		
Date of Sampling サンプル採取日	Date of Analysis 水質検査日	Raw (原水)	Filtered (浄化後)	Ratio (除去率)	Raw (原水)	Filtered (浄化後)	Ratio (除去率)	Raw (原水)	Filtered (浄化後)	Ratio (除去率)	Raw (原水)	Filtered (浄化後)	Ratio (除去率)
4 July 2015	5-7 July 2015	0.222	0.153	31%	1.52	0.69	55%	6.17	0.650	89%	0.761	0.169	78%
4 Oct 2015	5-8 Oct 2015	0.196	0.059	70%	2.00	0.43	79%	3.45	0.000	100%	0.634	0.033	95%
23 March 2016	23 March 2016	0.176	0.059	66%	1.82	0.39	79%	5.29	0.070	99%	0.642	0.034	95%
27 April 2016	28 April 2016	0.205	0.069	66%	1.69	0.41	76%	5.81	0.047	99%	0.698	0.029	96%
29 May 2016	1 June 2016	0.134	0.050	63%	1.52	0.46	70%	3.6	0.490	86%	0.597	0.157	74%
31 July 2016	1-2 August 2016	0.182	0.051	72%	1.71	0.38	78%	5.64	0.000	100%	0.601	0.000	100%
	Man of July 28		Almost cloar I						1	<u></u>			

Water purification at the well subjected to verification experiment in Chowgachha



Almost clear !

For a few months during the experiment, the unit was damaged caused by poultry. However, it was repaired by the collaboration between the AAN staffs and the residents using the installed well.

As a result, by July 2016,

Arsenic: Almost decreases to the water quality standard of Bangladesh Phosphoric acid: removal ratio of 78% Iron and manganese: removal ratio of approx. 100%

During the winter season, the temperature drops to 10° C. Although the removal ratio was expected to decrease as usually the microbial action reduces when the temperature drops, the data showed a good removal ratio in March 2016.

Trial and Error Attempt by AAN and residents (Chowgaccha Upazila, Jessore District)

Pictures were taken on 5th February, 2016 when the chamber replacement work was done. (Photos and info. :given by Asian Arsenic Network Ms. Tsushima.)





Sponges before washing

Residue after sponges washing (Blowncolored water- due to iron element. Arsenic is contained, too. Hopefully solidified in the future.





Trial and Error Attempt by AAN and residents (Chowgaccha Upazila, Jessore District)



Taping the outside of the sidewall to prevent fowl from pecking. Sponges are packed neatly.





Filling the gap between the base and the wire net with blocks to prevent fowl from pecking.

Photos and info: given by AAN Ms. Tsushima





As of 25th June, 2016 (It got dirty a little but it seemed working.)

Sponges in the top chamber were cleaned up well. (checked and confirmed by Dr.Shamim@AAN)





Repair work with sealer at site Filling the chamber with sponges



The sponges in the bottom chamber seemed cleaned up.

Source: pictures and info. by Ms. Tsushima, AAN



From the People of Japan

Arsenic Analysis by HG-AAS Water Quality Analysis (The equipment was procured by the fund of 'Grant Assistance for Grass-Roots Human Security Projects by the Peoples of Japan')



Source: Mr. Wali, AAN staff

Trial and Error Attempt by AAN and residents (Chowgaccha Upazila, Jessore District)



SSCM installed by a henhouse



Taking water at 13:31



Recharging water at 13:24



Drinking water, but the leakage will be found later.

Photos and info: given by AAN Ms. Tsushima

Conclusion:

- SSCM is effective for purification from metals, too. (arsenic, iron, and manganese)
- Removed metals accumulate in the media. So it is essential to make the media be cleaned up periodically.
- The SSCM using sponge for media is lighter than the one with sand and gravel for media, so is extremely easy for clean-up.
- It is proven that SSCM is the low-cost technology that enables easy local material procurement and local production.

Future issue: Both inside and outside of styrofoam chambers tend to get dirty as being used with accumulated residues and it is getting apparent. Such dirty look improvement is also a future issue.

Others

The voice of the residents: "We are very happy to eat 'WHITE' rice." It is said that around 400 persons per one set than the family using the chamber water come and ask for the water from the chambers nowadays.

Our expectations: When such equipment can be made with an exclusively designed mold, the production cost will become cheaper and it will lead to the improvement in non-infectious disease spreading among residents.

As for the SSCM, as stated in various report it is the proven fact that it is quite effective for the purification of water from organic substance. There must be many places where this method can be applicable in Japan and other countries, too, so we look forward to the extensive application of this SSCM.

We hear that AAN is studying to submit the patent application for the SSCM for water purification to protect its use in Bangladesh in the future.

What is the SSCM?

Effect of purification on organic matters

Current problem

Effect of purification



Problems of purification by Activated Sludge Process

1. This method needs large electricity power because it must aerate to supply oxygen into the water.

2. This method generates a large amount of dirt because it is only microorganisms that purifies.



Construction of Slanted-Soil-Chamber



Drawings of Slanted-Soil-Chamber Sectional side view of Slanted-Soil-Chamber has designed multi-stage.

The carrier of this method

The porous fragment is suitable.



Volcanic ash and sponge

Slanted-Soil-Chamber Method (SSCM) to purify wastewater for kitchen

(This method only uses potential energy without using electric power.)



In the case of waste water purification by Slanted-Soil-Chamber Method for kitchen



The average volume of treated water is 92L/day for 4 years and 4 months.

Sink

The result of purification of kitchen waste water: SS



The average removal rate is 74%.

The result of purification of kitchen waste water: BOD



The average concentration (mg/L): Raw water is 819mg/L, Treated water is 86mg/L.

The average removal rate is **83%.**

The result of purification of kitchen waste water : CODMn



The average concentration (mg/L): Raw water is 542mg/L, Treated water is 51mg/L.

The average removal rate is 80%.

The result of purification of kitchen waste water: T-N



The result of purification of kitchen waste water: T-P



The result of purification of sewage waste water : E-coli





Treated water's value is about one digit smaller than Raw water's value.

Case of Nepal (Sewerage) Timeline of Activities

22nd Oct, 11

Nov,11

SSCM Start-up

Microbes growth

Dec, 11Microbes growth period







Inlet (left), outlet (right)

SSCM 1: TSS: Inlet: 215, Outlet: 108 mg/L (50%) COD: Inlet: 815, Outlet: 490 mg/L (40%)



Timeline of Activities (Contd.)

24th March, 12





CURRENT CONFIGRATION

SSCM	Barrier Size	Date
SSCM 1	2 cm	24 th March,12
SSCM 2	2 cm	24 th March,12
SSCM 3	6 cm	11 th March,12
SSCM 4	4 cm	11 th March,12



2 sizes of bricks evenly mixed 1 mm - 1.5 mm 0.5 mm - 1 mm

Sample of Result (Water quality) SSCM-4



Sample of Result (Water quality) SSCM-3 (test piece)



Pay attention to the capacity on repair ?

Combination of localization and standardization for sustainable management

Needless to say, practitioners have to consider the sustainability at the time of installation of products/system for water resources management.



In case of one country, around 60-70% of pump system in whole nation is now malfunction because of aged, less spare parts, shortage of number of staffs for repair and budget. This situation might cause the crisis of economy and food security. So far, it is necessary to improve the capacity of repair as well as installation of new pump system.

Combination of localization and standardization



SSCM filter user family in Jossor, Bangladesh

SSCM filter user family in Chandpur, Bangladesh

Thank you

