WEEKLY EPIDEMIOLOGICAL REPORT

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High quality drinking water through Bio-Sand Filter (part 2)

Slow Sand Filter

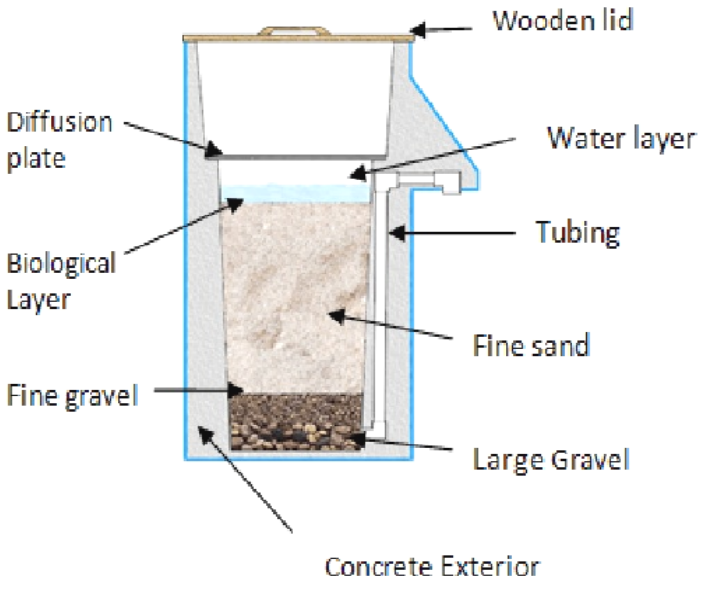
In slow sand filter, water moves slowly through sand beds, particles are removed by physical filtration and pathogens are destroyed by microbial population in biological layer. Microbes in biological layer needs dissolved oxygen in water to survive. Hence the filter has been designed to operate continuously. In conventional system larger inlet and outlet storage tanks are required for continuous filter operation.

The shortcomings of the above two household systems have been addressed to a greater extent by a novel application of water purification processes which is branded as **Bio Sand Filter**.

Bio- Sand Filter

Bio Sand Filter (BSF) is a development of **Centre for Affordable Water and Sanitation Technology in Canada *(CAWST).* It is an adaptation of traditional slow sand filter in such a way that the filters can be built on smaller scale and can be operated intermittently**. These modifications are suitable for use at household level or small group level. It is simply a concrete container, with layers of sand and gravel inside it. The sand and gravel remove dirt, bacteria, viruses and parasites and other impurities from the water, making it suitable for drinking.

Cross section of Bio Sand Filter



Following construction, when water is poured into the top of the filter, the organic material it is carrying, trapped at the surface of the sand, forming a biological layer (microorganisms) or 'schmutzdecke'. Biological layer find food and oxygen from organic materials and dissolved oxygen present in water and propagate over a period of 1-3 weeks, and after three weeks filter is ready for use. A layer of water (5 cm deep) is maintained above the sand at all times. This layer of water allows diffusion of oxygen to the biological layer for its survival. Hence BSF could be conveniently used intermittently at household level unlike slow sand filters which should operate continuously.

Water is poured into the top of the filter whenever needed. There is a diffuser plate placed just above the sand bed that absorbs the shock of the falling water so as not to disturb the biological layer. The water then passes through the sand bed, several layers of gravel and collects in a pipe at the bottom of the filter. It is then pushed up through plastic piping that is encased in the concrete, and out of the filter, for the user to collect.

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As with all slow sand filters, the removal of pathogens happens in the Bio-Sand filter through a combination of biological and mechanical processes.

Table 03. Removal of impurities by Bio Sand Filter

Harmful agent	% of removal	Method of removal
Bacteria	90-99.9%	Physical straining Predation Natural dying
Viruses	99%	Physical straining Predation Natural dying
Protozoa	99%	Physical straining Predation Natural dying
Helminths	100%	Physical straining
Arsenic	85-95%	By adding 5 Kg of non-galvanized iron nails

Source:
Bio sand Filter Purpose and Design, Project Implementation Workshop Reference Manual 2006, Center for Affordable Water and Sanitation Technology.

Maintenance of Bio Sand Filter

After continuous usage, the pore openings between sand grains might clog with debris and the flow rate through the filter decreases. Then the sand filter should be agitated to clean the filter and suspended materials over the sand be removed using a container. The process can be repeated till the desired flow rate is established. After cleaning, a re-establishment of the biological layer takes place quickly, returning removal efficiency to its previous level.

Bio Sand Filter project at "Yovunsirigama" –Gamagoda, Kaluthara

"YOVUNSIRIGAMA" is situated at Gamagoda Grama Niladri division (724) at Dodangoda Divisional Secretariat in the Kalutara district. Thirty two families live in this village and the total population is 141. The village is situated on top of a mountain and people had to face many hardships to obtain water. They travel a long distance to carry water especially during dry seasons. The people in the village were suffering from diarrhoeal diseases frequently as a result of obtaining water from common wells, using several containers to draw water and drinking water without boiling.

The training programme on Bio-Sand Filter was conducted for selected MOOH and Public Health Inspectors at the National Institute of Health Science (NIHS) by an engineer attached to the *Centre for Affordable Water and Sanitation Technology in Canada (CAWST).* "YOVUNSIRIGAMA" –GAMAGODA PHI area was selected for implementation of the project as a pilot basis since the safe water was a felt need of people.

A village level committee was established including formal and informal leaders to sensitize the villagers about the project and follow up the progress. A village youth was trained for construction of BSF by the range PHI of Gamagoda. Yovunsirigama villagers agreed to pay Rupees 200/- for each BSF construction. One cement bag had been shared among three families helping themselves for construction.

Sand was obtained from the nearby streams in the village and required gravel was donated by a philanthropist. A mould was provided by Mutual Assistance International (MAI) Sri Lanka, a foundation committed to uplift the lives of rural poor. The project started on 07th March 2007 and thirty (30) BSFs were constructed within two months. Net cost for construction of one BSF was Rupees 1500-2000/-.

Table 04 depicts the *E. coli* counts of water samples taken from wells and BSF filters before and after filtration.

Table 04. *E. coli* count per 100ml water before and after filtration through BSF

Water samples	Before filtration (well water) *E. coli* count number/100ml	After filtration (BSF water) *E. coli* count number/100ml
1	50	0
2	25	0
3	8	7
4	0	0
5	8	0
6	50	5
7	25	0
8	8	0
9	20	0

Hence the Bio Sand Filter is a cost effective water purification technology which could be used at resource poor settings due to low cost in construction, ability to use at household level and easy maintenance.

Reference:

1. **Sri Lanka Country Assistance Program Evaluation:** Water Supply and Sanitation Sector August 2007

This article was compiled by Dr D.T.P Liyanage, Consultant Community Physician, Deputy Director (Field Services), NIHS, Kalutara

 continued with No.10

Table 1: Vaccine-preventable Diseases & AFP

06th -12th March - 2010(10th Week)

Disease	No. of Cases by Province									Number of cases during current week in 2010	Number of cases during same week in 2009	Total number of cases to date in 2010	Total number of cases to date in 2009	Difference between the number of cases to date in 2010 & 2009
	W	C	S	N	E	NW	NC	U	Sab					
Acute Flaccid Paralysis	00	01	00	00	00	00	00	01	00	02	02	21	13	+61.53 %
Diphtheria	00	00	00	00	00	00	00	00	00	00	00	00	00	-
Measles	00	01	00	00	00	00	00	00	00	01	02	19	30	-36.7 %
Tetanus	00	00	00	00	00	00	00	00	00	00	00	06	06	0.0 %
Whooping Cough	00	00	00	00	00	00	00	00	00	00	01	03	17	- 82.3 %
Tuberculosis	42	67	61	00	16	10	10	06	01	215	74	1981	1510	+31.2 %

Table 2: Newly Introduced Notifiable Disease

06th -12th March - 2010(10th Week)

Disease	No. of Cases by Province									Number of cases during current week in 2010	Number of cases during same week in 2009	Total number of cases to date in 2010	Total number of cases to date in 2009	Difference between the number of cases to date in 2010 & 2009
	W	C	S	N	E	NW	NC	U	Sab					
Chickenpox	04	04	15	10	04	03	10	10	06	66	433	757	2142	- 64.6 %
Meningitis	01 CB=1	01 KN=1	04 GL=3 HB=1	00	01 TR=1	05 KR=2 PU=3	00	04 BD=3 MO=1	04 KG=2 RP=2	20	17	353	192	+ 83.8 %
Mumps	02	00	01	00	02	00	02	03	04	14	39	174	365	- 52.3 %
Leishmaniasis	00	00	02 MT=2	00	00	00	06 AP=6	00	00	08	03	79	301	- 73.8 %

Key to Table 1 & 2

Provinces: W: Western, C: Central, S: Southern, N: North, E: East, NC: North Central, NW: North Western, U: Uva, Sab: Sabaragamuwa.

DPDHS Divisions: CB: Colombo, GM: Gampaha, KL: Kalutara, KD: Kandy, ML: Matale, NE: Nuwara Eliya, GL: Galle, HB: Hambantota, MT: Matara, JF: Jaffna, KN: Killinochchi, MN: Mannar, VA: Vavuniya, MU: Mullaitivu, BT: Batticaloa, AM: Ampara, TR: Trincomalee, KM: Kalmunai, KR: Kurunegala, PU: Puttalam, AP: Anuradhapura, PO: Polonnaruwa, BD: Badulla, MO: Moneragala, RP: Ratnapura, KG: Kegalle.

Data Sources:

Weekly Return of Communicable Diseases: Diphtheria, Measles, Tetanus, Whooping Cough, Chickenpox, Meningitis, Mumps.

Special Surveillance: Acute Flaccid Paralysis.

Leishmaniasis is notifiable only after the General Circular No: 02/102/2008 issued on 23 September 2008.

Table 4: Selected notifiable diseases reported by Medical Officers of Health

06th -12th March - 2010(10th Week)

DPDHS Division	Dengue Fever / DHF*		Dysentery		Encephalitis		Enteric Fever		Food Poisoning		Leptospirosis		Typhus Fever		Viral Hepatitis		Human Rabies		Returns Re-
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	%
Colombo	65	1264	1	27	1	4	0	16	0	5	28	143	0	3	0	18	0	1	**85**
Gampaha	66	1283	0	7	1	7	0	10	0	2	11	105	0	1	2	21	0	0	**60**
Kalutara	19	304	2	36	0	4	0	5	0	16	13	54	0	0	2	12	0	0	**75**
Kandy	35	415	1	68	0	0	1	4	0	1	1	10	4	41	1	19	0	0	**74**
Matale	9	246	2	145	0	0	0	6	3	57	1	22	0	0	0	13	0	0	**92**
Nuwara	1	45	2	22	0	0	2	31	0	3	1	6	0	22	1	12	0	0	**85**
Galle	23	149	4	39	1	3	0	0	1	5	3	8	0	2	0	4	0	2	**89**
Hambant	24	222	1	10	0	2	0	1	0	1	0	19	1	35	1	3	0	0	**73**
Matara	14	108	2	27	0	1	0	1	1	35	22	78	10	58	0	7	0	0	**94**
Jaffna	15	1758	0	36	0	1	9	234	0	4	0	0	0	83	2	20	0	0	**42**
Kili-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Mannar	6	55	1	12	0	0	0	18	0	0	0	0	0	0	0	8	0	0	**60**
Vavuniya	4	442	0	13	0	1	0	23	0	1	0	0	0	0	1	5	0	0	**50**
Mullaitivu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Batticaloa	38	673	3	27	0	1	0	5	0	9	0	1	0	1	0	0	0	0	**85**
Ampara	0	24	0	20	0	0	0	2	0	6	0	14	0	0	0	6	0	0	**43**
Trincomal	11	601	0	39	0	4	0	3	0	7	0	8	0	4	0	6	0	0	**80**
Kurunega	14	384	3	57	0	2	1	9	0	1	6	114	1	16	4	30	0	1	**70**
Puttalam	3	410	3	21	0	3	4	28	0	114	1	45	0	0	0	1	0	0	**56**
Anuradha	34	600	1	17	0	0	1	3	0	0	2	14	3	12	4	16	0	4	**74**
Polonnar	7	87	1	18	0	1	0	0	0	2	2	27	0	0	0	13	0	0	**100**
Badulla	6	150	6	46	0	0	2	29	4	10	3	17	1	19	1	14	0	0	**87**
Monaraga	8	104	5	52	0	0	0	16	0	1	0	12	0	14	1	2	0	0	**64**
Ratnapur	16	311	4	77	0	2	0	4	0	8	3	77	0	25	0	33	0	1	**39**
Kegalle	24	271	1	15	0	4	1	17	0	2	8	59	0	4	0	27	0	0	**73**
Kalmunai	14	356	1	38	0	0	0	4	0	0	0	0	0	0	0	7	0	1	**85**
SRI LANKA	**456**	**10262**	**44**	**869**	**03**	**41**	**21**	**469**	**09**	**290**	**105**	**833**	**20**	**340**	**20**	**297**	**00**	**10**	**71**

Source: Weekly Returns of Communicable Diseases WRCD).
*Dengue Fever / DHF refers to Dengue Fever / Dengue Haemorrhagic Fever.
**Timely refers to returns received on or before 12th March , 2010 Total number of reporting units =311. Number of reporting units data provided for the current week: 205
A = Cases reported during the current week. B = Cumulative cases for the year.

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Comments and contributions for publication in the WER Sri Lanka are welcome. However, the editor reserves the right to accept or reject items for publication. All correspondence should be mailed to The Editor, WER Sri Lanka, Epidemiological Unit, P.O. Box 1567, Colombo or sent by E-mail to chepid@sltnet.lk.

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