DACAAR

Water Expertise and Training Centre
Action Research on Plastic BSF, Mazar, Balkh

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EXECUTIVE SUMMARY

Action research on DACAAR's Pilot Plastic Biosand Filter Project was carried out in Dehidadi district of Balkh Province of Afghanistan during the month of June 2014, funded by CIDA. In total, 50 plastic biosand filters were manufactured, distributed and installed to households in three villages. A research team visited a representative sample of 30 households to conduct interviews, make observations of the filters and to test the quality of source and filtered water.

The overall objectives of the study were to identify the effectiveness and to transfer project knowledge, skills and lessons learned to DACAAR and other NGOs running WASH program in Afghanistan. Specific Objectives of the study were to identify the rate of adoption , the User's perceptions, the effectiveness of the filter in removing pathogens , cost of the filter, availability of materials required for fabrication of filter and training of staff on fabrication of plastic filter.

The average length of time that the filters had been in use was 4.5 months. The research team found that 96.8% were using the filter consistently for their drinking water and food preparation. Water analysis result showed the biosand filter to be effective in removing of 98% of the faecal bacteria and 97% of the turbidity.

An average of 50 litres of water was filtered each day with some households reporting up to 100 litres per day. All of the (100%) users felt that the filter provided enough water for their household. All of the users reported better taste (100%), better smell (100%) and better appearance (100%). When asked about their perception of their family's health, 100% stated it had improved.

The observations of the filters showed that 100% of the outlet tubing was generally cut to the correct length below the spout (2-3 cm),100% of the filters were located correctly and 93.3% of the filters were levelled properly. In addition, 96.3% of the top of the sand was found to be not disturbed because the water was not leaking from the edges of the diffuser plate, as the quality of the diffuser basin was good.

Overall, the perceptions of the families using the filters were strongly positive, with 100% saying that they had recommended the biosand filter to others. When asked if they thought the filter saved them money, 100% of the households reported that they thought that it had saved money.

The cost of the construction materials of the plastic biosand filter was reasonable, even though cheaper than the concrete biosand filter and the materials could be find locally very easily in the whole country. It is very light, therefore easy to be carried and easy to be used, even by children since the height of filter is lower than the concrete filter.

Searching and purchasing of good quality plastic bucket and basin, proper training on fabrication and usage of the filter, selection good filter media, selection of really needy people for filer distribution and installation and follow up of the project after one year are strongly recommended.

It worth mentioning that the findings of this research was shared in learning exchange program held by DACAAR in December 2014 with 46 people from 20 client organizations.

1. BACKGROUND/INTRODUCTION

1.1 Introduction

Historical evidence demonstrates that piped water systems dramatically reduced morbidity and mortality rates due to diarrhoea in industrialized countries in the 19th century[1]. Based on this evidence, many countries focused on installing community-based improved water supplies during the last few decades in an attempt to duplicate this dramatic health improvement in less developed countries.

Recent systematic reviews of water, sanitation and hygiene (WASH) interventions suggest that the beneficial effect of improving household water quality at the point of use to reduce diarrheal diseases risks had been previously underestimated[2]. Current reviews estimate 30-40% reduction in diarrheal disease by improving household drinking water quality at the point of use, making such treatment more effective than improvements at the source, which reduce diarrhoeal disease by 25%[3].

The goal of point of use (POU) household water treatment and safe storage technologies is to empower people without access to safe water to improve water quality by treating it and storing safely in the home. There are a number of different POU technologies which policy makers, implementers and users can select as appropriate for particular circumstances and population.

The biosand filter is an emerging Point Of Use water treatment technology that is currently being implanted and promoted internationally. Laboratory studies have examined biosand filter performance, including its ability to reduce the different classes of microorganism. These studies show reductions ranging from 90% to 99% for fecal coliform, including E.coli, approximately 90% for virus and 99.9% for protozoa parasites[4].

Infectious diseases are still a threat to public health in Afghanistan. Diarrheal diseases are responsible for the deaths of children yearly all over the country. Based on reports overall, 23% of children under five had diarrhoea (AMICS, 2011). Much of the high incidence of water-related diseases is due to the consumption of unsafe water, inadequate sanitation, and poor hygienic practices.

Therefore, DACAAR is committed to spread out the biosand filter technology throughout the country considering its affordability, accessibility and adaptability for intermittent use and suitability for households in order to achieve the Afghanistan Millennium Development Goal (MDG), which says" Halve, by 2020, the proportion of people without sustainable access to safe drinking water and sanitation"[5].

In many regions of the country, it was reported that the concrete filter is heavy and difficult to be transfer to hilly and mountainous areas . Some of the filters were cracked, had leakage and raw materials were very difficult to be found. Since there was obvious needs for such technology to be used by people to make their water safe at household level.

Therefore, DACAAR WET Centre decided to conduct an action research on plastic BSF to know whether the effectiveness of the filter is similar to concrete one or different and to understand the users perception and satisfaction with usage of the plastic BSF.

1.2 Project introduction

The pilot plastic biosand filter project was implemented by DACAAR WET Centre with financial support of CIDA, during June 2014. Totally 50 biosand filters were distributed and installed into 50 households in three villages of Dehdadi districts of Balkh province.

The criteria for installing of biosand in above mentioned areas were:

1. A partial baseline survey had already been done, revealing need for safe water in the villages.
2. The families' numbers could not meet the criteria for improving water points.
3. Accessibility to abundant sweat surface water.
4. Community members are keen to use household water treatment technology.
5. Deep water table that is more than 60 meter depth, while the water which cannot be extracted by handpump.
6. Saline underground water, while surface water is sweat.
7. Hard strata of ground with no possibility of digging borehole.

It is to be mentioned that priority was given to widows, disabled, and vulnerable families, people who were using only unsafe surface water such as river, streams and ponds and were committed to use this new technology properly.

1.3 Objectives of Research

1.3.1 Rate of Adoption:

Defined as the percentage of filters still in consistent use one month after installation, rate of adoption is an important objective because it indicates the percentage of households who have adopted household water treatment using the biosand filter for their water needs. Consistent sustained usage is perhaps the single greatest challenge for household water treatment since it requires that individuals develop the habit of treating their drinking water daily. The number of households still using their filter is determined by the research team through unannounced visits in order to avoid any bias.

Note that another similar parameter; '*Rate of Sustained Use*' is the percentage of people using the filter for more than one year. In this evaluation it was found that the households had received their filter an average of 4.5 months (between 4 and 5 months) previous to the visits by the research teams, but the adoption rate is a good indicator for sustained use.

1.3.2 Effectiveness of Biosand Filter

The biosand filters in household use must be effective in reducing the contamination of the water sufficiently to improve the health and economic well-being of the families using them. This research included physical and microbiological water testing to determine the removal effectiveness of the biosand filters.

This objective has been 'well covered' in this research because DACAAR was able to provide a trained water analysis technicians to complete a comprehensive set of testing of the filters.

1.3.3 User knowledge

The biosand filter is operated and maintained entirely by the family in the household. They need to know how and when to 'maintain' or 'clean' the filter. Each household should be

taught how to do 'swirl and dump' – a simple technique to remove the particles trapped in the top of the sand that eventually plugs the filter and slows its flow rate. At least one family member also should be taught that this 'cleaning' of the filter is only done when the flow rate becomes unacceptably slow.

These 5 – 10 minutes of training/demonstration is normally done when the filter is first installed in the household and again with each follow-up visit. User knowledge includes 'User recall' as the time period between cleaning may be several weeks to several months depending on the turbidity of the source water. The household may have been taught how to clean the filter to restore the flow rate, but subsequently forgot the training.

1.3.4 Users' perceptions

Understanding the Users' perceptions towards the biosand filter is necessary to determine if the project is likely to be successful in the long-term. If the Users do not like or appreciate the filter and recommend others to obtain a filter, it is unlikely that scale-up will be possible. The Users in the households are the decision-makers in this situation; it is important to know what they think.

1.3.5 Sharing and Dissemnination of findings

It is the first time that DACAAR doing action research on plastic biosand filter in Afghanistan. There are many organisations working in the WASH sector and faced with the same problem as DACAAR regarding the concrete biosand filter transportation and availability of construction materials locally and are very keen to find a solution for their problem. Therefore, all the findings to be shared in Learning Exchange in December 2014 and use this new technology in hilly and mountainous areas.

1.3.6 Provision of Additional Technical Options of HWT

Concrete and metallic biosand filters are already introduced to the NGO and government department of WASH sector, but they have their own limitations and advantages. Therefore it will be another technological option to be used in very remote, hilly, mountainous and where the raw materials for concrete and metallic filters are not available.

1.3.7 To get knowledge on fabrication

As this is the first time for DACAAR to pilot such new technology in Afghanistan and get proper knowledge on fabrication, finding raw materials, cost of materials and instruments needed for fabrication of plastic biosand filter. DACAAR continuously provide support to other NGOs in country on WASH thematic areas. Therefore it will enable DACAAR to provide technical and consultancy support based on experience to other NGOs, those who want to implement such new technology in their relevant sites.

1.4 Methodology

1.4.1 Data collection

The research took place from 22 to 27 of November 2014 and data was collected from three villages in Dehdadi district of Balkh province. These sites were chosen because DACAAR' WET Centre had CIDA supported pilot biosand filter projects in those villages.

1.4.2 Sampling strategy

DACAAR provided a list of 50 households where they had distributed and installed biosand filters in Charahi Sarak Code Barq, Karta Ezatullah and Now Abad Tokhta villages of Dehdadi districts.
A representative sample of (30 households) of the households with filter was randomly selected, so that a sufficiently accurate evaluation could be carried out in a reasonable time period. Interviews and observations of 30 households have been taken for this research

1.4.3 Data entry and aAnalysis

The Statistical Package for Social Sciences (SPSS, Ver. 18) was used for data entry and analysis. The results are presented in percentages to visualize the results more effectively.

1.4.4 Variable and activities

The research team collected the necessary data to satisfy the objectives mentioned above:

a) **Rate of Adoption** is estimated through direct observation supplemented by interview questions. "*Does the filter appear to be in use*?" is determined when the research team asks for consent from the User to participate in the study.

b) **Effectiveness** of the filter was determined in each of the 30 households using water analysis of the raw source water poured into the filter (Water In) and the filtered water flowing out of the filter (Water Out).

A total of 540 individual water tests were conducted:

- Physical properties; water testing included 480 tests covering the following 4 parameters:
  - TDS (total dissolved solids) measured by electrical conductivity meter – (120) tests were recorded
  - Turbidity measured by an Electronic Turbidity Meter - (120)
  - pH measured with an electronic pH Meter – (120)
  - Temperature measured along with electrical conductivity meter - (120)
- Microbiological contamination using membrane filtration involved 60 tests:
  - 30 tests of Water In
  - 30 tests of Water Out

c) **User Knowledge** is assessed with interview questions regarding when and how often the filter is cleaned and who trained the user. The user is also asked to describe the cleaning procedure to determine how much of the training they had remembered.

d) **User Perceptions** towards the biosand filter are determined through interview questions that ask what the user thinks and says about the filter:

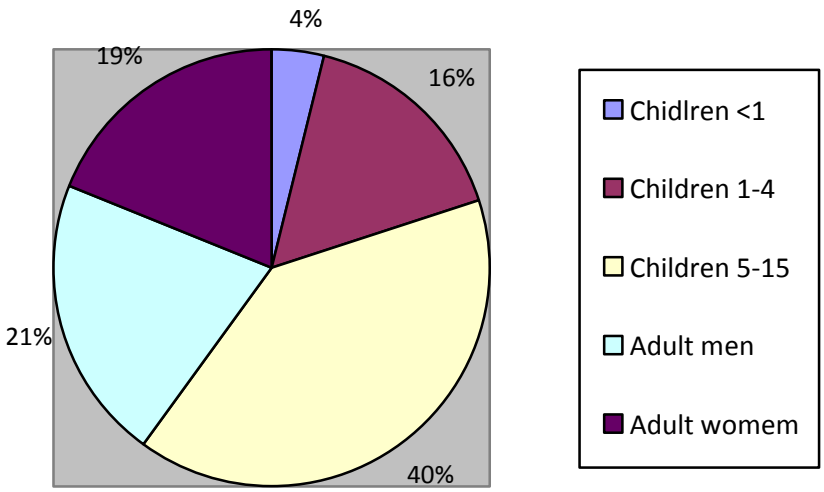
- Taste, smell and appearance of the filtered water,
- Perceived change in health of the family since they began using the filter,
- Quantity of water (*Is it sufficient for the family?*), and
- Overall satisfaction; (*Do you like the filter? Does it save time? Have you recommended it to others?*).

2. RESULTS

2.1.1 Demographics

The 30 households were surveyed included 238 people – an average of 8 people per household. The range was large - from a minimum of 4 to a maximum of 13 people per household.
In Afghanistan, a person is considered a child until he or she reaches 15 years of age. Using this convention, 60% were children.
Infants, under 1 year old were found (4%) of the total population. The vulnerable age group (after weaning); children aged 1 to 4 years, accounted for (16%) of the total number of people. The 5 to 14 year old children accounted for 40% of the total.
The adult men outnumbered the women with a ratio of 51 to 46. Two (6.7%) women were the head of the household in 30 of the visits.

Chart-1: Demographic of study population



2.2 Water Source, Collection and Storage

Most of the households (53.3%) used a stream or canal as their main source of drinking water and 46.7% were using pond as their main source of water.

2.3 Quantity of water

Quantity of water varied from minimum of 20 litter per day to maximum of 100 litter per day for the very large families. On average the households would use 50 litter (almost 6.5 litter/ person) per day. All of the families reported that the filter provided enough water for the household. 96.7 % of the households stated that they give filtered water to neighbours or other families and the remaining 3.3% who did not give the filtered water to the neighbours said" filleted water is only enough for our own family consumption".

The responsibility for collecting the water rests roughly more with the older boyes (63.3%). men (20%), women (13.3%) and older girls (3.3%) were also responsible for collecting water. Time to collect water and return back was only 20 minutes (mean), ranging from 5 up to 60 minutes.

After filtering the water through the biosand filter, 100% of the households were storing the water in containers (mostly in jerry cans). Since recontamination of treated water is a common problem. Observations were made of the water storage containers, a mixture of storage containers were being used; many (60%) of the households had narrow mouthed , 26.7% had wide mouthed and 13.3% had both type of the containers.

The opening of all the containers was covered in 73.3% of the cases. In 23.3% of the houses only some of the containers were covered and 3.3%% of the containers were not covered at all. Most of the families (96.7%) take water form tap attached to container and 3.3% pour the water out of the containers which helps prevent recontamination and none of them take the water by dip. The research teams judged the water storage containers to be clean in 86.7% of the households and unclean in 13.3% of the households.

2.4 Rate of Adoption

Based on sample size of 30 households and the simple random sampling method of selecting households, the unannounced visits found the **Rate of Adoption to be 96.8%**. Of the 30 households, 29 were consistently using their filters after an average 4.5 months since receiving them.

100% households using the filter said they used the filtered water for drinking, food preparation and for other purposes such as for hand washing and bathing, which was depended on size of household. All of the (100%) families reported that the filter provided enough water for the households.

2.5 Observations of the Biosand Filters

The research team made 30 specific observations of the components of the filter in order to determine if the filter was correctly built, installed, used, and maintained.

The plastic filter body was assessed to be durable in 100% of the filters and none of the filter had leakage and crack needed to be repaired in the last five months.

The height of the water above the sand is measured during the 'pause period' when the filter is not flowing. The correct water height is 5 cm. In the 30 cases where the height of water could be measured, it was found to range from 3 to 8 cm, mean was 5.5 cm very close to the normal accepted range..

The flow rate of each filter is a critical quality control parameter. The average flow rate was 3.9 litters per minute. The maximum flow rate was 0.5 L/min only for seven filters – a bit higher than the recommended maximum of 0.4 L/min (for these Version 10 biosand filters). These **flow rates indicate that the filtration sand was properly prepared and is the correct size** for use in the biosand filter. The hole should been two in inside pipe but they made three holes, therefore the flow rate was affected.

Table-1: Observation of filter

Observed Part	Correct	Incorrect
Filter Concrete	100%	0%
Lid	100%	0%
Diffuser plate	100%	0%
Out tubing	100%	0%

Placement	100%	0%
Top of sand	93.3%	6.7%
Level	91.5%	8.5%

The temperature of the water coming out of the filters averaged 15 degrees Celsius, which is enough good for biological activity. The total dissolved solids (TDS) of the filtered water measured by electrical conductivity averaged 553 mg/L which is in normal range, while the source water TDS averaged 600 mg/L .

The pH of the water from the source was 8.4 with the water out of the filters averaging 8.3. This pH is within the normal range for drinking water.

2.6 Effectiveness of Biosand Filters

2.6.1 Bacteria; average removal was 98%

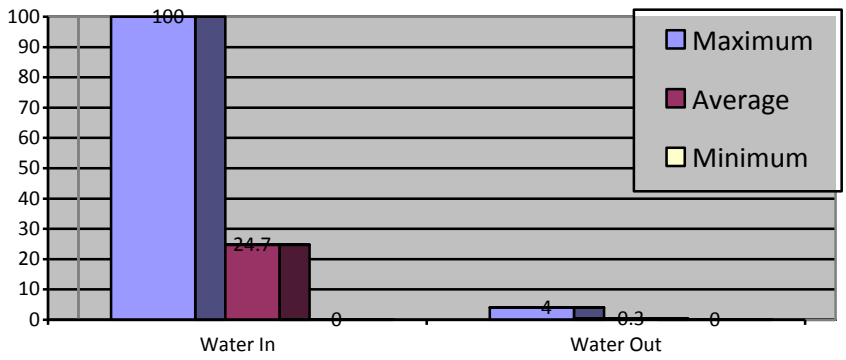
Fecal bacteria contamination is indicated by the number of thermotolerant coliforms in each 100 mL water sample measured as colony forming units (cfu) per 100 mL (cfu/100mL). The Water Out vs. the Water In was determined for each filter then averaged arithmetically for all 30 filters providing the estimate of 98% removal of the bacteria. The source water (Water In) had an average bacterial contamination of 24.70 cfu/100mL with the filtered water (Water Out) averaging 0.30 cfu/100mL.

Table-2: Bacteria counts in different type of water

Type of water	Maximum	Minimum	Mean
Bacteria in In water	100 cfu	0 cfu	24.70 cfu
Bacteria in Out water	4 cfu	0 cfu	0.30 cfu

In addition to percent removal, it is important to note the quality of the filtered water was it safe to drink. Bacterial contamination less than 1-5 cfu/100mL is considered to be 'reasonable quality' and measurements greater than 6 cfu/100mL as 'polluted water'. In this evaluation the bacteria in 6 out of 30 samples from the source water (Water In) showed contamination from 1-4 cfu/100 mL ('reasonable). The maximum bacteria measured in the filtered water (Water Out) was 4 cfu/100mL only in one sample, with 24 of the 30 filters measuring no bacteria out of the filter.

Chart-2: Filter effectiveness in bacterial removal

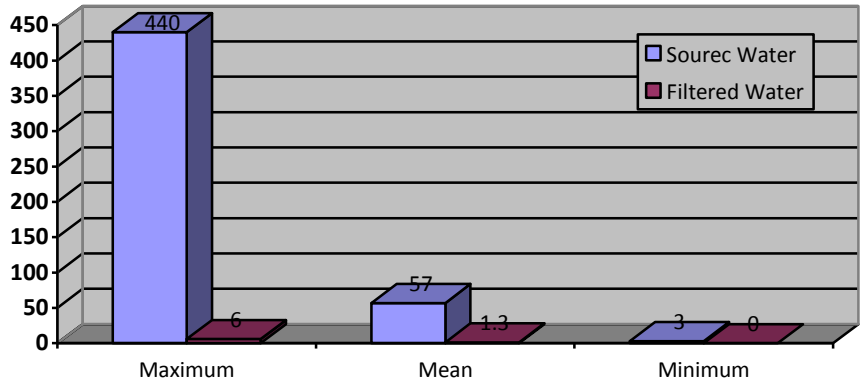


Average removal effectiveness for the biosand filter is normally expected to be between 90% – 99%. While the 98% achieved in this project is very good, and not within the expected range, even though it is still better than the source water which is more contaminated.

2.6.2 Turbidity; average removal was 99%

The results of the water testing indicated that the filters were effective in removing 97% of the turbidity; from an average of 57 NTU in the source water to 1.3 NTU in the filtered water. The turbidity of the source water was generally high with a maximum of 440 NTU. The maximum turbidity in the filtered water was 6 NTU only in one case, which is a bit higher than the normal acceptable range of 5 NTU.

Chart-3: Filter effectiveness in turbidity removal



A somewhat higher turbidity removal is normally expected from the biosand filter. In properly installed and operated filters the turbidity of the filtered water is often less than 1 NTU with no values over 5 NTU. We can say that filters achieved the expected effectiveness in turbidity removal.

2.7 Use of Filter and User Knowledge

The turbidly of In water should be lowered as much as possible to minimize clogging of the filters. It was observed that many of the households (100%) let the water settle before pouring it in the filter and no one poured the water directly into the filter as soon as they collect it. Usually, it is the woman of the household who is responsible for cleaning the filter (90%) , and (10%) the older girls were responsible for cleaning the filter.

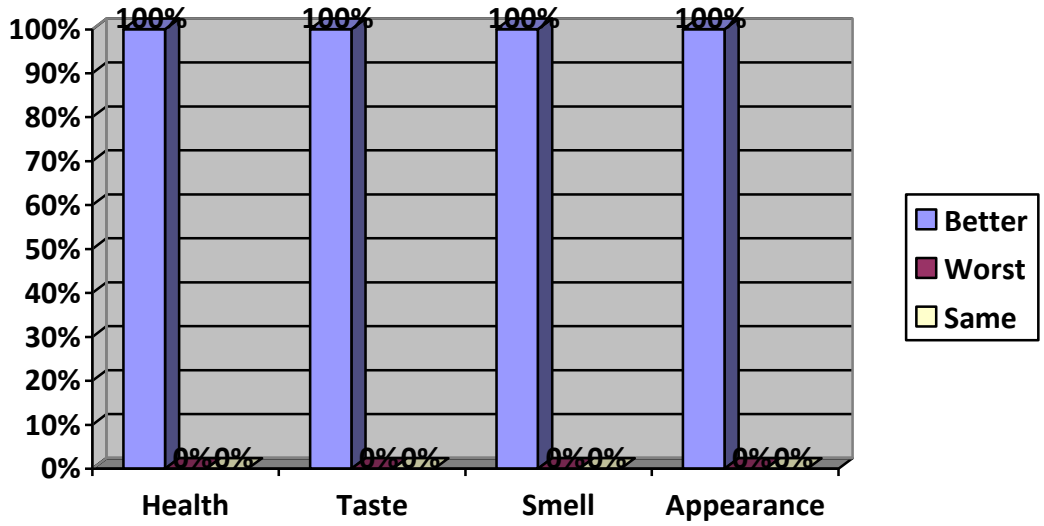
DACAAR was the source of the training in 100% of the responds directly conducted to the women. Each respondent was asked to describe how she/he cleans the filter. The majority, 86.7%, remembered properly and in 13.3% of the households the responsible person for maintenance was absent. This result is surprising since many of the respondents did knew how to clean filter and many of them said that they clean filter every third and seventh day as the source water was from river and it was muddy and turbid.

2.8 User Perception

The User perception is one of the most important results of reseach since they reflect directly on the ability to scale up; if the users are positive towards the biosand filter they will recommend it to others.

The overall perceptions of the households were strongly positive as shown below.
The final question asked was "Have you recommended the filter to others?" 100% replied 'Yes' and no one replied 'No'.

Chart-4: Users' perception



2.9 Dissemination of findings

As DACAAR regularly share and disseminate the finding of the action researches and project evaluations in its learning exchange program every year in the month of December and in some technical group meeting . Therefore the findings of action research on plastic bucket biosand filter were shared in the learning exchange in separate session and fruitful discussion was carried out on the topic between participants and it was welcomed by participants of learning exchange. Participants provided with the soft copies of all the presentations including presentation on action research on plastic bucket biosand filter as well.

2.10 To get knowledge on fabrication of Plastic bucket biosand filter

The fabrication and construction of plastic biosand filter was carried out in three steps:
1st Step: WET Centre staff members bought raw materials required for plastic biosand filter, which were including the bucket, basin (diffuser box) elbow, washer, joints and glue and a sample plastic biosand filter was fabricated by WASH Adviser and meanwhile trained two WET Centre staff on fabrication of plastic biosand filter. The fabricated biosand filter was checked for leakage and other shortcomings here in Kabul.

2nd Step: Two trained WET Centre staff went to Balkh province, purchased required materials and trained one plumber from field. The trained plumber fabricated 50 biosand filter in five days.

3rd Step: The fabricated plastic filters were distributed to already surveyed and indentified needy families with a safe water storage container as well. All the households who received the filter were trained on operation and maintenance of the filter and on safe hygienic practices by hygiene supervisory couple and biosand filter technician.

The total cost of plastic biosand filter was 750 AFs, but cost will be differ in different province of the country due to transportation variations. The fabrication cost will be 30-50 Afs per filter. The cost of sand and gravel will be also differ in different province based on availability and transportation cost.

3. DISCUSION AND CONCLUSION

These households need and appreciate the biosand filters installed by DACAAR. After 5 months, 29 of the 30 households were still using their filter daily, which indicating very good adoption rate for a new technology.

With an average of 8 people per household, the biosand filters were fully utilized with 20 – 100 litres of water filtered each day. The source water was mostly surface water with moderately high turbidity (57 NTU on the average). Despite the relatively high turbidity, the filters were shown to be effective in removing 98% of the E. Coli bacteria which is within the expected range (90% - 99%). Turbidity removal was 97%, slightly more than expected but still very good with 100% of the respondents saying that the appearance of the water was better since they started using the filters.

Observations of the filter and responses from the households regarding problems that they had encountered indicated that the construction and installation of the filters was generally well done. The filters are durable and no problems were encountered by the users for last five months.

The research found that the perceptions of the families using the filters were strongly positive. Nearly all of the respondents liked the filter mostly because "It cleans the water" and "It helps our health". Almost 100% believed that since they started using the filter their family's health had improved. All household found the filter to be easy to use. Almost all stated that they had recommended the filter to others.

The durability of plastic filter will be less than the concrete bioand filter, but it is cost effective and need very simple materials which are available everywhere in Afghanistan, but good quality raw materials will help to prolong the life of biosand filter. On the other hand the fabrication and transportation is very simple and could be transfer to very mountainous areas as it will weight only 4-6 Kg without filter media while the concrete biosand filter weight almost 45 Kg without media.

We can conclude that DACAAR's plastic biosand filter was successful. DACAAR could provide many Afghan families with safer and cleaner water, which will result in decreasing morbidity and mortality causing by water-born disease in vulnerable group; children under five years of age. The technology can also be replicated by those who don't have filter as DACAAR can't reach each and every family in Afghanistan.

4. RECOMMENDATIONS

To have quality and durable plastic biosand filter the following recommendations to be considered while implementing plastic biosand filter project.

4.1 Search and order good quality of plastic bucket and diffuser basin

As there are different quality plastic bucket with different volume available in market, therefore it is vital to look for best quality with 70 liter volume in order to prolong the life of plastic biosand filter and produce no health problem to the users.

4.2 Proper training on fabrication and training of beneficiaries on O&M.

Quality product will grantee quality work and output, therefore proper training on fabrication and installation will help to produce quality plastic biosand filter with proper installation at household. Training on operation and maintenance to the users is also important for proper usage and timely cleaning of filter, which can increase the effectiveness of biosand filter in removal of bacteria and turbidity.

4.3 Selection of good quality filtration sand

Again filter media is crucial for effectiveness of biosand filter. The good quality media to be selected such as sand come from crushed rocks, quarry and river bank. The sand grain should not be uniform, should have different sizes and wash properly.

4.4 Select really needy households for sustained use of filter.

In many evaluations which are conducted by DACAAR, revealed that if people are really needy they will use the filter consistently as they need to drink clean water. Therefore, while we are planning a project a real need assessment to be carried out and based on need assessment the priority to be given to very need people in order to maintain the sustainability of biosand filters projects.

4.5 Pre-filtering of the of source water

Cleaning the filter more often than required will disturb the biolayer and reduce the effectiveness of the filter as many of the respondent said they clean filter every third or every seventh day. So, it is recommended that DACAAR consider proper training in each household on how and when to clean the filters and always advise people on pre- filtering water treatment such as sedimentation and cloth filtering, even though people remembered the maintenance and operation procedure perfectly.

APPENDICES

4.6 Research Questionnaire

Province	
District	
Village	
Date	
Interviewee	
Interviewer	
GPS	Lat: Long:
Verbal consent	1. Yes 2. No
Does filter appear to be in use?	1. Yes 2. No

1. Observation

1.1 Plastic Biosand Filter

Component of filter	Correct	Incorrect
1.1.1. Placement of lid		
1.1.2. Placement of diffuser plate		
1.1.3. Top of sand disturbed		
1.1.4. Location of filter		
1.1.5. Leveled properly		
1.1.6. Valve or pipe on spout		
1.1.7. Cleanliness		

Quality of Plastic BSF construction

1.2. Component of Plastic BSF	Correct	Incorrect	Nature of the problem
1.2.1. Leaking			
1.2.2. Lid and diffuser plate			
1.2.3. Concrete			
1.2.4. Other problem			

2.Measurments

1.1. Height of water above sand in filter	
1.2. Electrical conductivity	
1.3. Temperature in degree C	
1.4. Flow rate in minute	
1.5. Turbidity of Water In (NTU)	
1.6. Turbidity Water Out	
1.7. Turbidity of Water Stored	
1.8. pH of Water Out	
1.9. pH of Water In	
1.10. pH of Water Stored	
1.11. Bacteria in Water In (CFU/100mL)	

1.12. Bacteria in Water Out	
1.13. Bacteria in Water Stored	
2. Questionnaire 3.1.	
2.1.1. Number of people in family	
2.1.2. Number of children less than 1 year	
2.1.3. Number of children 1-4 years	
2.1.4. Number of children 5-14 years	
2.1.5. Number of adult men	
2.1.6. Number of adult women	
2.1.7. Who is the head of the family	1. Yes 2. No
2.2. Water questionnaire	
2.2.1. Where do you get water?	1. Well 2. Piped 3. Canal, river, pond and stream 4. Rain 5. Other (Specify)
2.2.2. How much water do you use in the filter every day?	Quantity:
2.2.3. How long does it take to get water?	Minute:
2.3. Biosand Filter Questionnaire	
2.3.1. How long have you had filer?	Time in minute:
2.3.2. What are all the purposes' you use filtered water for?	1. Drinking 2. Food preparation 3. Bathing 4. Hand washing 5. Other (Specify)…….
2.3.3. Do you do anything with the filtered water before you put into the filter?	1. Let it settle 2. Racket 3. Pour it through cloth 4. Nothing
2.3.4. Do you do anything else to treat water after filtering it?	1. No 2. Yes, Specify,
2.3.5. What method do you use to take water out of the containers?	1. Tap 2. Dip 3. Pour
2.3.6. Please tell us about the taste of the water?	1. Better 2. Worse 3. About the same
2.3.7. What about its smell?	1. Better

	2. Worse 3. About the same
2.3.8. What about its appearance?	1. Better 2. Worse 3. About the same
2.3.9. Since you started using filter, do your family's health has improved, stayed the same or became worse?	1. Better 2. Worse 3. About the same
2.3.10. Does the filter produce enough water for the entire family?	1. Yes 2. No
2.3.11. Do you give water from the filter to your neighbors or others?	1. Yes 2. No
2.3.12. Who is in the household knows how to use the filter?	1. Men 2. Women 3. Older children
2.3.13. Is it easy to use the filter?	1. Yes 2. No
2.3.14. How often do you clean the filter?	Explain:
2.3.15. What is the reason that you decided to clean the filter?	Explain:
2.3.16. Who is responsible for the cleaning of the filter in the household?	1. Men 2. Women 3. Older girl 4. Older boy
2.3.17. How did this person learn about the maintenance of the filter?	1. Training by NGO 2. Informed by male member 3. Other, specify:
2.3.18. How do you clean the filter?	1. Remember properly 2. Did not remember properly 3. The respondent is not the user
2.3.19. Have you had problem with the filter?	1. No 2. Yes, specify:
2.3.20. Do you like the filter?	1. Yes, because: 2. No, because:
2.3.21. Have you recommended the filter to the filter?	1. Yes 2. No

Other comments:

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