

**THE UNITED REPUBLIC OF TANZANIA**  
**MINISTRY OF WATER**



**MOROGORO WATER LABORATORY**



**TULIP WATER FILTER TESTING REPORT**

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## 1. INTRODUCTION

The Tulip siphon water filter is a candle type water filter which uses gravity siphon pressure to force water through a high-quality ceramic filter element. The innovative design results in a high flow rate of 4-5litres per hour, while the filter element can be cleaned by backwashing.

The Tulip siphon water filter is very compact as existing water storage containers can be used. The filter is designed to be used by families at household level. The filter element is impregnated with nano silver in order to increase the bacterial removal efficiency of the filter and to reduce the recontamination risk of stored filtered water.

Winrock is a Non Governmental Organization under iWASH project which deals with water supply and sanitation. Winrock wants to make this product available on the market in Tanzania via a sustainable supply chain. In order to do so, Winrock would like to test locally (in Tanzania) the effectiveness of this technology in removing bacteria and reducing turbidity in water. For this reason Winrock has supplied Morogoro Water Laboratory with three Tulip siphon water Filters, randomly selected from 2,500 filters, for testing the effectiveness in removing **Total coliform**, **Faecal coliform** and reducing **Turbidity** in water samples from five selected water sources.

## 2. OBJECTIVES

The objectives of the test were to test locally the efficiency of the Tulip siphon water filter in removing bacteria (**Total coliform and faecal coliform**) and reducing **turbidity** in water from five different sources river, dam, open well near St. Mathew Hospital, ring well with rope pump at iWASH office and one blind sample supplied by Winrock.

## 3. METHODOLOGY

1. Three Tulip siphon water filters with no visible defects, well packed in boxes with all accessories were selected at random from a stock of 2,500 Tulip siphon water filters at iWASH office Morogoro.
2. Five different sources of water namely Ngerengere river upstream, Mindu dam, an Open well near St. Mathew Hospital, the Ring well at iWASH office and One blind sample supplied by Winrock were selected as sources of water for testing .
3. The experiment was assembled by placing a big bucket of about 140 litres situated 0.7m above the container for storage of filtered clean water, three filters were immersed in the bucket with the hose to the filtered water container for each filter.
4. The filters were soaked in clean water overnight as per instruction manual.
5. Eighty (80) litres of the water from each source were collected as a sample and poured in the big bucket. ***In case of high turbidity samples, filtration using a piece of cloth prior to filtration as recommended in the Tulip filter instructions was carried out.***
6. Two hundred (200mls) of raw water was collected from 80 litres as a sample before filtration.
7. The siphon action was started by squeezing the rubber bulb, the first 20 litres of filtered water was discarded after which 200mls of filtered water from each filter was collected for analysis.
8. Each sample was tested 4 times; once as raw water sample from the source and after passing through each filter to evaluate the performance of each filter.

9. Membrane filtration technique was employed to analyse both *Total coliform* and *faecal coliform* bacteria in contaminated water and filtered water.
10. Turbidity was measured according to standard methods for the examination of water and wastewater 1992
11. After each test the filter was cleaned by backwashing.

## 4.0 RESULTS AND DISCUSSION

### 4.1 Bacteriological test

The level of *total coliform* contamination in raw water from five different sources ranged from 60cfu/100ml to 7500cfu/100ml as shown below in table 1

*Table 1: Results for total coliform bacteria before filtered*

Water sources	Concentrations in CFU/100ml
Water from Ngerengere river	7,500
Mindu dam	356
Open well near St. Methew Dispensary	620
Blind source supplied by Winrock	312
Ring well at iWASH office	60

After passing the water through the three different Tulip siphon water filters, there was total coliform bacteria removal of from a range of 60-7,500cfu/100ml to a range of 0-15cfu/100ml, as shown in table 2 below from the above range *total coliform* bacteria the has been reduced by 99.8-100% in water before filtration.

*Table 2: Results for total coliform bacteria after filtration*

Water sources	Concentrations in CFU/100ml		
	<i>Filter 1</i>	<i>Filter 2</i>	<i>Filter 3</i>
Water from Ngerengere river	1	15	0
Mindu dam	0	0	0
Open well near St. Methew Dispensary	0	1	0
Blind source supplied by Winrock	0	0	0
Ring well at iWASH office	0	0	0

The level of contamination of *Faecal coliform* bacteria in raw water from five different sources range from 12cfu/100ml to 6,400cfu/100ml as shown below in table 3

Table 3: Results for Faecal coliform bacteria before filtered

Water sources	Concentrations in CFU/100mls
Water from Ngerengere river	6,400
Mindu dam	20
Open well near St. Methew Dispensary	288
Blind source supplied by Winrock	168
Ring well at iWASH office	12

After passing the water through three different Tulip water filters, the results from each filter for all samples was 0cfu/100mls of the *faecal coliform* bacteria as shown below in table 4

Table 4: Results for Faecal coliform bacteria after filtration

Water sources	Concentrations in CFU/100mls		
	Filter 1	Filter 2	Filter 3
Water from Ngerengere river	0	0	0
Mindu dam	0	0	0
Open well near St. Methew Dispensary	0	0	0
Blind source supplied by Winrock	0	0	0
Ring well at iWASH office	0	0	0

#### 4.2 Turbidity test (NTU)

Turbidity of water from five selected samples before filtration range from 2.0NTU to 39.0NTU as shown in table 5 below

Table 5: Results for Turbidity in NTU before filtered

Water sources	Turbidity in NTU
Water from Ngerengere river	39.0
Mindu dam	34.0
Open well near St. Methew Dispensary	2.0
Blind source supplied by Winrock	14.0
Ring well at iWASH office	2.0

After filtration process turbidity of filtered water range from 0.0NTU to 7.0NTU as shown in table 6 below. From the results the Tulip water filter has reduced turbidity by 84 -100% in all samples from different sources.

*Table 6: Results for Turbidity in NTU after filtration*

Water sources	Turbidity in NTU		
	<i>Filter 1</i>	<i>Filter 2</i>	<i>Filter 3</i>
Water from Ngerengere river	6.0	4.0	5.0
Mindu dam	6.0	5.0	7.0
Open well near St. Methew Dispensary	0.0	0.0	0.0
Blind source supplied by Winrock	1.0	0.0	0.0
Ring well at iWASH office	0.0	0.0	0.0

The results above show that, after conducting tests on raw water and filtered water, the Tulip Water Filter has shown good performance as it is specified in Total and Faecal coliform removal by 99.8-100% and 100% respectively (Appendix 1). The turbidity was reduced by 82.35-100 % ( Appendix 1) The results for micro organisms' removal have shown no faecal coliform bacteria growth after treatment. This indicates that, the filter has high efficiency on removing bacteria.

## 5.0 CONCLUSION

The Tulip water filters performed well in removing two bacterial (*Total coliform and Faecal coliform*) indicators and turbidity reduction in this study.

Recontamination of the filter water through improper handling practices is a real threat to the effectiveness of this technology. The users of Tulip water filter should have some knowledge of safe water, sanitation, and hygiene practices, therefore education and training in proper technology use and safe water storage practices should be part of the program to improve filtered water quality.

The effectiveness of the Tulip water filter is much depends on the extent of contamination and turbidity level of the water. The manufacturer should exactly state at what level of turbidity pre filtration is applicable/recommended.

Further research should be done on possibility of silver interference with other physical and chemical properties of water. The possibility of breakage of the filters during scrubbing suggests that the availability of replacement parts and access to or awareness of distribution points may limit the sustainability of Tulip water filter.

## References

1. Apha A.-CPCF 1975. Standard Method for Examination of Water and Waste water (4<sup>th</sup> Edition) American Public Health Association American water Work Association, Waste pollution control Federation. Washington DC USA
2. EPA (Environmental Protection Agency, USA). 1987. *Guide standard and protocol for testing microbiological water purifiers*. Washington DC: United States Environmental Protection Agency
3. Roberts, M. 2004. Field test of a silver-impregnated ceramic water filter. Vientiane, Lao PDR: 30<sup>th</sup> WEDC International Conference. Available online at <http://wedc.lboro.ac.uk/conferences/pdfs/30/Roberts.pdf>. Rogers, E. 2003. *Diffusion of Innovations* (5th Ed). New York: Simon and Schuster.



# PICTORIAL PRESENTATION OF BACTERIOLOGICAL RESULTS

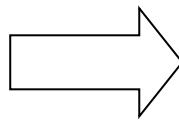
Blind sample *(before)*



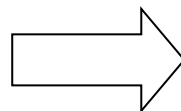
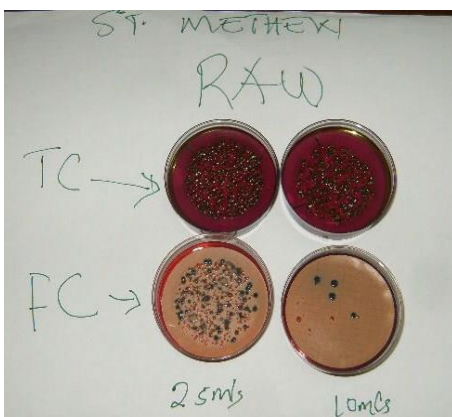
*(after)*



Well with rope pump



Open well near St Methew Dispensary



**Mindu dam**

