Supplementary material

Evaluating the efficacy of point-of-use water purifiers using the water quality index in rural southwest China

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Supplementary Text

In these Supplementary Notes, we provide more details about this research, including five texts and five tables:

1. The test method and grading basis for the parameter of odor and taste.
2. Table S1. Rankings of the odor and taste tests.
3. The test method for the parameter of visible objects.
4. Reasons for not detecting other parameters.
5. Details of WQI calculation Equation and examples of WQI calculation.
6. Calculation method and calculation example of average removal rate.
7. Table S2. Test results of the water quality parameters in the raw water samples (n = 67).
8. Table S3. Test results of the water quality parameters in the purified water samples (n = 67).
9. Table S4. Analysis of the factors influencing the water quality index (WQI) of purified water.
10. Table S5. Comparison of water quality parameters of purified water according to the service time of the filter element in the water treatment system (n = 67).

Test method and grading basis for the parameter of odor and taste

Referring to the Chinese Standard Examination Methods for Drinking Water (GB/T 5750-2006) [1] and the Chinese Sanitary Standards for Drinking Water (GB5749-2006) [2], at each sampling point, take a 100 mL water sample in a 250 mL Erlenmeyer flask washed with distilled water. After shaking the Erlenmeyer flask, odor the water from the top of the bottle, describe it with appropriate words, and record its intensity in six levels. At the same time, take a small amount of water into the mouth, do not swallow it, taste the water, describe it, and record the intensity in six levels (Table S1). When calculating WQI, the odor and test shall be taken as the single index I_i according to the detection level (0–5) below.

Table S1. Rankings of the odor and taste tests.

Rank	Intensity	Instructions
0	none	No odor or taste
1	slight	Difficult for ordinary drinkers to detect
2	weak	Ordinary drinker can detect
3	obvious	Already obviously noticed
4	strong	Already significant odor
5	very strong	Has a strong stench or odor

Test method for visible objects

Referring to the Chinese Standard Examination Methods for Drinking Water (GB/T 5750-2006) [1] and the Chinese Sanitary Standards for Drinking Water (GB5749-2006) [2], take a 100 ml water sample in a 250 mL Erlenmeyer flask. Shake the water sample first, then directly observe the impurities in the water in a bright place, and record according to the observation. If no impurities are observed, record as A. If a small amount of impurities is observed, record as B. If more impurities are observed, record as C. When calculating WQI, if visible objects are detected (B or C), $I_i = 1.50$; if not (A), $I_i = 0.10$.

Reasons for not detecting other parameters

There are also some important parameters that will affect drinking water quality, such as arsenic, fluorine, and microorganisms. Arsenic and fluoride are indicators that large-scale epidemiological data confirms that long-term exposure to drinking water can cause population health hazards. Considering that arsenic and fluorine are geological elements, these pollutions are usually caused by natural geochemical processes. There is no arsenic contamination in our study area, and at the same time, according to the Yunnan Provincial Institute of Endemic Disease Control [3], the fluorine content in drinking water from 150 villages in our sampling area (Dali Bai Autonomous Prefecture) is extremely low, all of which meet China's drinking water standards. Therefore, we did not test these indicators. Microbiological parameters require laboratory and rapid transportation to laboratory. These conditions were not met in this study. In addition, during the investigation, we learned that most people use the water treated by water purification devices for cooking and drinking after boiling, which can avoid the risk of microorganisms to some extent. Therefore, we did not test microbiological parameters.

Details of WQI calculation Equation and examples of WQI calculation.

In the calculation method of WQI selected in this study (a comprehensive index method including "punitive terms" for items exceeding the standards, proposed by Yuan and Wang [4]), the most serious indicator $I_{i,max}$ (the parameter with the greatest potential harm) that exceeds the standard is taken into consideration, and all other parameters that exceed the standard $I_{i,exceed}$ (the other parameters that cause potential harm to health) are continuously multiplied (Π). This WQI can be used to replace the single-factor evaluation method in China's drinking water standard (any index exceeding the standard is regarded as a water sample that does not compliance with drinking water standards), and to comprehensively evaluate the performance of the water purifiers. WQI < 1 means that all parameters of the water samples basically meet the Chinese drinking water standards. The WQI is large, indicating that there are multiple parameters in the water sample that do not meet drinking water standards or some indicators exceed the standard seriously.

Equation (1) is used to calculate each single index (I_i) except pH.

$$I_i = C_i / S_i \tag{1}$$

where I_i is the single index, C_i is the individual test result, and S_i is the standard value (the standard value for each parameter according to China's Sanitary Standards for Drinking Water (GB5749-2006) [2]) of the index.

When the $I_i < 1$, it means that the individual test result does not exceed the standard value (According to Equation 3, this parameter will not contribute much to the increase of the WQI of this water sample). If the I_i is greater than 1, it means that the single detection result exceeds the national standard value (According to Equation 3, this parameter has a greater contribution to the increase of the WQI of this water sample) and it is one of the $I_{i,exceed}$ of this water sample.

For example, the copper content in a water sample is 3 mg/L, and the copper concentration in the Chinese drinking water standard does not exceed 1 mg/L, which is calculated as:

$$I_{Cu} = 3.0/1.0 = 3 \quad (1)$$

This I_{Cu} is one of the $I_{i,\ exceed}$ of this water sample.

If C_i is below the detection limit (BDL) or <0.1 S_i, the assignment value I_i = 0.1. For example, the copper content in a water sample is 0.05mg/L, which is C_i < 0.1, the I_{Cu} = 0.1. If C_i is below the detection limit (BDL), the I_{Cu} = 0.1. At the same time, this I_{Cu} is not one of the $I_{i,\ exceed}$ of this water sample.

If visible objects are detected, I_i = 1.50; if not, I_i = 0.10. Odor and taste shall be taken as the single index I_i according to the detection level (0–5), the test methods and grading standards for visible objects and odor and taste are shown in the supplementary material (Table S1). For example, the visible objects are detected in a water sample, and Odor and test is 0, which is calculated as: $I_{visible\ objects}$ = 1.50, $C_{odor\ and\ taste}$ = 0 and the $I_{odor\ and\ taste}$ = 0.1. At the same time, this $I_{visible\ objects}$ is one of the $I_{i,\ exceed}$ of this water sample, $I_{odor\ and\ taste}$ is not one of the $I_{i,\ exceed}$ of this water sample.

Equation (2) is used to calculate the pH index (I_{pH}).

$$I_{pH} = \left|C_{pH} - \left(S_{\max} + S_{\min}\right)/2\right| / \left|S_{\max} - \left(S_{\max} + S_{\min}\right)/2\right| \quad (2)$$

For example, the pH of a water sample is 9.8, and the Chinese drinking water standard allows it 6.5-9.5, which is calculated as:

$$I_{pH} = \left|9.8 - (9.5 + 6.5)/2\right| / \left|9.5 - (9.5 + 6.5)/2\right| = 1.2$$

This I_{pH} is one of the $I_{i,exceed}$ of this water sample.

Equation (3) is used to calculate the WQI.

$$WQI = \sqrt{(\sum_{i=1}^{n} I_i)/n \times \sqrt{I_{i,\max}}} \times \prod I_{i,exceed} \quad (3)$$

For example,10 parameters of a water sample were tested. The copper concentration in the water sample is 3 mg/L (2 mg/L higher than the standard value), and the TDS is 1600 mg/L (100 mg/L higher than the standard value). The other eight parameters are all <0.1 Si.

According to Equation 1, I_{Cu} = 3, while I_{TDS} = 1.07, I_i = 0.1 for other parameters. At the same time, $I_{i,max}$ = 3, $I_{i,exceed}$ = 3 and 1.07. The result calculated according to Equation 3 is:

$$WQI = \sqrt{(3 + 1.07 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1)/10 \times \sqrt{3}} \times 3 \times 1.07 = 3.88$$

Calculation method and calculation example of average removal rate

Equation (4) is used to calculate the average removal rate (RR, %) for each pair of raw water and purified water:

$$\mathrm{RR} = \left[\sum_{i=1}^{n} \left(C_{ir} - C_{ip}\right)/C_{ir}\right] / n \times 100\% \quad (4)$$

Where C_{ir} is the individual test result of the raw water parameters, and C_{ip} is the individual test result of the purified water parameters corresponding to C_{ir}.

For example, suppose there are three water purifiers, the ammonia nitrogen content in 3 raw water samples of water purifiers is C_{1r} = 0.35 mg/L, C_{2r} = 0.08 mg/L and C_{3r} = 0.31 mg/L respectively. and the content in 3 purified water samples of water purifiers is C_{1p} = 0.22 mg/L, C_{2r} = 0.32 mg/L and C_{3r} = 0.96 mg/L respectively.

The result calculated according to Equation (4) is:

$$\mathrm{RR} = \left[(0.35 - 0.22)/0.35 + (0.08 - 0.32)/0.08 + (0.31 - 0.96)/0.31\right]/3 \times 100\% = -473\%$$

The removal rate is negative means the ammonia nitrogen concentration increases after purification.

When C_{ir} is below the detection limit (or C_{ir} is 0) and C_{ip} is higher than the detection limit, the RR is defined as -1000%. When C_{ir} is below the detection limit (or C_{ir} is 0), C_{ip} is also below the detection limit (or C_{ip} is 0), the RR is defined as 0%.

For example, suppose there are three water purifiers, the ammonia nitrogen content in 3 raw water samples of water purifiers is C_{1r} is BDL, C_{2r} is BDL and C_{3r} = 0.31 mg/L respectively. and the content in 3 purified water samples of water purifiers is C_{1p} = 0.35 mg/L, C_{2r} is BDL and C_{3r} = 0.96 mg/L respectively.

The result calculated according to Equation (4) is:

$$\text{RR}=\left[-10+0+\left(0.31-0.96\right)/\,0.31\right]/\,3\times 100\%=-403\%$$

Table S2. Test results of the water quality parameters in the raw water samples (*n* = 67).

Number	Type of Water Supply	Color (TCU)	Turbidity (NTU)	Odor and Taste	Visible Objects	pH	Chemical Oxygen Demand (mg/L O_2)	Total Organic Carbon (mg/L)
1	SC[1]	0.50	0.0	0	A	7.8	2.4	2.0
2	SC	2.57	0.0	0	A	8.0	3.8	1.3
3	SC	0.78	0.0	0	A	7.9	0.4	0.1
4	SC	1.12	0.0	0	A	8.1	1.8	1.2
5	DC[2]	2.46	0.0	0	A	7.8	BDL[3]	0.1
6	DC	0.50	0.0	0	A	7.7	2.9	1.6
7	DC	1.51	0.0	0	A	8.1	2.9	1.1
8	DC	0.78	0.0	0	A	7.8	0.9	4.6
9	SC	0.95	0.0	0	A	7.7	0.3	0.1
10	SC	0.06	0.0	0	A	8.0	2.9	1.6
11	SC	0.22	0.4	0	A	8.2	0.8	1.2
12	DC	0.45	0.0	0	A	7.3	2.7	2.0
13	SC	0.33	0.4	0	A	7.6	1.2	1.3
14	SC	0.17	0.0	0	A	8.0	2.6	1.6
15	DC	0.11	0.0	0	A	7.6	2.9	1.3
16	DC	0.17	0.0	0	A	7.8	1.3	0.1
17	DC	0.17	0.0	0	A	7.8	3.7	0.7
18	SC	1.95	0.0	0	A	8.0	2.3	0.1
19	SC	2.51	0.0	0	A	7.8	2.7	0.2
20	DC	0.00	0.0	0	A	7.3	2.3	0.1
21	DC	1.56	0.0	0	A	7.5	1.3	2.0
22	SC	0.22	0.0	0	A	7.9	2.9	0.1
23	SC	1.10	0.0	0	A	7.9	1.0	0.3
24	DC	1.80	0.0	0	A	7.7	4.8	1.6
25	DC	0.40	0.0	0	A	8.4	6.1	2.0
26	DC	0.00	0.0	0	A	8.3	0.3	0.1
27	SC	8.70	0.0	0	A	7.7	2.2	0.7
28	DC	0.20	0.0	0	A	8.1	1.4	0.4
29	DC	0.00	0.0	0	A	8.1	0.5	0.1
30	DC	0.10	0.0	0	A	8.2	1.6	0.5
31	SC	0.00	0.0	0	A	8.4	2.1	0.7
32	SC	0.00	0.0	0	A	8.4	1.3	0.4
33	SC	1.90	0.4	0	A	8.2	4.2	1.4
34	DC	0.60	0.0	0	A	8.4	6.3	2.1
35	SC	1.50	0.4	0	A	8.3	4.2	1.4
36	SC	1.20	0.0	0	A	8.1	3.9	1.3
37	DC	0.80	0.0	0	A	8.3	3.8	1.3
38	DC	0.70	0.0	0	A	8.3	0.3	0.8
39	DC	0.00	0.0	0	A	8.1	0.7	0.2
40	SC	0.30	0.0	0	A	7.8	2.9	0.9
41	SC	0.00	0.0	0	A	8.1	1.5	0.5
42	SC	2.80	0.0	0	A	8.3	4.6	1.5
43	DC	0.40	0.0	0	A	7.8	4.5	1.5
44	SC	0.90	0.9	0	A	7.7	4.6	1.5
45	SC	4.60	0.0	0	A	8.0	5.1	1.2

46	SC	1.40	0.0	0	A	7.8	3.9	1.3
47	SC	2.00	0.0	0	A	8.8	4.6	1.5
48	DC	4.40	0.0	0	A	7.4	6.1	2.1
49	DC	0.90	0.0	0	A	8.0	4.4	1.5
50	DC	2.70	0.0	0	A	7.9	5.8	2.0
51	DC	1.40	0.0	0	A	7.9	4.3	1.4
52	SC	1.70	0.0	0	A	7.8	4.1	1.4
53	DC	0.10	0.0	0	A	8.1	0.1	BDL
54	DC	0.40	0.0	0	A	8.1	0.4	0.1
55	SC	0.80	0.0	0	A	8.2	0.5	0.1
56	SC	0.60	0.0	0	A	8.2	0.3	0.1
57	SC	0.30	0.0	0	A	8.3	0.5	0.1
58	SC	0.20	0.0	0	A	8.2	0.6	0.2
59	SC	0.30	0.0	0	A	8.4	2.9	0.1
60	SC	0.30	0.0	0	A	8.2	2.9	0.1
61	SC	3.50	0.0	0	A	8.3	4.8	1.6
62	DC	4.50	0.0	0	A	8.1	6.2	2.1
63	SC	0.00	0.0	0	A	8.1	1.9	0.6
64	SC	0.00	0.0	0	A	8.2	2.2	0.7
65	SC	0.00	0.0	0	A	8.1	4.9	1.7
66	SC	1.90	0.0	0	A	8.0	5.8	4.8
67	SC	0.00	0.0	0	A	8.1	3.2	1.1

(continued table)

Number	Total Dissolved Solids (mg/L)	Iron (mg/L)	Copper (mg/L)	Total Hardness (mg/L $CaCO_3$)	Ammonia Nitrogen (mg/L N)	Sulfide (mg/L)	Hexavalent Chromium (mg/L)	Nitrate Nitrogen (mg/L N)
1	140	0.017	BDL	373.8	0.01	BDL	0.018	5.0
2	140	0.033	0.003	409.4	0.1	BDL	0.015	4.0
3	130	0.122	BDL	391.6	0.18	0.003	0.018	2.5
4	146	BDL	BDL	373.8	0.11	BDL	0.030	2.5
5	300	0.023	BDL	801.0	0.58	BDL	0.029	BDL
6	285	0.013	BDL	836.6	0.16	0.004	0.033	0.1
7	330	0.031	BDL	890.0	0.15	0.002	0.007	0.1
8	337	BDL	BDL	854.4	0.21	BDL	0.017	0.3
9	545	0.015	BDL	765.4	0.10	0.003	0.029	0.5
10	228	0.051	BDL	623.0	0.22	BDL	0.028	5.0
11	216	BDL	BDL	694.2	0.17	0.004	0.027	7.0
12	210	0.005	BDL	498.4	0.32	BDL	0.009	BDL
13	202	0.048	BDL	391.6	0.08	BDL	0.027	0.1
14	217	BDL	BDL	373.8	0.05	0.004	0.029	1.0
15	136	0.009	BDL	409.4	1.20	BDL	0.020	0.1
16	135	0.036	BDL	427.2	0.96	BDL	0.029	BDL
17	135	0.013	BDL	373.8	0.13	0.003	0.018	0.1
18	136	0.523	BDL	391.6	0.08	BDL	0.016	BDL
19	290	0.016	0.001	854.4	0.31	BDL	0.033	0.6
20	509	0.022	BDL	605.2	BDL	BDL	0.019	3.5
21	292	0.022	BDL	872.2	0.26	0.003	0.032	0.6
22	284	0.051	BDL	801.0	0.03	BDL	0.009	0.3
23	210	0.019	0.007	252.8	BDL	0.007	0.032	0.7
24	396	BDL	BDL	158.4	BDL	0.003	0.018	13.2
25	400	BDL	0.001	633.7	0.05	0.003	0.033	22.2
26	73	BDL	0.001	158.4	0.06	0.001	0.032	0.1
27	160	0.020	0.005	221.8	0.81	BDL	0.032	0.7
28	170	0.011	BDL	221.8	0.31	0.004	0.034	0.6
29	100	0.020	BDL	126.7	1.15	0.003	0.043	0.1
30	110	0.005	0.001	126.7	6.80	0.003	0.032	0.1
31	353	0.027	BDL	506.9	2.69	0.003	0.026	7.0
32	103	0.001	BDL	190.1	0.18	0.003	0.030	0.3
33	190	0.019	BDL	285.2	4.24	0.006	0.055	0.2
34	215	0.061	BDL	316.8	5.22	0.030	0.048	5.0
35	168	0.012	0.001	253.5	1.14	0.004	0.039	0.2
36	190	BDL	BDL	253.5	0.71	BDL	0.018	0.2
37	207	0.070	0.01	253.5	7.45	BDL	0.03	0.3

38	95	BDL	BDL	190.1	BDL	0.004	0.037	0.2
39	297	0.449	BDL	475.3	0.11	0.004	0.032	0.3
40	190	0.015	BDL	285.2	3.78	0.003	0.053	1.5
41	390	0.014	BDL	443.6	2.46	0.003	0.011	0.6
42	197	0.013	BDL	285.2	0.93	BDL	0.037	0.7
43	190	BDL	BDL	221.8	6.69	0.003	0.007	0.2
44	202	0.028	BDL	221.8	0.20	0.004	0.022	0.3
45	198	0.044	0.001	221.8	6.69	0.004	0.023	0.3
46	195	BDL	0.003	221.8	0.22	0.006	0.0100	0.2
47	184	0.007	0.014	253.5	2.71	0.003	0.011	0.2
48	138	0.429	BDL	221.8	BDL	0.018	0.008	0.2
49	155	0.060	BDL	221.8	0.30	0.008	0.02	0.3
50	173	0.031	BDL	221.8	5.39	0.003	0.013	0.4
51	193	0.105	BDL	221.8	7.80	0.003	0.027	0.4
52	198	0.028	BDL	158.4	10.45	0.001	0.036	0.4
53	77	0.041	0.001	190.1	7.43	BDL	0.041	0.4
54	114	0.003	BDL	190.1	7.29	0.004	0.027	0.1
55	79	0.317	BDL	190.1	1.70	0.002	0.022	0.2
56	77	0.048	BDL	221.8	0.42	BDL	0.021	0.1
57	113	0.004	0.006	190.1	BDL	0.005	0.021	0.1
58	115	0.020	0.004	221.8	BDL	0.004	0.020	0.1
59	82	0.018	0.008	158.4	BDL	0.005	0.020	0.1
60	58	0.024	0.002	126.7	8.30	0.004	0.019	0.1
61	80	BDL	BDL	221.8	0.09	0.004	0.019	0.1
62	125	0.013	BDL	253.5	3.74	0.004	0.019	0.3
63	133	0.067	0.099	190.1	0.02	0.016	0.018	0.3
64	94	0.032	0.055	190.1	0.06	0.014	0.018	0.2
65	147	BDL	0.002	190.1	7.42	0.001	0.017	0.2
66	94	0.011	0.003	190.1	0.44	0.004	0.017	0.1
67	105	0.008	BDL	190.1	0.65	BDL	0.017	0.2

[1] Below Detectable Limit (BDL).[2] Decentralized water supply (DC). [3] Small centralized water supply (SC).

Table S3. Test results of the water quality parameters in the purified water samples (*n* = 67).

Number	Water Purifier Service Time (years)	Filter Element Service Time (years)	Color (TCU)	Turbidity (NTU)	Odor and Taste	Visible Objects	pH	Chemical Oxygen Demand (mg/L O_2)	Total Organic Carbon (mg/L)
1	3.0	1.5	0.00	0.0	0	A	7.7	BDL[1]	BDL
2	2.5	0.7	0.00	0.0	0	A	8.5	1.3	BDL
3	1.5	0.7	0.00	0.0	0	A	8.5	2.8	0.24
4	1.0	1.0	0.00	0.0	0	A	8.5	BDL	0.24
5	1.5	1.5	0.00	0.0	0	A	8.2	BDL	0.12
6	0.5	0.5	0.00	0.0	0	A	8.6	0.6	0.12
7	1.5	0.2	0.00	0.0	0	A	8.5	1.1	BDL
8	2.0.	1.0	0.30	0.0	0	A	8.6	1.5	0.24
9	2.5	1.0	0.20	0.0	0	A	8.3	0.2	BDL
10	2.5	1.5	0.00	0.0	0	A	8.9	0.4	BDL
11	1.5	0.5	0.00	0.0	0	A	8.9	2.8	0.12
12	3.0	0.5	0.10	0.0	0	A	8.1	0.4	1.21
13	3.5	1.0	0.00	0.0	0	A	8.3	2.4	0.97
14	1.5	0.7	0.10	0.0	0	A	8.5	0.7	BDL
15	2.0	1.0	0.00	0.0	0	A	8.6	1.5	0.24
16	2.5	0.7	0.00	0.0	0	A	8.5	BDL	0.10
17	3.5	1.0	0.00	0.0	0	A	7.9	0.6	0.60
18	2.0	0.7	0.00	0.0	0	A	8.1	0.4	BDL
19	1.0	1.0	0.00	0.0	0	A	8.4	2.2	0.12
20	1.0	1.0	0.00	0.0	0	A	7.6	0.7	BDL
21	1.5	0.5	1.2	0.9	0	A	8.2	0.2	BDL
22	1.0	1.0	0.00	0.0	0	A	8.5	0.2	BDL
23	3.0	3.0	0.10	0.0	0	A	8.6	0.4	0.10
24	1.5	0.2	0.30	0.0	0	A	8	3.0	1.00
25	2.5	2.5	0.00	0.0	0	A	8.8	0.6	0.20
26	1.0	0.7	0.00	0.0	0	A	7.8	BDL	BDL
27	0.5	0.5	0.00	0.0	0	A	8.4	0.05	BDL
28	0.1	0.1	0.00	0.0	0	A	8.8	BDL	BDL
29	0.8	0.8	0.00	0.0	0	A	8.8	0.1	BDL
30	3.0	3.0	0.00	0.0	0	A	8.2	1.2	0.40
31	2.3	2.3	0.00	0.0	0	A	8.9	BDL	BDL
32	2.0	2.0	0.00	0.0	0	A	8.9	BDL	BDL
33	2.0	1.0	0.00	0.0	0	A	8.6	2.3	0.80
34[2]	3.0	1.5	0.00	0.0	0	A	8.9	0.4	0.10
35	1.5	1.5	0.00	0.0	0	A	8.8	0.2	BDL

36	0.5	0.5	0.00	0.0	0	A	8.4	0.7	0.20
37	2.2	0.7	0.00	0.0	0	A	8.4	2.6	0.80
38	1.5	0.5	0.00	0.0	0	A	8.5	0.4	0.10
39	1.5	0.5	0.00	0.0	0	A	8.3	BDL	BDL
40	1.5	1.5	1.30	0.0	0	A	7.9	3.5	1.20
41	6.5	6.5	0.00	0.0	0	A	8.5	0.6	0.20
42	3.0	1.0	2.10	0.0	0	A	8.3	4.5	1.50
43	0.3	0.3	0.00	0.9	0	A	8.7	BDL	BDL
44	1.5	1.5	0.00	0.0	0	A	8.1	BDL	BDL
45	2.3	1.3	0.00	0.0	0	A	8.5	0.3	0.10
46	3.0	1.5	0.00	0.0	0	A	8.4	0.5	0.10
47	2.5	2.5	0.00	0.0	0	A	8.4	0.6	0.20
48	2.0	1.5	0.00	0.0	0	A	7.8	0.8	0.20
49	0.5	0.5	0.00	0.0	0	A	8.4	0.4	0.10
50	2.0	2.0	0.00	0.0	0	A	8.3	0.3	0.10
51	1.6	1.6	0.50	0.0	0	A	9.7	1.3	0.40
52	3.5	3.5	2.40	0.0	0	A	7.9	0.2	BDL
53	0.3	0.3	0.20	0.0	0	A	8.3	0.2	BDL
54	3.0	2.0	0.60	0.0	0	A	8.4	1.4	0.40
55[2]	3.0	3.0	1.20	0.0	0	A	8.7	0.3	0.10
56	1.3	1.3	0.10	0.0	0	A	8.3	0.1	BDL
57	6.0	4.0	0.60	0.0	0	A	8.3	0.4	0.10
58	2.0	2.0	0.60	0.0	0	A	8.2	0.3	0.10
59	0.6	0.6	0.30	0.0	0	A	8.3	2.5	0.10
60	1.5	0.7	0.30	0.0	0	A	8.4	2.7	0.10
61	0.3	0.3	0.70	0.0	0	A	8.7	0.7	0.20
62	3.0	3.0	0.62	0.0	0	A	8.3	0.9	0.15
63	3.0	1.0	0.00	0.0	0	A	8.5	1.1	0.30
64	3.0	1.0	0.00	0.0	0	A	8.7	1.4	0.50
65	3.5	0.7	0.00	0.0	0	A	8.6	1.6	0.50
66	5.5	1.2	0.00	0.0	0	A	8.6	3.2	1.00
67	2.0	2.0	0.50	0.0	0	A	8.5	3.9	1.30

(continued table)

Number	Total Dissolved Solids (mg/L)	Iron (mg/L)	Copper (mg/L)	Total hardness (mg/L CaCO3)	Ammonia Nitrogen (mg/L N)	Sulfide (mg/L)	Hexavalent Chromium (mg/L)	Nitrate Nitrogen (mg/L N)
1	12	0.038	0.002	205.7	0.19	BDL	0.012	0.5
2	4	BDL	0.002	74.8	0.04	BDL	0.008	0.2
3	7	0.018	BDL	149.6	0.14	BDL	0.025	BDL
4	4	0.038	BDL	205.7	0.18	BDL	0.026	BDL
5	23	BDL	BDL	130.9	0.17	BDL	0.071	BDL
6	16	0.026	BDL	168.3	0.17	BDL	0.021	BDL
7	15	BDL	0.006	205.7	0.06	BDL	0.019	BDL
8	16	0.059	BDL	168.3	0.08	BDL	0.021	BDL
9	66	0.03	BDL	130.9	0.21	BDL	0.011	0.3
10	9	0.045	BDL	130.9	0.27	BDL	0.019	0.1
11	6	0.076	BDL	280.5	0.29	BDL	0.035	1.0
12	9	0.088	0.002	74.8	0.21	BDL	0.035	0.1
13	26	0.038	0.006	168.3	0.20	BDL	0.011	0.1
14	9	0.354	BDL	168.3	0.32	BDL	0.019	0.4
15	6	0.004	BDL	374	0.28	BDL	0.028	BDL
16	8	0.008	BDL	130.9	0.10	BDL	0.029	BDL
17	79	0.588	BDL	261.8	0.17	BDL	0.019	0.1
18	91	0.088	0.001	317.9	0.14	BDL	0.023	BDL
19	8	0.008	BDL	224.4	0.11	BDL	0.012	0.1
20	320	0.415	BDL	355.3	0.17	0.001	0.019	10.0
21	16	0.038	BDL	130.9	0.10	BDL	0.005	0.5
22	8	0.026	0.015	112.2	0.02	BDL	0.007	BDL
23	20	BDL	0.002	31.7	0.84	0.003	0.018	0.1
24	290	0.003	BDL	443.6	0.40	0.005	0.044	7.8
25	43	0.067	0.003	31.7	0.37	BDL	0.02	8.9
26	26	BDL	BDL	63.4	5.44	0.004	0.136	0.2
27	0	0.030	0.005	31.7	0.75	0.004	0.022	0.1
28	20	0.028	0.003	31.7	0.25	BDL	0.014	0.1
29	10	0.015	0.011	31.7	1.76	0.002	0.04	0.1
30	50	BDL	BDL	31.7	0.62	0.001	0.037	0.4
31	27	0.045	BDL	31.7	2.33	0.004	0.038	2.5
32	17	0.022	BDL	29.3	0.86	0.004	0.067	0.1
33	15	0.012	0.002	63.4	2.58	0.001	0.047	0.4
34[2]	24	0.014	0.012	31.7	5.44	0.013	0.046	0.1
35	4	BDL	0.003	30.1	1.16	0.007	0.005	0.3
36	170	0.188	0.001	285.2	0.22	BDL	0.098	0.1
37	178	0.270	BDL	285.2	0.24	0.004	0.029	0.1
38	89	0.029	0.002	158.4	0.25	0.004	0.030	0.1
39	24	0.200	0.001	31.7	0.20	0.002	0.040	0.4

40	227	0.528	BDL	316.8	2.52	0.002	0.051	0.5
41	210	BDL	0.002	348.5	2.10	0.004	0.041	0.8
42	186	0.003	0.001	285.2	0.78	BDL	0.023	0.1
43	4	BDL	BDL	27.9	3.71	0.004	0.013	0.1
44	24	0.265	0.013	31.7	3.36	0.004	0.021	0.1
45	19	0.030	0.012	31.7	0.80	0.003	0.053	0.1
46	4	BDL	BDL	29.9	5.33	0.005	0.015	0.1
47	25	0.030	0.009	31.7	6.68	0.009	0.010	0.1
48	144	0.011	0.012	285.2	3.57	0.003	0.009	0.1
49	10	0.029	BDL	31.7	BDL	0.003	0.034	0.1
50	11	0.034	BDL	31.7	BDL	0.003	0.013	0.1
51	463	0.061	BDL	63.4	BDL	0.004	0.036	0.1
52	14	0.317	BDL	31.7	0.06	0.009	0.035	0.1
53	108	0.449	BDL	221.8	1.77	0.003	0.054	0.1
54	24	BDL	BDL	31.7	2.13	0.001	0.055	0.1
55[2]	21	0.021	BDL	31.7	9.68	0.001	0.037	0.1
56	94	0.014	BDL	158.4	9.86	BDL	0.030	0.1
57	110	0.067	0.001	221.8	BDL	0.004	0.056	0.1
58	115	0.006	0.003	190.1	1.32	0.004	0.041	0.1
59	78	0.007	BDL	158.4	6.15	0.004	0.036	0.1
60	66	0.028	BDL	126.7	0.67	BDL	0.036	0.2
61	4	0.023	BDL	28.1	BDL	0.003	0.038	0.1
62	21	0.058	BDL	31.7	BDL	0.003	0.053	0.1
63	5	0.047	BDL	31.7	5.14	0.008	0.023	0.1
64	3	0.023	0.083	31.7	BDL	0.012	0.043	0.1
65	5	0.024	0.110	28.9	0.46	BDL	0.021	0.1
66	2	0.020	0.004	31.7	5.63	BDL	0.005	0.2
67	9	0.020	0.004	31.7	0.40	BDL	0.041	0.1

[1] Below Detectable Limit (BDL).[2] The owners of the two water purifiers (34 and 55) stated that the water from the water purifiers was not used for drinking or cooking. The remaining owners stated that the water from the water purifier was used for drinking and cooking.

Table S4. Analysis of the factors influencing the water quality index (WQI) of purified water.

Factor	**Category**	**Sample Size**	**WQI**		**WQI ≤ 1**		χ^2	p
			$\bar{x}$[1]	s[2]	**Number**	**%**		
Water purifier service time (years)	≤2	39	8.65	23.27	25	64	0.33	>0.05
	>2	28	11.22	22.77	16	57		
Filter element service time (years)	≤1	39	5.63	17.36	30	77	9.72	<0.01
	>1	28	15.41	28.33	11	39		
WQI of raw water	≤1	35	11.10	25.39	23	66	0.63	>0.05
	>1	32	8.22	20.18	18	56		
Type of water supply	Decentralized	29	9.85	20.96	21	72	3.86	<0.05
	Small centralized	38	9.62	24.59	20	53		

[1]Mean of WQI of purified water.[2]Sndard deviation of WQI of purified water.

Table S5. Comparison of water quality parameters of purified water according to the service time of the filter element in the water treatment system (n = 67).

Parameter (Unit)	ANOVA	
	F	***p***
Colour (TCU)	1.80	>0.05
Turbidity (NTU)	1.47	>0.05
pH	0.26	>0.05
Total dissolved solids (mg/L)	0.29	>0.05
Iron (mg/L)	0.53	>0.05
Copper (mg/L)	0.71	>0.05
Total hardness (mg/L $CaCO_3$)	5.63	<0.05
Sulfide (mg/L)	5.13	<0.05
Ammonia nitrogen (mg/L N)	7.35	<0.01
Chemical oxygen demand (mg/L O_2)	1.60	>0.05
Total organic carbon (mg/L)	0.12	>0.05
Hexavalent chromium (mg/L)	0.25	>0.05
Nitrate nitrogen (mg/L N)	0.00	>0.05

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