

Evaluation of BioPhoton-X(TM)TM technology for optimizing water quality in the Aguas de Chacua treatment plant in the Sibaté municipality, Cundinamarca.

1. Target

Evaluate the turbidity behavior of water with the implementation of BioPhothonxTM technology

2. Materials

- ✓ 500L capacity water tank
- ✓ Recirculation pump
- ✓ Photonic lamps
- ✓ Photonic screens
- ✓ Ultrasonication valve
- ✓ Exchanger valve
- ✓ PVC structure for air supply
- ✓ Sampling flasks
- ✓ Photometer for turbidity reading
- ✓ pH - meter
- ✓ Kit for apparent color reading
- ✓ Mounting for jar test

3. Methodology

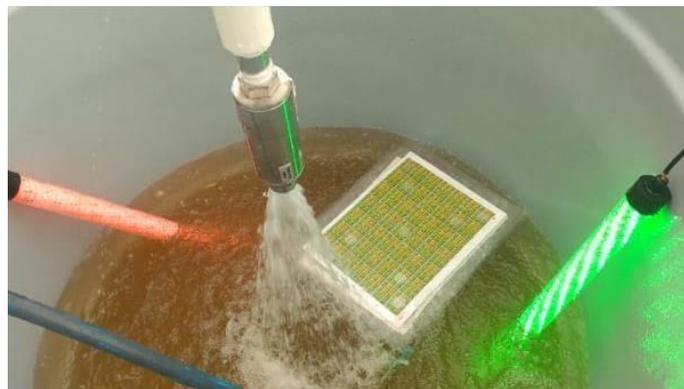
1. The recirculation pump and the PVC structure were attached to the water tank.



2. The photonic screens were incorporated together with the lamps, according to each treatment, inside the tank and turned on.
3. It began with the filling of the tank from tap number 2, which supplies raw water with pH adjustment by adding sodium hydroxide (caustic soda)
4. Once the water reached the height of the pump, it was turned on to start the recirculation process, accompanied by the coupling of the evaluated valve (according to treatment) in the return of the water to the tank.
5. Once the capacity was reached (450L approx.), The water supply to the tank was suspended, continuing with the recirculation process. The treatment time began to be timed.
6. With the help of the sampling flasks, water samples were taken at times 0, 3.5, 7, 14, 21, 28, 35 and 42 minutes of treatment for analysis in the laboratory and a final sample of 20L for the analysis of jugs.
7. The Chacua water staff performed the analysis of pH, apparent Color and Turbidity to each of the samples in the laboratory.
8. The Chacua water staff performed a jar test to determine the ideal dose of aluminum sulfate for flocculation, and the possible effect of the BioPhoton-X™ treatment on the dose to be used.

3.1 Treatments

T1: Water treated with the ultrasonication valve, 3 photonic screens, a green pulsed light and a red pulsed light.



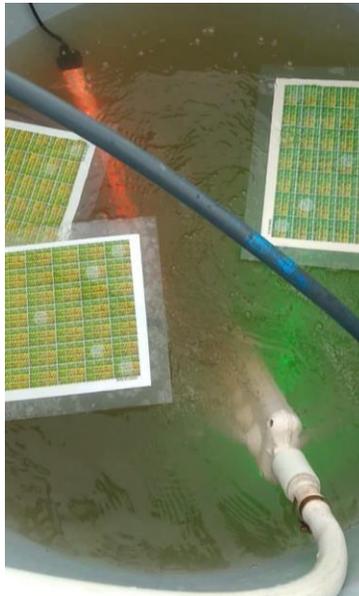
T2: Water treated with the ultrasonication valve, 3 photonic screens and two blue pulsed lights.



T3: Water treated with the exchange valve, 3 photonic screens, and two blue pulsed lights.



T4: Water treated with the exchanger valve, 3 photonic screens, a green pulsed light and a red pulsed light.



4. Results

The data obtained for treatment 1 are presented below.

Table 1. Data obtained from reading different water quality parameters, from samples taken at different times for treatment 1 (ultrasonication valve, 3 photonic screens, a green pulsed light and a red pulsed light)

Samples	Time (min)	pH	Apparent Color	Turbidity (NTU)
1	0	6.43	9	10
2	3.5	6.70	7	10
3	7	6.69	7	10
4	14	6.65	7	13
5	21	6.70	10	13
6	28	6.65	4	12
7	35	6.72	4	10
8	42	6.60	5	12

Based on the turbidity data obtained for the 20L sample, the jar test was assembled to determine the effective dose for the flocculation process of solids with aluminum sulfate (Table 2).

- ✓ pH 6.66
- ✓ Turbidity 9NTU

Table 2. Data obtained from the evaluation of the jar test carried out with the 20L sample taken at the end of treatment 1 (ultrasonication valve, 3 photonic screens, a green pulsed light and a red pulsed light)

Jar	Dose AlSO ₄ (10g / 100mL)	Without filter		Filtered	
		pH	Turbidity (NTU)	pH	Turbidity (NTU)
1	0.8	5.54	1	5.46	1
2	0.9	5.43	1	5.20	1
3	1	5.39	1	5.15	1
4	1.1	5.35	1	5.34	1

In table number 3, the data obtained for reading from the samples taken with treatment number 2, ultrasonication valve, 3 photonic screens and 2 blue light lamps are presented.

Table 3. Data obtained from reading different water quality parameters, from samples taken at different times for treatment 2 (ultrasonication valve, 3 photonic screens, two blue pulsed lights)

Samples	Time (min)	pH	Apparent Color	Turbidity (NTU)
1	0	6.64	6	5
2	3.5	6.62	10	8
3	7	6.25	8	7
4	14	6.46	7	6
5	21	6.63	7	5
6	28	6.69	6	4
7	35	6.66	9	5
8	42	6.71	8	4

Based on the turbidity data obtained for the 20L sample, the jar test was assembled to determine the effective dose for the flocculation process of solids with aluminum sulfate (Table 4).

- ✓ pH 6.25
- ✓ Turbidity 6NTU

Table 4. Data obtained from the evaluation of the jar test carried out with the 20L sample taken at the end of treatment 2 (ultrasonication valve, 3 photonic screens, two blue pulsed lights)

Jar	Dose AlSO ₄ (10g / 100mL)	Without filter		Filtered out	
		pH	Turbidity (NTU)	pH	Turbidity (NTU)
1	0.60	4.95	1.00	5.24	1.00
2	0.70	5.40	<1	5.26	<1
3	0.80	5.32	<1	5.23	<1
4	0.90	5.30	<1	5.08	<1

In table number 5, the data obtained for reading from the samples taken with treatment number 3, exchanger valve, 3 photonic screens and 2 blue light lamps are presented.

Table 5. Data obtained from reading different water quality parameters, from samples taken at different times for treatment 3 (exchange valve, 3 photonic screens, two blue pulsed lights)

Samples	Time (min)	pH	Apparent Color	Turbidity (NTU)
1	0	6.87	5	4
2	3.5	6.60	5	4
3	7	6.70	4	3
4	14	6.72	11	5
5	21	6.70	10	5
6	28	6.71	7	5
7	35	6.68	7	4
8	42	6.72	9	4

Based on the turbidity data obtained for the 20L sample, the jar test was assembled to determine the effective dose for the flocculation process of solids with aluminum sulfate (Table 6).

- ✓ pH 6.91
- ✓ Turbidity 5NTU

Table 6. Data obtained from the evaluation of the jar test carried out with the 20L sample taken at the end of treatment 3 (exchange valve, 3 photonic screens, two blue pulsed lights).

Jar	Dose AlSO ₄ (10g / 100mL)	Without filter		Filtered	
		pH	Turbidity (NTU)	pH	Turbidity (NTU)
1	0.50	5.49	<1	5.42	<1
2	0.60	5.42	<1	5.42	<1
3	0.70	5.45	<1	5.38	<1
4	0.80	5.41	<1	5.38	<1

Table number 7 presents the data obtained for reading from the samples taken with treatment number 4; exchanger valve, 3 photonic screens and a red light lamp and a green light lamp.

Table 7. Data obtained from reading different water quality parameters, from samples taken at different times for treatment 4 (exchange valve, 3 photonic screens, a red pulsed light and a green pulsed light)

Samples	Time (min)	pH	Apparent Color	Turbidity (NTU)
1	0	6.48	8	5
2	3.5	6.48	9	5
3	7	6.55	7	6
4	14	6.55	5	5
5	21	6.62	6	5
6	28	6.69	6	6
7	35	6.66	5	5
8	42	6.62	5	5

Based on the turbidity data obtained for the 20L sample, the jar test was assembled to determine the effective dose for the flocculation process of solids with aluminum sulfate (Table 8).

- ✓ pH 6.52
- ✓ Turbidity 6N

Table 8. Data obtained from the evaluation of the jar test carried out with the 20L sample taken at the end of treatment 3 (exchange valve, 3 photonic screens, a red pulsed light and a green pulsed light).

Jug	Dose AISO4 (10g / 100mL)	Without filter		Filtered	
		pH	Turbidity (NTU)	pH	Turbidity (NTU)
1	0.40	5.35	2	5.35	<1
2	0.50	5.37	<1	5.34	<1
3	0.60	5.34	<1	5.38	<1
4	0.70	5.36	<1	5.34	<1

Conclusions.

- BioPhoton-X(TM)TM technology was effective in reducing the turbidity values of the treated water.
- According to the observed results, the BioPhoton-X™ technology would allow the application of the lowest dose of AISO4 to be considered for the treatment of flocculation of solids present in the water.
- Thanks to the implementation of BioPhoton-X™ technology, it is possible to consider evaluating the decrease in sodium hydroxide (caustic soda) dosage, according to the observed pH values in all treatments.