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Treatment of sanguaza from Ancon market using air micro-nanobubbles at laboratory scale

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Resumen

El propósito de la presente investigación es reducir las concentraciones de los parámetros físicos y químicos de las aguas de Sanguaza, provenientes de los puestos de pescado que se encuentran en el mercado de Ancón; tomándose dos puntos de muestreo, Se hallaron parámetros físicos (Turbidez y Temperatura) y Parámetros químicos (pH., DQO y DBO_5); se realizaron 5 repeticiones, con diferentes concentraciones de muestras, siendo la más resaltante la Repetición N° 4, donde se obtuvieron porcentajes de eficiencia a los 60 minutos de la turbidez promedio de 79.61%, de DBO_5 en un 69.68% y de DQO en 69.24%. También se obtuvo un p.H. neutro trabajando con una temperatura ambiente de 20.15 °C. Concluyendo así, que las micro-nanoburbujas de aire logran reducir de una manera eficaz las concentraciones de los parámetros de las aguas de sanguaza.

Palabras clave: sanguaza, pescado, parametros fisicos, parametros quimicos, micro-nano burbujas, aire.

Abstract

The purpose of the present investigation is to reduce the concentrations of the physical and chemical parameters of the waters of Sanguaza, coming from the fish stations that are in the market of Ancón; taking two sampling points, Physical parameters were found (Turbidity and Temperature) and Chemical parameters (pH, COD and BOD_5); 5 repetitions were made, with different concentrations of samples, the most outstanding being Repetition No. 4, where efficiency percentages were obtained at 60 minutes of the average turbidity of 79.61%, of BOD_5 in 69.68% and of COD in 69.24 %. A p.H. neutral working at an ambient temperature of 20.15 °C. Concluding thus, that the air micro-nanobubbles manage to reduce in an effective way the concentrations of the parameters of the waters of sanguaza.

Keywords: sanguaza, fish, physical parameters, chemical parameters, micro-nano bubbles, air.

1. Introduction

Water is considered as a finite resource, essential for life, the ecological balance, but at the same time it is vulnerable and scarce. Besides its importance lies because it is necessary for the development of our activities.
The city of Ancón, located north of Lima, has a landing on the pier of the same resort. In this place every day you fish and it is taken to different points of the capital. It also supplies the market in the area from very early hours of the day.
In this place the merchants wash and eviscerate the captured marine species and when they join with the water, the sanguaza is formed. This aqueous liquid is thrown into the laundry room of the

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sales station, passing through pipes without any previous treatment and turning into domestic wastewater.

The Microbubbles (MBs) have diameter more than 100 µm, the micro-nanobubbles (MNBs) have diameter between 1 to 100 µm and the nanobubbles (NBs) have diameter less than 1 µm within the fluid field (Valverde, 2016).

• There reduction of fecal was 130000 CFU /100 mL until 100 CFU / 100 mL and total coliforms 240000 CFU /100 mL until 100 CFU / 100 mL presents in domestic wastewater after applying the airozone micro-nanobubbles (Cruz and Valverde, 2016).

The micro-nanobubbles generation technology in water is applied in: sea water, water bodies, groundwater, domestic wastewater and industrial wastewater (Valverde, 2017). The best treatment reduction Efficiency of BOD_5 in river's water was applying ozone micronanobubbles (Salguero and Valverde, 2017).

It is observed that removal efficiency of Amoxicillin using air micro-nanobubbles was obtained for COD in water with 0.5 mg amoxicillin/L achieved 76.9% at 45 minutes and for organic matter in water with 0.5 mg amoxicillin/L achieved 65.8% at 45 minutes (Mendez and Valverde, 2017).

2. Materials and Methods

The design of the research was experimental and the type of study applied.

Water collection
The fish sanguaza were collected from two stalls in the Ancón market, Lima. A total of 20 liters of water was taken from Sanguaza.

Figure 1. Collection of blood for treatment

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Sanguaza Treatment by applying air micro-nanobubbles.

The Sanguaza treatment was carried out using the Micro-Nanobubble generator (MNBGs) patented by PhD. Jhonny Valverde Flores. The average diameter of the air MNBs in the laboratory was 1.479 μm.

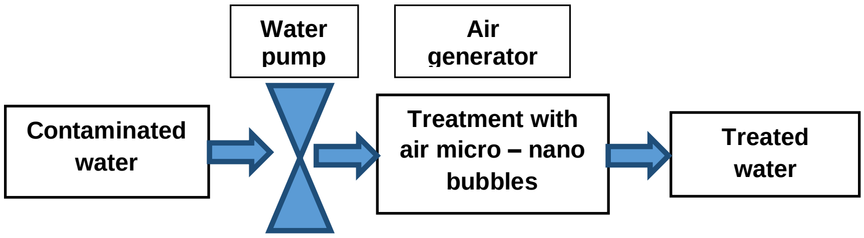

Figure 2. Flow chart of air MNBs treatment

The experimental tests were worked with a pressure of 90 PSI and with a flow rate of 6.60 L / min. The parameters of the initial sample were measured. Five repetitions were made with different concentrations in the samples at times of 30 min, 45 min and 60 min. Subsequently, the physical parameters (Turbidity and Temperature) and chemical parameters (pH, COD and BOD_5) of the waters were analyzed.

Analysis of Laboratory Samples

The physical parameters (turbidity and temperature) and the chemical parameters (Biochemical Oxygen Demand, Chemical Oxygen Demand and Hydrogen Potential) of the sanguaza waters were analyzed.

Figure 3. Analysis of physical parameters

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Figure 4. Analysis of chemical parameters

Treatment's efficiency on Turbidity, BOD_5 and COD.

To measure the air MNBs treatment's efficiency on Turbidity (NTU) was used the equation 1:

$$\% \, Remotion(NTU) = \frac{[NTU]_{initial} - [NTU]_{end}}{[NTU]_{initial}} * 100 \qquad (1)$$

To measure the air MNBs treatment's efficiency on BOD5 was used the equation 2:

$$\% \, Remotion(BOD5) = \frac{[BOD5]_{initial} - [BOD5]_{end}}{[BOD5]_{initial}} * 100 \qquad (2)$$

To measure the air MNBs treatment's efficiency on COD was used the equation 3:

$$\% \, Remotion(COD) = \frac{[COD]_{initial} - [COD]_{end}}{[COD]_{initial}} * 100 \qquad (3)$$

3. Results

With the experiments carried out, concentrations by samples were found in the physical and chemical parameters. With this, the Tables were produced with results for each parameter. Physical parameters

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Table 1. Results of the temperature in the samples with different treatment times

	Time (min)	Temperature (°C)					
		Repetition 1	Repetition 2	Repetition 3	Repetition 4	Repetition 5	Average Temperature
Sample 1	0	20.5	19.4	19.4	20.4	20.4	**20.02**
	30	19.8	20.2	20.4	20.4	20.2	**20.2**
	45	20.4	19.3	20.3	20.3	20.4	**20.14**
	60	20.6	19.1	19.8	20.4	20.8	**20.14**
Sample 2	0	20.3	20.4	19.4	19.5	19.5	**19.82**
	30	20.4	20.3	20.4	19.8	20.4	**20.26**
	45	19.6	19.4	20.1	20.2	19.9	**19.84**
	60	18.5	20.3	19.8	20.2	20.2	**19.8**
Average Sample	0	20.4	19.9	19.4	19.95	19.95	**19.92**
	30	20.1	20.25	20.4	20.1	20.3	**20.23**
	45	20	19.35	20.2	20.25	20.15	**19.99**
	60	19.55	19.7	19.8	20.3	20.5	**19.97**

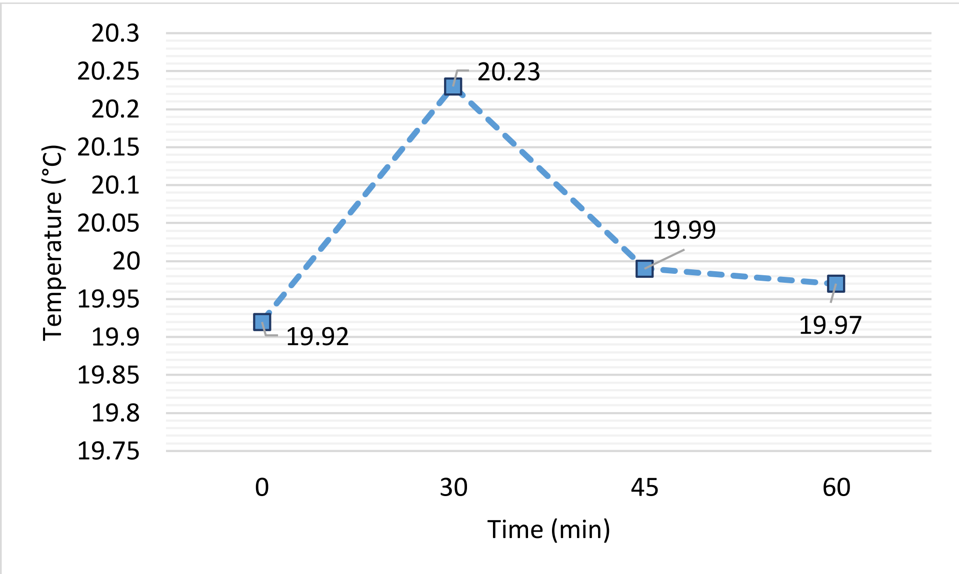

Figure 5. Average temperature vs. time of treatment by air MNBs

Table 2. Turbidity results in the samples with different treatment times

	Time (min)	Turbidity (NTU)					Average Turbidity (NTU)
		Repetition 1	**Repetition 2**	**Repetition 3**	**Repetition 4**	**Repetition 5**	
Sample 1	0	271	358	580	582	546	**467.4**
	30	197	90.3	150	149	152	**147.66**
	45	181	65.9	66	84	84	**96.18**
	60	132	59.3	45	76	59	**74.26**
Sample 2	0	483	314	138	328	398	**332.2**
	30	191	195	106	165	243	**180**
	45	172	177	96	48	102	**119**
	60	111	134	84	32	83	**88.8**
Average Sample	0	377	336	359	455	472	**399.8**
	30	194	142.65	128	157	197.5	**163.83**
	45	176.5	121.45	81	66	93	**107.59**
	60	121.5	96.65	64.5	54	71	**81.53**

Of the five repetitions of the data obtained from the Turbidity, the average of the turbidity was obtained. At minute 60 of sample 1, repetition 3 has 45 NTU. At minute 60 of sample 2, repetition 4 has 32 NTU.

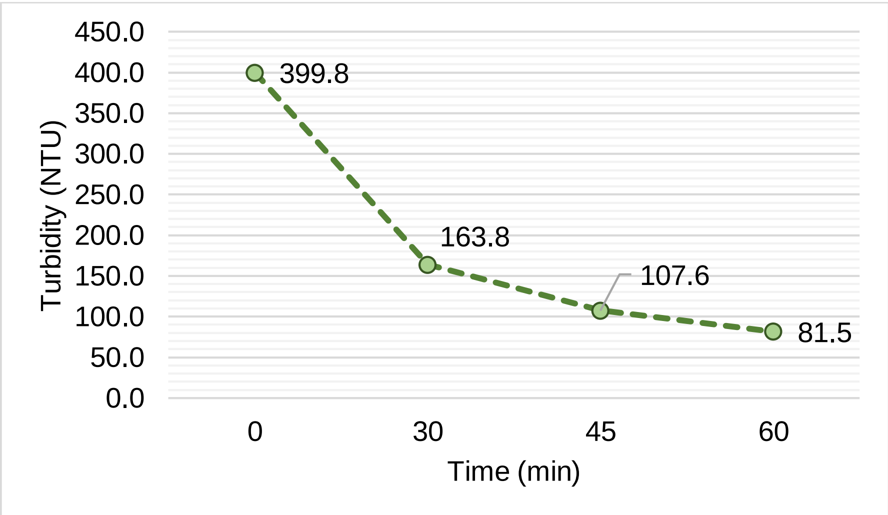

Figure 6. Average Turbidity vs. time of treatment by air MNBs

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The average sample of the turbidity in the zero minute was 399.8 NTU while in the 60th minute was 81.5 NTU.

Chemical parameters

Table 3. pH results in samples with different treatment times

	Time (min)	pH					Average pH
		Repetition 1	Repetition 2	Repetition 3	Repetition 4	Repetition 5	
Sample 1	0	6.71	6.38	6.4	7.21	6.43	**6.626**
	30	7.28	6.5	6.55	7.39	6.59	**6.862**
	45	7.72	6.59	6.72	7.45	7.21	**7.138**
	60	7.56	6.63	7.12	7.68	7.32	**7.262**
Sample 2	0	7.21	6.16	6.34	6.4	6.32	**6.486**
	30	6.48	6.51	6.51	6.69	7.82	**6.802**
	45	7.43	6.6	6.67	6.75	6.54	**6.798**
	60	7.28	6.98	6.83	6.94	6.79	**6.964**
Average Sample	0	6.96	6.27	6.37	6.805	6.375	**6.556**
	30	6.88	6.505	6.53	7.04	7.205	**6.832**
	45	7.575	6.595	6.695	7.1	6.875	**6.968**
	60	7.42	6.805	6.975	7.31	7.055	**7.113**

Of the five repetitions of the data obtained from the pH, the average pH was obtained. In sample 1 at 60 minutes, repetition 2 has the lowest pH of 6.63. In sample 2 at 60 minutes, repetition 5 has the lowest pH of 6.79.

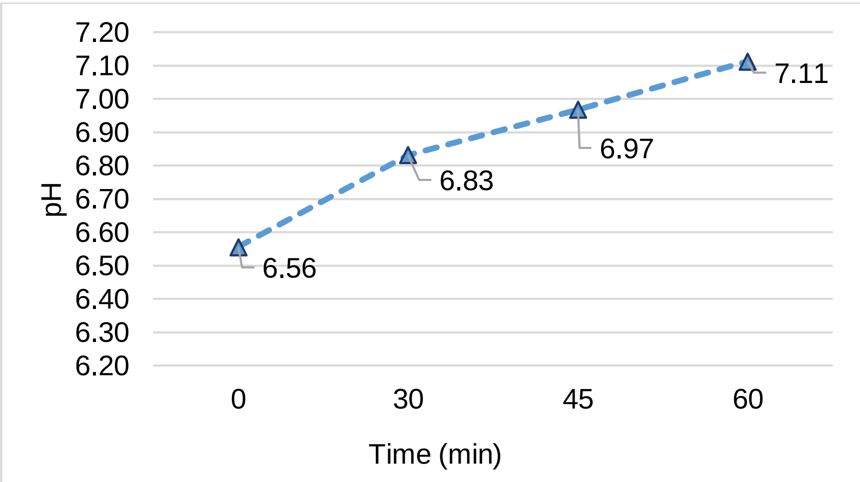

Figure 7. Average pH vs. time of treatment by air MNBs

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The average pH sample in the zero minute was 6.56 while in the 60th minute it was 7.11.

Table 4. BOD_5 results in samples with different treatment times

	Time (min)	BOD_5 Repetition 1	Repetition 2	Repetition 3	Repetition 4	Repetition 5	Average BOD_5 (mg/L)
Sample 1	0	490	480	470	460	470	**474**
	30	380	320	350	370	360	**356**
	45	270	130	230	240	230	**220**
	60	130	120	120	140	190	**140**
Sample 2	0	380	330	450	440	450	**410**
	30	320	230	340	350	370	**322**
	45	210	150	250	260	260	**226**
	60	130	120	130	130	130	**128**
Average Sample	0	435	405	460	450	460	**442**
	30	350	275	345	360	365	**339**
	45	240	140	240	250	245	**223**
	60	130	120	125	135	160	**134**

Of the five repetitions of the data obtained from the BOD_5, the BOD_5 average was obtained. In sample 1 at 60 minutes, repetitions 2 and 3 have the lowest BOD_5 of 120 mg/L. In sample 2 at 60 minutes, repetition 2 has the lowest BOD_5 of 120 mg/L.

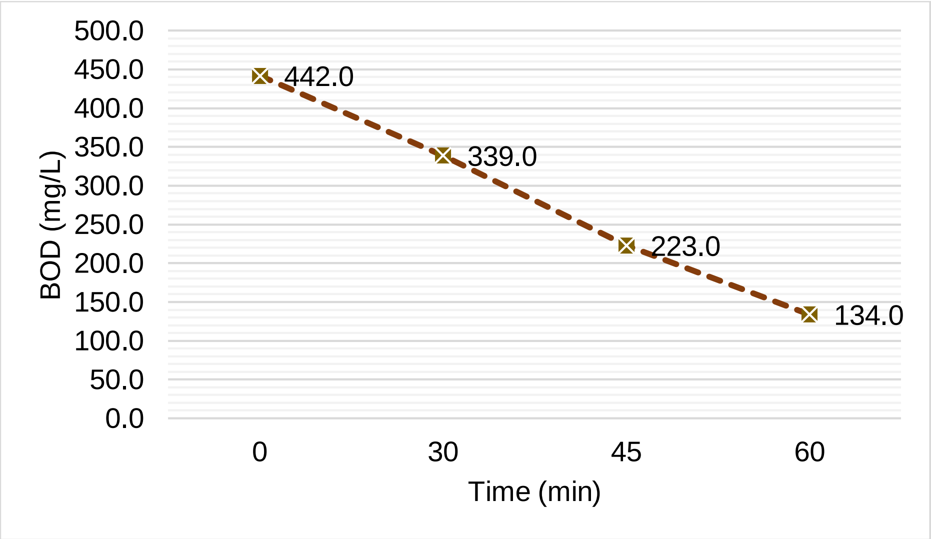

Figure 8. Average BOD_5 vs. time of treatment by air MNBs

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The average BOD_5 sample in the zero minute was 442 mg/L while in the 60 minute it was 134 mg/L.

Table 5. DOC results in samples with different treatment times

	Time (min)	COD					Average COD (mg/L)
		Repetition 1	**Repetition 2**	**Repetition 3**	**Repetition 4**	**Repetition 5**	
Sample 1	0	500	505	502	503	507.2	**503.44**
	30	400.8	402	401.3	403.2	405	**402.46**
	45	270	207.7	272	274	271	**258.94**
	60	158.3	159	158.8	157	160.2	**158.66**
Sample 2	0	480	471	474	473	475.2	**474.64**
	30	397.8	396	395	398	397.8	**396.92**
	45	261	260	262.7	263	264.3	**262.2**
	60	140.8	142	141	143	144.2	**142.2**
Average Sample	0	490	488	488	488	491.2	**489.04**
	30	399.3	399	398.15	400.6	401.4	**399.69**
	45	265.5	233.85	267.35	268.5	267.65	**260.57**
	60	149.55	150.5	149.9	150	152.2	**150.43**

Of the five repetitions of the data obtained from the DOC, the COD average was obtained. In sample 1 at 60 minutes, repetition 4 has the lowest COD of 157 mg/L. In sample 2 at 60 minutes, repetition 1 has the lowest COD of 140.8 mg/L.

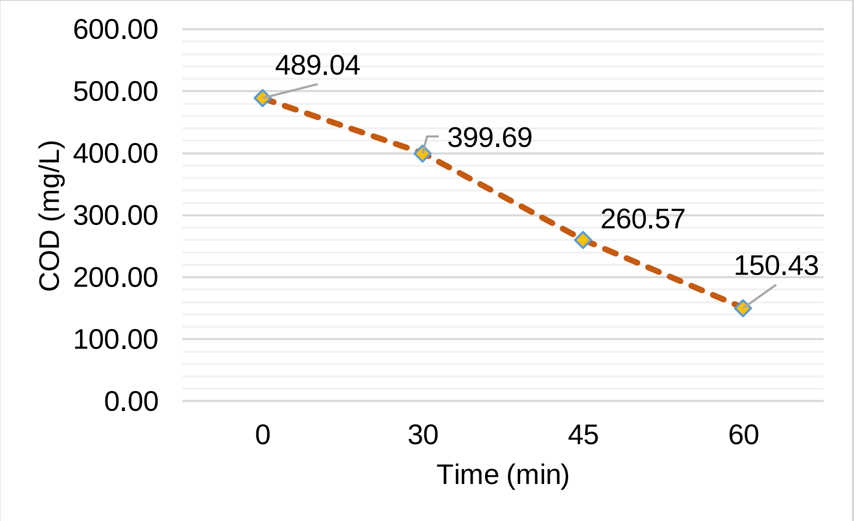

Figure 9. Average COD vs. time of treatment by air MNBs

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The average sample of the COD in the zero minute was 489.04 mg/L while in the 60 minute it was 150.43 mg/L.

Average Efficiency of Average Samples

For the efficiency result of the treatment with air Micro-Nanobubbles by average sample of sanguaza, the general averages were found and efficiency was obtained.

To calculate treatment's efficiency until 30 minutes with air MNBs on Turbidity (NTU) in Average Sample as % Remotion was used the equation 1:

% remotion (Average Sample) = (399.8 – 163.8)*100/ 399.8 = 59.02 %

To calculate treatment's efficiency until 45 minutes with air MNBs on Turbidity (NTU) in Average Sample as % Remotion was used the equation 1:

% remotion (Average Sample) = (399.8 – 107.6)*100/ 399.8 = 73.09 %

To calculate treatment's efficiency until 60 minutes with air MNBs on Turbidity (NTU) in Average Sample as % Remotion was used the equation 1:

% remotion (Average Sample) = (399.8 – 81.05)*100/ 399.8 = 79.61 %

As a resume the efficiency is seen in figure 10.

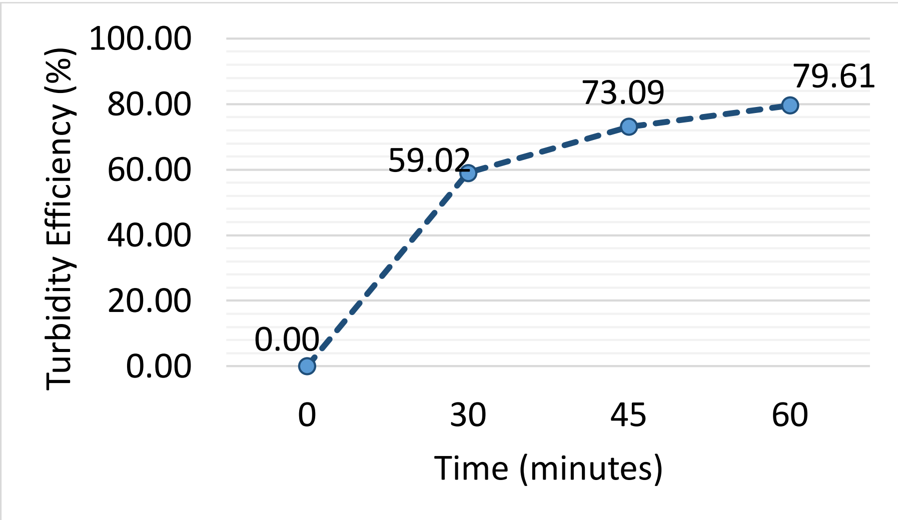

Figure 10. Average Turbidity Efficiency vs. time of treatment by air MNBs

The average efficiency for Turbidity in the 30 minute was 59.02%, while in the 60 minute it was 79.61%.

To calculate treatment's efficiency until 30 minutes with air MNBs on BOD_5 in Average Sample as % Remotion was used the equation 1:

% remotion (Average Sample) = (442.0 – 339.0)*100/ 442.0 = 23.30 %

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To calculate treatment's efficiency until 45 minutes with air MNBs on BOD_5 in Average Sample as % Remotion was used the equation 1:

% remotion (Average Sample) = (442.0 – 223.0)*100/ 442.0 = 49.55 %

To calculate treatment's efficiency until 60 minutes with air MNBs on BOD_5 in Average Sample as % Remotion was used the equation 1:

% remotion (Average Sample) = (442.0 – 134.0)*100/ 442.0 = 69.68 %

As a resume the efficiency is seen in figure 11.

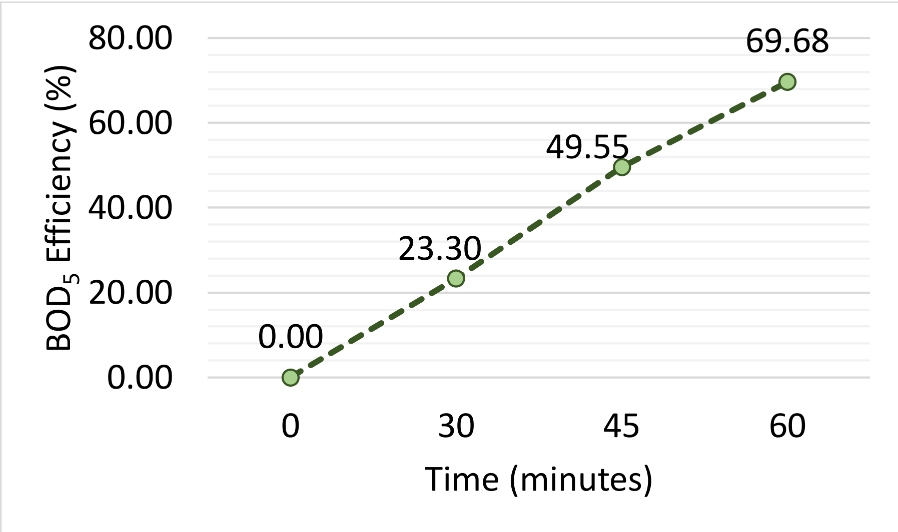

Figure 11. Average BOD_5 Efficiency vs. time of treatment by air MNBs

The average efficiency for COD in the 30 minute was 23.30%, while in the 60 minute it was 69.68%.

To calculate treatment's efficiency until 30 minutes with air MNBs on COD in Average Sample as % Remotion was used the equation 1:

% remotion (Average Sample) = (489.04 – 399.69)*100/ 489.04 = 18.27 %

To calculate treatment's efficiency until 45 minutes with air MNBs on COD in Average Sample as % Remotion was used the equation 1:

% remotion (Average Sample) = (489.04 – 260.57)*100/ 489.04 = 46.72 %

To calculate treatment's efficiency until 60 minutes with air MNBs on COD in Average Sample as % Remotion was used the equation 1:

% remotion (Average Sample) = (489.04 – 150.43)*100/ 489.04 = 69.24 %

As a resume the efficiency is seen in figure 12.

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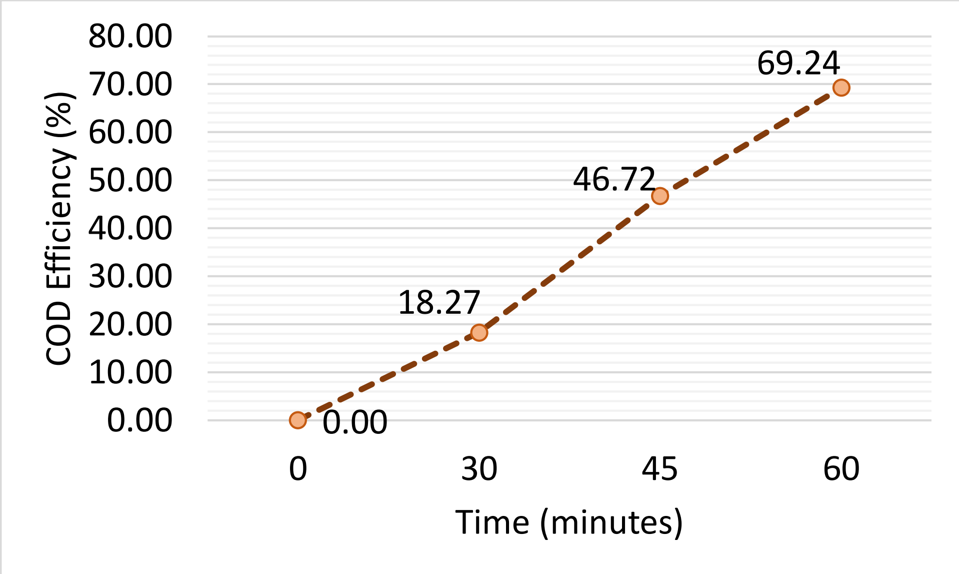

Figure 12. Average COD Efficiency vs. time of treatment by air MNBs

The average efficiency for COD in the 30 minute was 18.27%, while in the 60 minute it was 69.24%.

4. Conclusions

- Sanguaza treated applying air micro-nanobubbles in three times (30 minutes, 45 minutes and 60 minutes) achieved an average turbidity of 81.5 NTU, average BOD_5 of 134 mg/L and COD of 150.43 mg/L.

- The treatment efficiency at 60 minutes achieved average turbidity of 79.61%, BOD_5 of 69.65% and COD of 69.24%. Consequently, it is possible to ensure the efficiency of physical and chemical parameters.

- Finally, nanotechnology is a very useful technique for treating contaminated water of domestic origin, thus improving the physical and chemical parameters of the waters of sanguaza

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