

Table 2 Average levels of water quality parameters at Upstream, Discharge point and Downstream along Omi-Asoro Stream, Ilesa.

Parameter	Upstream	Discharge point	Downstream
pH	6.8 ± 0.2	6.7	6.5 ± 0.1
TDS (mg/L)	180 ± 10	140	147 ± 4
TSS (mg/L)	2350 ± 2210	1260	3550 ± 5300
Total solids (mg/L)	2530 ± 2220	1400	3700 ± 5300
Turbidity (FTU)	1.7 ± 1.8	1.1	5.2 ± 4.2
Alkalinity (mg/L)	215 ± 5	115	129 ± 2
Total hardness (mg/L)	56 ± 5.3	54	65 ± 13
Ca (mg/L)	28 ± 4	26	34 ± 9.2
Mg (mg/L)	28 ± 9.2	28	31 ± 18
DO (mg/L)	6.5 ± 0.7	1.2	2.3 ± 1.6
BOD (mg/L)	12.5 ± 2.4	29	13.3 ± 3.0
COD (mg/L)	1053 ± 101	1440	1200 ± 363
Cl ⁻ (mg/L)	5.2 ± 0.4	7.1	7.8 ± 0.9
NO ₃ ⁻ (µg/ml)	1 ± 0.3	0.7	1.1 ± 0.3
PO ₄ ³⁻ (µg/ml)	0.4 ± 0.3	0.5	0.6 ± 0.3
SO ₄ ²⁻ (mg/L)	80 ± 6.1	124	122 ± 46

Table 3 Comparison of the average levels of Omi-Asoro Stream, with water quality standards.

Physicochemical Parameters	Mean±SD (This study)	Range	*FEPA	*WHO	**USEPA	*
pH	6.6 ± 0.2	6.4 - 6.9	6.5 – 8.5	-	6.5 – 8.5	
TDS (mg/L)	156±18	140 - 190	-	-	500	
TSS (mg/L)	2955±4200	530 - 14300	>10	-	-	
TS (mg/L)	3120±4200	700 – 14450	500	500	-	
Turbidity (FTU)	3.7±3.8	0.6 – 11.6	1	-	-	
Alkalinity (mg/L)	154±43	130 - 220	-	-	-	
Mg Hardness (mg/L)	30±14	4 - 48	-	-	-	
Ca Hardness (mg/L)	31±7.8	24 - 52	-	-	-	
Total Hardness(mg/L)	61±11	48 – 80	200	-	-	
DO (mg/L)	3.4±2.5	0.4 – 7.3	7.5	-	-	
BOD (mg/L)	14.6±5.5	9.7 – 28.5	0	-	-	
COD (mg/L)	1180±300	600-1720	-	-	-	
Cl ⁻ (mg/L)	7.0±1.4	5.0 – 9.2	250	-	250	
NO ³⁻ (mg/L)	1.1±0.3	0.7 – 1.4	10	50	10	
PO ₄ ³⁻ (mg/L)	0.5±0.3	0.1 – 1.04	>5	-	-	
SO ₄ ²⁻ (mg/L)	110±40	76 – 198	500	-	250	

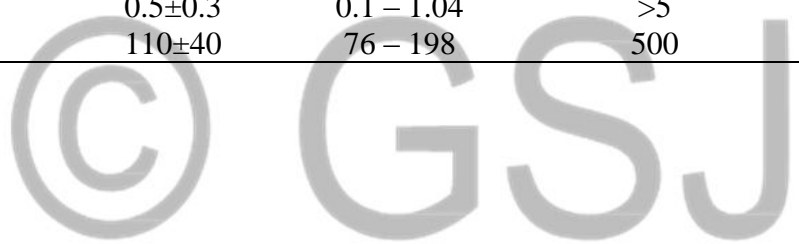


Table 4. Comparison of the quality of effluent discharged into Omi-Asoro stream and brewery effluent qualities of some countries with some effluent quality standards.

Parameters	Effluent qualities of some countries				
	Effluent discharge into Omi-Asoro Stream				
	*Overall average	Range	a Brewery effluent in Yaounde, Cameroun	b Brewery effluent in Benin, Nigeria	c WHO Disc limits
pH	6.6 ± 0.2	6.4 – 6.9	4.9–4.2	6.41	6.5–9.5
TS (mg/L)	3120 ± 4200	700 – 14450	–	280	–
TDS (mg/L)	156 ± 18	140 – 190	480 ± 92	92.5	1000
TSS (mg/L)	2960± 4200	530 – 14300	740 ± 115	187	30
Turbidity (FTU)	3.7 ± 3.8	0.6 – 11.6	245 ± 98	150	5
Total hardness (mg/L)	61 ± 11	48 – 80	–	–	–
Alkalinity (mg/L)	154 ± 43	130–220	–	–	–
Cl ⁻ (mg/L)	7.0 ± 1.4	5.0 – 9.2	–	–	–
NO ³⁻ (µg/ml)	1.1 ± 0.3	0.7 – 1.4	–	3.2	–
Mg (mg/L)	30 ± 14	4 – 48	–	11.4	–
SO ₄ ²⁻ (mg/L)	110 ± 40	76 – 198	–	–	–
PO ₄ ³⁻ (µg/ml)	0.5 ± 0.3	0.1 – 1.0	–	–	–
DO (mg/L)	3.4 ± 2.5	0.4 – 7.3	–	0.81	–
BOD (mg/L)	14.6 ± 5.5	9.7 – 29	925 ± 82	360	50
COD (mg/L)	1180 ± 300	600–1720	1195 ± 170	729	150
Ca (mg/L)	31 ± 7.8	24–52	–	–	–

Table 5. Comparison of overall average of upstream and downstream levels of Omi-Asoro stream with some water quality standards.

Parameters	Omi-Asoro Stream		Water quality standards		
	Upstream	Downstream	a WHO	b CQC	c FQC
pH	6.8 ± 0.2	6.5 ± 0.1	6.5–9.5	6.5–9.0	6.5–8.0
TS (mg/L)	2530± 2220	3700 ± 5300	–	–	–
TDS (mg/L)	180 ± 10	147 ± 4	<1200	500	–
TSS (mg/L)	2350 ± 2210	3550 ± 5300	–	–	–
Turbidity (FTU)	1.7 ± 1.8	5.2 ± 4.2	5	–	–
Mg (mg/L)	28 ± 9.2	31 ± 18	-	-	-
Ca ²⁺ (mg/L)	28 ± 4	34 ± 9.2	–	–	–
Total hardness (mg/L)	56 ± 5.3	65 ± 13	500	–	–
Alkalinity (mg/L)	215 ± 5	129.2 ± 2.0	–	–	–
Cl ⁻ (mg/L)	5.2 ± 0.4	7.8 ± 0.9	250	250	200
NO ₃ ⁻ (mg/L)	1 ± 0.3	1.1 ± 0.3	50.0	–	10.0
SO ₄ ²⁻ (mg/L)	80 ± 6.0	122 ± 46	500	500	250
PO ₄ ³⁻ (µg/ml)	0.4 ± 0.3	0.6± 0.3	–	–	0.30
DO (mg/L)	6.5 ± 0.7	2.3 ± 1.6	–	5.5–9.5	≥5.0
BOD (mg/L)	12.5 ± 2.4	13.3 ± 3.0	–	–	–
COD (mg/L)	1050 ± 101	1200±370	–	–	≤6.0

Notes: WHO=WHO drinking water guidelines, CQC=Canadian water quality criteria for aquatic freshwater life, FQC=Flemish quality criteria for aquatic freshwater, USEPA=US Environmental Protection Agency.

Table 6. Effect of industrial pollutants on the quality of some Nigerian streams compared to quality parameters for the other Nigerian rivers and Ajayi and Osibanjo o. 1982; Kakulu

Parameters	Iya-Alaro stream, Ikeja	Shasha stream, Ikeja	Nasarawa stream, Kaduna	WHO Recommended limit	Tolerance limit
Colour	Coloured variable	Coloured variable	Coloured variable	Colourless	–
Temperature °C	36.0	36.0	-	-	–
pH	11.0	6.5	11.5	7.0 - 8.5	–
Total solids (mg/L)	1150	800	2685	500	–
Suspended solids (mg/L)	73	165	145	-	–
BOD (mg/L)	80	230	-	-	–
COD (mg/L)	330	750	-	-	–
Lead (mg/L)	0.06	0.20	-	0.05	–
Manganese (mg/L)	0.05	0.16	-	0.05	–
Iron (mg/L)	4.9	4.8	-	0.10	–

Table 7. Correlation levels of physicochemical parameters of water samples from Omi-Asoro Stream, Ilesa

	<i>pH</i>	<i>TDS</i>	<i>TSS</i>	<i>TS</i>	<i>Turbidity</i>	<i>Alkalinity</i>	<i>Mg. Hardness</i>	<i>Ca Hardness</i>	<i>Tot. Hardness</i>	<i>DO</i>	<i>BOD</i>	<i>COD</i>	<i>Cl</i>	<i>NO3</i>	<i>PO4</i>	<i>SO4</i>
<i>pH</i>	1															
<i>TDS</i>	0.579	1														
<i>TSS</i>	-0.051	-0.014	1													
<i>TS</i>	-0.049	-0.01	1	1												
<i>Turbidity</i>	0.025	-0.31	0.183	0.182	1											
<i>Alkalinity</i>	0.6052	0.9844	-0.06	-0.06	-0.366	1										
<i>Mg. Hardness</i>	-0.477	-0.044	0.507	0.507	-0.476	-0.05	1									
<i>Ca Hardness</i>	0.025	-0.271	-0.02	-0.02	0.6098	-0.261	-0.637	1								
<i>Tot. Hardness</i>	-0.597	-0.247	0.643	0.642	-0.185	-0.247	0.8408	-0.118	1							
<i>DO</i>	0.3883	0.3571	-0.09	-0.09	-0.159	0.3722	-0.126	-0.274	-0.355	1						
<i>BOD</i>	0.0394	-0.318	-0.31	-0.31	-0.242	-0.344	-0.08	-0.39	-0.377	0.406	1					
<i>COD</i>	-0.379	-0.306	-0.67	-0.67	-0.276	-0.309	-0.008	-0.051	-0.046	-0.32	-0.32	1				
<i>Cl</i>	-0.524	-0.846	0.272	0.269	0.4533	-0.832	-0.054	0.619	0.3652	-0.32	-0.32	-0.32	1			
<i>NO3</i>	0.0118	-0.042	0.199	0.198	0.7302	-0.095	-0.24	0.628	0.1324	-0.44	-0.44	-0.44	-0.44	1		
<i>PO4</i>	0.0705	-0.293	0.081	0.08	0.7172	-0.351	-0.476	0.772	-0.071	-0.45	-0.45	-0.45	-0.45	-0.45	1	
<i>SO4</i>	-0.549	-0.535	-0.16	-0.17	-0.401	-0.505	0.3151	-0.283	0.2072	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	1

Table 8. Heavy metals concentrations (mg/L) in water at upstream, discharge point and downstream of Omi Asoro stream, Ilesa.

Point	Cd	Co	Ni	Zn	Pb	Cr	Mn
UPW1	0.001	< 0.007	0.01	0.14	0.02	0.013	2.05
UPW2	0.002	<0.007	0.01	0.08	0.02	< 0.01	1.81
UPW3	0.002	0.007	0.01	0.04	0.02	<0.01	2.17
DPW	0.001	< 0.007	0.01	0.16	0.03	< 0.01	1.1
DSW1	0.002	0.007	0.01	0.2	0.03	0.01	2.76
DSW2	0.003	0.01	0.02	0.3	0.04	0.01	3.0
DSW3	0.003	0.01	0.02	0.35	0.04	0.02	4.31
DSW4	0.003	0.007	0.01	0.1	0.02	< 0.01	2
DSW5	0.003	0.008	0.01	0.12	0.02	< 0.01	2.27
DSW6	< 0.001	< 0.007	0.01	0.1	0.02	< 0.01	2.27
Mean±SD	0.002±0.001	0.008±0.001	0.01±0.004	0.2±0.1	0.03±0.01	0.01±0.01	2.37±0.85

Table 9. Comparison of the average level of heavy metals in water from Omi-Asoro stream with water quality standards

Parameters	Overall					
	average	Range	CQC	USEPA	WHO (2004)	FEPA (1991)
Cd	0.002±0.001	< 0.001-0.003	-	0.005	0.003	0.01
Co	0.008±0.002	<0.007-0.01	0.05	-	-	-
Ni	0.012±0.004	0.01-0.02	0.025	0.05	0.02	0.05
Zn	0.2±0.1	0.04-0.35	0.03	0.5	3	5
Pb	0.03±0.01	0.02-0.04	0.017	0.015	0.01	0.05
Cr	0.01±0.01	<0.01-0.02	0.05	0.1	0.05	0.05
Mn	2.37±0.85	1.1-4.31	-	-	0.4	-

Table 10. Correlation levels of heavy metals in water samples from Omi-Asoro stream, Ilesa

	Cd	Co	Ni	Zn	Pb	Cr	Mn
Cd	1						
Co	0.787275	1					
Ni	0.450578	0.52648	1				
Zn	0.376168	0.448095	0.888374	1			
Pb	0.368654	0.456504	0.875	0.944566	1		
Cr	0.254619	0.323758	0.67212	0.818638	0.687103	1	
Mn	0.404655	0.647907	0.792116	0.76753	0.654841	0.750407	1

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