

Supplementary Material (SM)

Effect of Modified Septic Tank on Groundwater Quality around Federal University of Agriculture, Abeokuta, South-west Nigeria

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SM 1 Physical parameters for groundwater samples

Sample	pH	Temp (°C)	EC (µS cm ⁻¹)	TDS (mg L ⁻¹)	Sample	pH	Temp (°C)	EC (µS cm ⁻¹)	TDS (mg L ⁻¹)	Sample	pH	Temp (°C)	EC (µS cm ⁻¹)	TDS (mg L ⁻¹)	Sample	pH	Temp (°C)	EC (µS cm ⁻¹)	TDS (mg L ⁻¹)
FG1	7.16	27.1	362	181	AV1	6.92	27.1	173	86	IS1	6.58	26.8	190	95	CA1	6.9	26.1	308	154
FG2	6.79	27	367	184	AV2	6.51	27.1	440	220	IS2	6.97	26.8	151	75	CA2	6.74	26	226	114
FG3	6.79	27	538	269	AV3	6.65	27.2	253	127	IS3	6.5	26.9	293	146	CA3	6.55	26.1	444	223
FG4	6.93	26.8	698	349	AV4	7.93	27.1	455	227	IS4	6.82	26.9	287	143	CA4	7.34	26	565	283
FG5	6.86	26.7	483	241	AV5	6.89	26.7	293	147	IS5	6.84	27	135	68	CA5	6.75	26	318	160
FG6	6.91	26.9	565	283	AV6	6.37	27.2	83	42	IS6	8.66	27.1	190	95	CA6	6.53	26.1	140	70
FG7	7.87	26.9	610	305	AV7	7.65	27.1	294	147	IS7	7.53	26.7	387	193	CA7	6.52	26.1	788	394
FG8	7.95	26.9	712	355	AV8	7.74	27.1	306	153	IS8	6.8	26.6	368	184	CA8	6.46	25.9	296	146
FG9	7.68	27	471	235	AV9	7.77	26.9	904	456	IS9	7.12	26.6	300	150	CA9	6.26	26.1	109	54
FG10	6.97	27	620	310	A10	7.76	27.1	1035	621	IS10	6.82	26.7	361	180	CA10	6.8	26.1	518	158
FG11	6.8	26.8	915	458	AV11	6.73	27	230	115	IS11	7.76	27.4	860	433	CA11	6.79	26.1	336	168
FG12	7.77	26.7	515	258	AV12	7.82	27.1	505	252	IS12	7.57	26.8	627	313	CA12	6.82	26	221	110
FG13	6.81	27	437	219	AV13	6.89	26.8	190	95	IS13	6.85	26.7	258	129	CA13	7.4	25.9	250	125
FG14	6.51	27	376	188	AV14	7.9	26.8	365	182	IS1	8.39	27.3	396	198	CA14	6.84	26	213	107
FG15	6.71	26.9	285	142	AV15	7.77	26.9	193	96	IS15	7.8	27.2	501	250	CA15	6.9	26	455	234
Min	6.51	26.8	285	142		6.51	26.7	83	42		6.58	26.6	139	68		6.26	25.9	140	70
Max	7.95	27.1	915	458		7.9	27.2	1035	621		8.39	27.4	627	313		7.4	26.1	788	394
Mean	7.10	26.91	530.26	265.13		7.29	27.01	381.27	197.73		7.27	26.9	353.6	176.8		6.77	26.03	345.8	166.67

SM 2 Concentrations of major ions (mg L⁻¹) in groundwater samples from Funaab Gate and Alabata Village communities

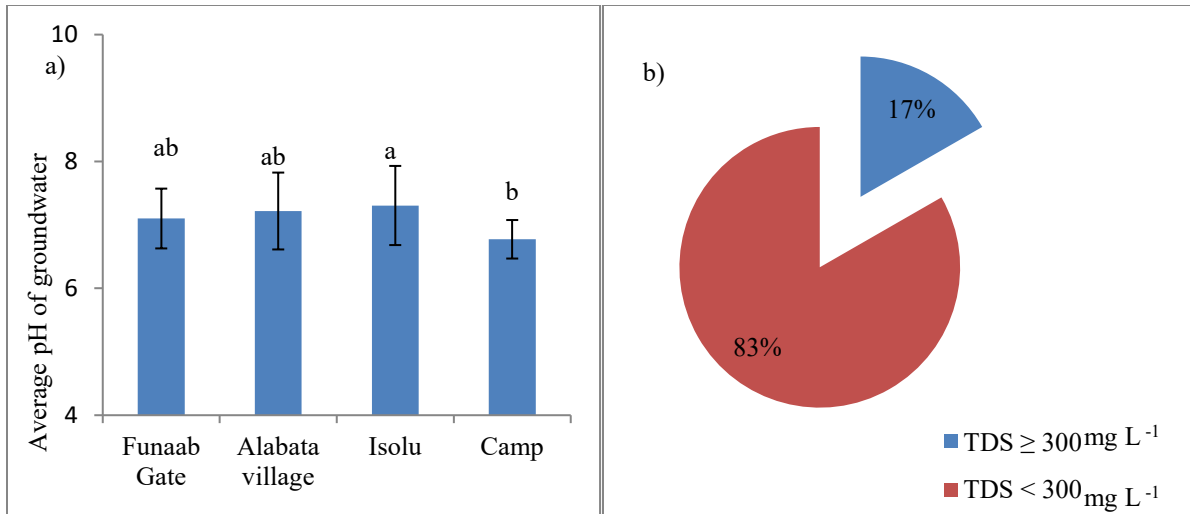
Sample	Na ⁺	K ⁺	Ca ²⁺	Mg ²⁺	Cl ⁻	NO ₃ ⁻	SO ₄ ²⁻	PO ₄ ³⁻	HCO ₃ ⁻	Sample	Na ⁺	K ⁺	Ca ²⁺	Mg ²⁺	Cl ⁻	NO ₃ ⁻	SO ₄ ²⁻	PO ₄ ³⁻	HCO ₃ ⁻
FG1	13.00	4.00	154.00	40.00	68.00	14.21	36.90	0.77	19.30	AV1	12.00	1.00	128.00	2.00	70.00	6.35	32.95	0.40	37.22
FG2	14.00	6.00	92.00	26.00	75.00	9.00	44.14	0.84	26.21	AV2	35.00	34.00	28.00	18.00	67.00	7.50	38.50	0.37	27.16
FG3	18.00	10.00	71.00	47.00	124.00	7.80	25.38	0.73	13.74	AV3	11.00	3.00	28.00	46.00	101.00	9.63	32.70	0.55	21.11
FG4	27.00	31.00	93.00	59.00	70.00	12.00	19.50	0.38	22.70	AV4	19.00	4.00	54.00	24.00	107.00	15.60	40.20	0.17	28.91
FG5	20.00	5.00	117.00	22.00	118.00	6.92	20.72	0.47	29.31	AV5	13.00	3.00	60.00	17.00	50.00	8.01	41.75	0.51	19.30
FG6	26.00	4.00	126.00	60.00	110.00	10.24	31.48	0.52	17.10	AV6	7.00	3.00	76.00	19.00	25.00	5.44	48.03	0.22	22.80
FG7	24.00	3.00	83.00	27.00	110.00	8.51	27.40	0.41	39.52	AV7	12.00	7.00	94.00	10.00	68.00	7.71	28.19	0.54	31.72
FG8	23.00	4.00	56.00	12.00	135.00	14.30	15.70	0.82	18.40	AV8	12.00	2.00	104.00	39.00	60.00	15.90	37.50	0.62	29.60
FG9	21.00	4.00	154.00	16.00	69.00	6.52	29.10	0.57	40.52	AV9	26.00	5.00	122.00	28.00	85.00	16.20	52.30	0.28	26.40
FG10	24.00	3.00	202.00	42.00	121.00	12.37	10.10	0.42	26.70	A10	44.00	11.00	62.00	16.00	70.00	5.09	56.11	0.52	20.60
FG11	30.00	9.00	160.00	36.00	116.00	7.38	37.30	0.61	24.06	AV11	15.00	5.00	94.00	16.00	63.00	6.33	48.10	0.70	38.10
FG12	20.00	5.00	211.00	20.00	167.00	12.85	43.90	0.67	30.19	AV12	25.00	11.00	96.00	34.00	100.00	14.62	30.60	0.14	32.83
FG13	19.00	3.00	109.00	21.00	190.00	10.18	36.91	0.70	44.17	AV13	10.00	2.00	66.00	14.00	39.00	5.70	36.40	0.62	16.40
FG14	18.00	4.00	64.00	16.00	88.00	10.01	50.38	0.30	27.50	AV14	14.00	4.00	80.00	20.00	30.00	15.49	19.30	0.61	37.19
FG15	11.00	2.00	50.00	14.00	127.00	10.20	45.50	0.70	50.40	AV15	8.00	3.00	54.00	22.00	44.00	6.03	36.40	0.49	37.30
Min	11.00	2.00	50.00	14.00	68.00	6.52	15.70	0.30	17.10		7.00	1.00	28.00	2.00	25.00	5.09	19.30	0.14	19.30
Max	27.00	31.00	211.00	60.00	190.00	12.85	50.38	0.84	44.17		44.00	34.00	122.00	46.00	107.00	15.49	56.11	0.70	37.22
Mean	20.53	6.47	116.13	30.53	112.53	10.17	31.63	0.59	28.65		17.53	6.53	76.40	21.67	65.27	9.71	38.60	0.45	28.44

SM 3 Concentrations of major ions (mg L⁻¹) in groundwater samples from Isolu and Camp communities

Sample	Na ⁺	K ⁺	Ca ²⁺	Mg ²⁺	Cl ⁻	NO ₃ ⁻	SO ₄ ²⁻	PO ₄ ³⁻	HCO ₃ ⁻	Sample	Na ⁺	K ⁺	Ca ²⁺	Mg ²⁺	Cl ⁻	NO ₃ ⁻	SO ₄ ²⁻	PO ₄ ³⁻	HCO ₃ ⁻
IS1	12.00	1.00	84.00	29.00	46.00	8.11	13.90	0.72	30.80	CA1	10.00	3.00	144.00	29.00	26.00	7.01	29.74	0.68	30.70
IS2	11.00	2.00	16.00	14.00	65.00	12.90	39.20	0.53	48.32	CA2	15.00	2.00	130.00	44.00	34.00	8.50	40.33	0.47	27.18
IS3	18.00	3.00	126.00	19.00	60.00	7.70	22.10	0.44	18.60	CA3	20.00	2.00	132.00	26.00	50.00	6.08	19.33	0.42	22.90
IS4	16.00	3.00	134.00	26.00	37.00	5.82	35.04	0.19	27.09	CA4	35.00	5.00	71.00	16.00	100.00	16.33	31.04	0.61	26.45
IS5	13.00	3.00	56.00	16.00	25.00	17.00	52.81	0.73	41.80	CA5	17.00	4.00	110.00	26.00	46.00	5.90	21.68	0.52	28.60
IS6	12.00	2.00	84.00	25.00	47.00	14.05	19.40	0.78	17.40	CA6	11.00	3.00	62.00	23.00	26.00	7.05	25.51	0.41	30.18
IS7	18.00	10.00	68.00	18.00	83.00	6.80	33.10	0.39	33.60	CA7	50.00	16.00	58.00	12.00	130.00	16.33	18.40	0.74	31.60
IS8	17.00	10.00	146.00	11.00	31.00	6.72	28.30	0.34	20.10	CA8	20.00	5.00	80.00	30.00	39.00	5.70	22.80	0.81	29.04
IS9	19.00	8.00	44.00	26.00	150.00	10.18	36.40	0.40	25.90	CA9	9.00	1.00	30.00	17.00	25.00	6.10	51.30	0.71	22.80
IS10	18.00	5.00	36.00	17.00	82.00	12.19	20.85	0.63	25.49	CA10	23.00	3.00	170.00	34.00	53.00	5.77	43.81	0.52	27.37
IS11	38.00	16.00	144.00	37.00	93.00	8.70	48.10	0.72	20.83	CA11	27.00	9.00	100.00	21.00	55.00	9.24	37.60	0.62	20.06
IS12	24.00	5.00	86.00	16.00	210.00	10.40	16.58	0.60	25.05	CA12	18.00	4.00	45.00	18.00	33.00	8.00	26.13	0.52	29.17
IS13	18.00	3.00	60.00	28.00	84.00	5.70	44.20	0.59	37.10	CA13	16.00	5.00	110.00	13.00	35.00	7.06	44.30	0.41	46.19
IS1	19.00	3.00	126.00	41.00	102.00	8.51	39.10	0.15	32.60	CA14	18.00	5.00	60.00	22.00	51.00	6.40	37.23	0.27	37.14
IS15	29.00	9.00	92.00	14.00	78.00	6.48	26.31	0.38	18.30	CA15	17.00	0.00	40.00	36.00	65.00	13.30	30.50	0.13	32.60
Min	11.00	1.00	16.00	11.00	25.00	5.70	13.90	0.15	17.40		9.00	1.00	30.00	12.00	25.00	5.70	18.40	0.13	22.80
Max	38.00	16.00	146.00	41.00	210.00	17.00	52.81	0.78	48.32		50.00	16.00	170.00	44.00	130.00	16.33	44.30	0.81	46.19
Mean	18.80	5.53	86.80	22.47	79.53	9.42	31.69	0.51	28.20		20.40	4.47	89.47	24.47	51.20	8.58	31.98	0.52	29.47

SM 4 Concentrations of heavy metals (mg L⁻¹) in groundwater samples

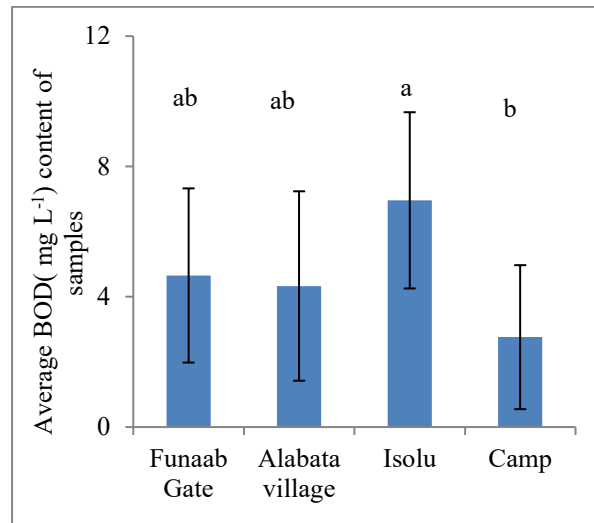
Sample	Fe	Zn	Sample	Fe	Zn	Sample	Fe	Zn	Sample	Fe	Zn
FG1	0.05	0.02	AV1	0.07	0.03	IS1	0.06	0.17	CA1	0.05	0.04
FG2	0.07	0.04	AV2	0.03	0.03	IS2	0.06	0.04	CA2	0.03	0.05
FG3	0.13	0.02	AV3	0.06	0.05	IS3	0.06	0.05	CA3	0.07	0.02
FG4	0.04	0.02	AV4	0.02	0.02	IS4	0.06	0.03	CA4	0.08	0.05
FG5	0.06	0.47	AV5	0.01	0.05	IS5	0.05	0.08	CA5	0.05	0.01
FG6	0.09	0.02	AV6	0.06	0.01	IS6	0.07	0.07	CA6	0.07	0.05
FG7	0.07	0.15	AV7	0.01	0.02	IS7	0.09	0.04	CA7	0.05	0.01
FG8	0.06	0.03	AV8	0.06	0.01	IS8	0.01	0.07	CA8	0.05	0.06
FG9	0.03	0.10	AV9	0.02	0.16	IS9	0.08	0.04	CA9	0.08	0.03
FG10	0.02	0.07	A10	0.08	0.03	IS10	0.05	0.06	CA10	0.05	0.01
FG11	0.04	0.02	AV11	0.01	0.11	IS11	0.06	0.14	CA11	0.06	0.04
FG12	0.06	0.03	AV12	0.08	0.18	IS12	0.04	0.08	CA12	0.04	0.09
FG13	0.02	0.04	AV13	0.05	0.06	IS13	0.09	0.22	CA13	0.03	0.02
FG14	0.13	0.04	AV14	0.03	0.04	IS1	0.02	0.05	CA14	0.03	0.04
FG15	0.03	0.05	AV15	0.04	0.01	IS15	0.04	0.51	CA15	0.04	0.04
Min	0.02	0.02		0.01	0.01		0.01	0.03		0.03	0.01
Max	0.13	0.47		0.08	0.18		0.09	0.51		0.08	0.09
Mean	0.06	0.07		0.04	0.05		0.06	0.11		0.05	0.04



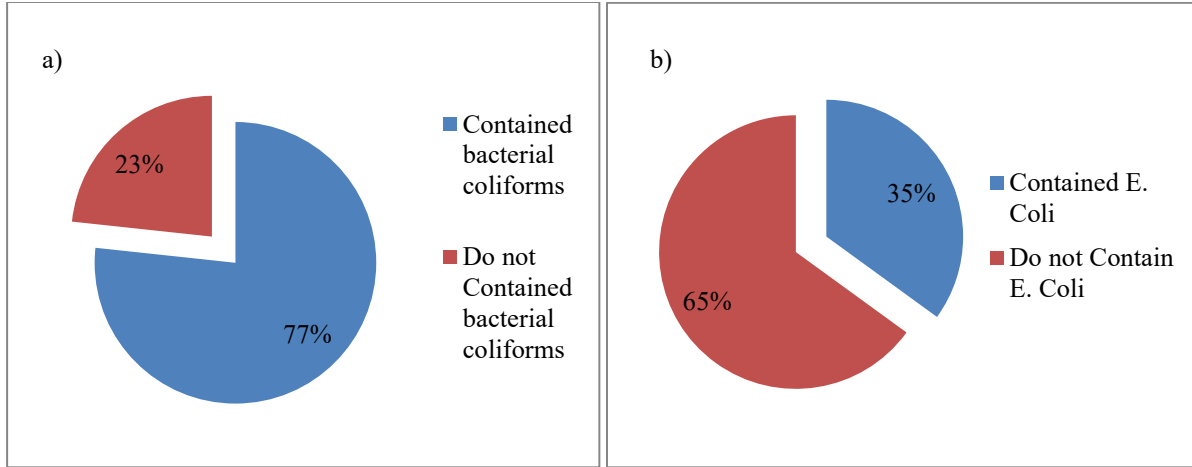
SM 5 pH and TDS of groundwater in present study.
Data labels with different alphabets indicate significant difference.

SM 6 Classification of groundwater samples on the basis of biological oxygen demand

Classification	BOD (mg L^{-1})	Percentage in present study
Clean water	1 - 2	33.33%
Doubtful quality water	3 - 5	20%
Poor quality water	> 5	46.67%



SM 7 Biological oxygen demand of groundwater within the study area.
Data labels with different alphabets indicate significant difference.



SM 8 Bacteriological analysis of groundwater in study area.

SM 9 Correlation scores for EC, TDS, major ions and heavy metals

	EC	TDS	Na ⁺	K ⁺	Ca ²⁺	Mg ²⁺	Cl ⁻	NO ₃ ⁻	SO ₄ ²⁻	PO ₄ ³⁻	HCO ₃ ⁻	Fe	Zn	<i>E. coli</i>	TCC
EC															
TDS	0.987**														
Na ⁺	0.293*	0.240													
K ⁺	0.237	0.204	0.770*												
Ca ²⁺	0.824**	0.819**	0.111	0.065											
Mg ²⁺	0.429**	0.426**	-0.081	0.146	0.595**										
Cl ⁻	0.520**	0.498*	0.103	0.808*	0.389*	0.113									
NO ₃ ⁻	-0.331	-0.359	-0.071	0.651*	-0.250	-0.196	0.585								
SO ₄ ²⁻	0.114	0.204	-0.513	-0.433	0.194	0.286	-0.307	-0.029							
PO ₄ ³⁻	-0.081	-0.066	-0.262	0.092	0.189	0.149	-0.093	0.287	0.321						
HCO ₃ ⁻	0.041	-0.011	-0.049	-0.015	0.270	0.019	-0.117	0.135	0.215	0.042					
Fe	0.195	0.181	-0.055	0.094	0.047	0.119	0.191	0.516	0.460	0.045	0.371				
Zn	0.100	0.098	0.402**	-0.088	0.132	0.001	0.084	0.125	0.353	0.215	0.060	0.025			
<i>E. coli</i>	0.051	0.044	0.262	0.455*	0.014	0.112	0.355	0.790	0.140	0.219	0.184	0.010	-0.176		
TCC	0.051	-0.23	0.312	-0.145	0.035	0.112	0.461	0.506*	-0.070	0.062	0.051	0.026	-0.080	0.714*	

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).