

2004/08/08

2005/04/07

Butomus umbellatus

:

Microbiological Purification of Wastewater Using Butomus

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Received 08/08/2004

Accepted 07/04/2005

ABSTRACT

Water samples were collected three times a week to make chemical, physical and microbiological tests, in order to determine the role of Macrophytes in improving and enhancing domestic wastewater purification processes, by the means of providing the necessary oxygen for microorganisms; absorbing some metal elements and chemical ions in addition to adsorbing a portion of microorganisms on its surfaces. This will lead to the completion of water purification and mineralization processes.

Necessary tests for evaluating the purification processes had been carried on raw and treated water for a period of 17 days each experiment, using special tanks previously made for this purpose.

The results obtained confirmed the effective role of microorganisms in domestic wastewater treatment and water purification using macrophytes which were capable of providing the suitable conditions to motivate heterotrophic microorganisms, which are characterized by the ability to decompose the organic matter and its active oxidation, which affects the concentrations of nitrates, ammonium, suspended solids and electrical conductivity... Etc.

Tests results clearly confirm the positive effect of Macrophytes as *Butomus umbellatus* on enhancing purification processes and activating the organic matter mineralization by microorganisms.

Key words: Aquatic macrophytes, Heterotrophic microorganisms, *Butomus umbellatus*, Domestic wastewater, Microbiological purification, Wastewater treatment, Biological treatment of domestic wastewater.

[2003 1996]

[2001 1996 1990]

]

[2003

[1999]

1.33

.[Pescod, 1992]

[Arar, 1988]

()

Sludge

[1990]

. [1983]

pH
[Goel, 1997]

Rhizosphere

Alexander et al 1987, Hoffman 1989, May et al, 1990,]

. [Goel 1997

[Goel, 1997]

Biofilters

()

Ivlev, 1950; Zerov, 1979]

[Smirnova, 1984; Sirenko et al., 1989; Goel, 1997

Detoxication

Mineralization

[Kuznetsov, 1970]

. [Benefield, 1980]

(1)

[2000]

Butomaceae

Butomus

6

9

Butomus umbellatus

Rhizomes

25 - 20

10 - 5

[Mouterde 1966]

()

15

()

[Pescod, 1992]

6 - 4

24 - 12

[2004]

.2004

2003

[2001]

pH meter

pH
TDScan t

pHScan1
2100 p turbidity

Nutrient Agar NA

[APHA, 1985] 48 28

24 37

EMB

Lactose

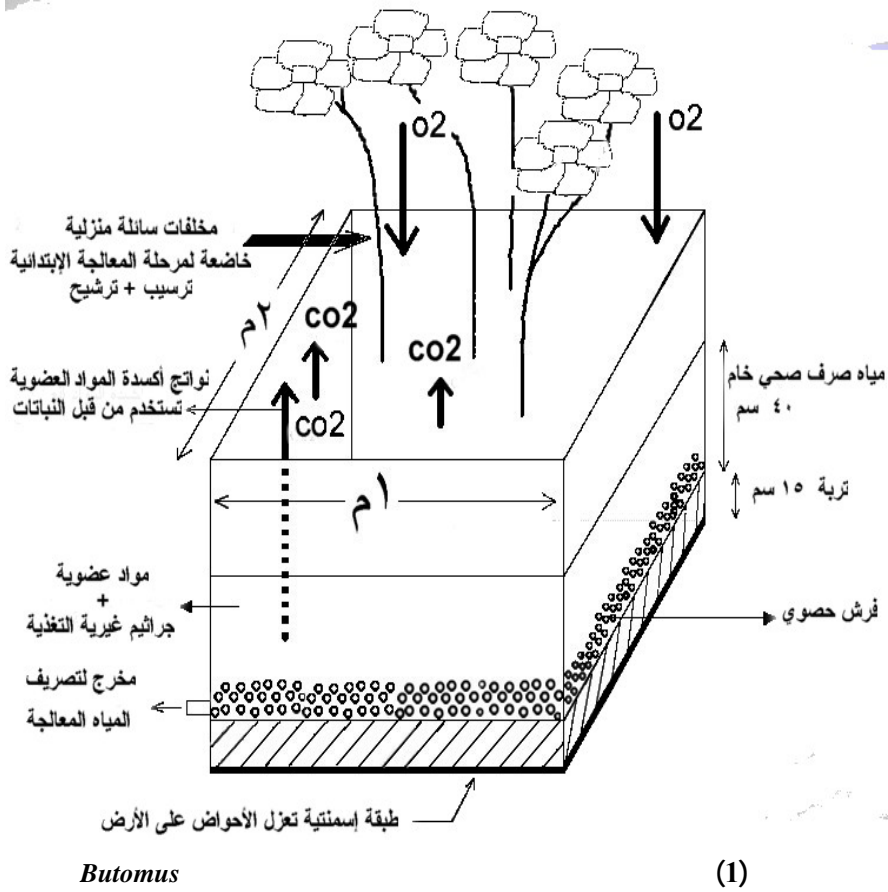
MPN

Broth

:

BOD

. Aqua Lytic AL 214



[2001]

Spectrophotometer DR

. Hach 2000

420

15

DO BOD pH

SBSS Excel

BOD

22 - 14.5

21.8 - 10

:Temperature

18.5

(1) 14.5

.1

()

Biochemical Oxygen Demand BOD

[1983]

. [2000]

pH

(1) 7.8 - 7.0

:pH

7.5 - 7.1

pH

.2

pH

:Turbidity

.3

NTU 374 - 225

(1) NTU 654 - 23.5

NTU 23,5

Butomus

		:Electric Conductivity	.4
1.20	(1)	1.40 - 0.70	1.50 -
	0.70	pH	
		:Dissolved Oxygen DO	.5
- 0.37)	DO	
		/ 6.32 - 4.87	/ 0.89
			(1
		:Biochemical Oxygen Demand BOD	.6
	/ 310 - 245		
	(1)	/ 50 - 30	
		% 86 BOD	

(1)

17	15	12	9	6	3	0		
25	24	23	29	30	31	27	°	1
21	21	19	25	25	26	22	°	
7.8	7.8	7.8	7.6	7.5	7.3	7.4	pH	
1.40	1.40	1.30	1.10	1.20	1.30	1.40	ms	
415	405	318	253	240	187	374	NTU	
5.61	4.85	3.69	2.62	1.87	1.35	0.89	/ DO	
45	55	85	110	180	250	305	/ BOD	
21	22	20	21	23	22	26	°	2
13	16	14	15	16	16	19	°	
7.8	7.8	7.7	7.5	7.4	7.3	7.3	pH	
1.40	1.30	1.30	1.20	1.00	1.10	1.20	ms	
654	634	588	295	169	190	225	NTU	
4.97	4.16	3.69	2.56	1.87	1.56	0.65	/ DO	
50	65	75	95	120	185	245	/ BOD	
19	27	19	19	22	26	20	°	3
10	16	11	15	13	14	14	°	
7.4	7.2	7.1	7	7.2	6.8	7.1	pH	
1.50	1.30	1.20	1.20	1.30	1.0	1.30	ms	
345	298	203	130	45.9	44.9	362	NTU	
45	70	95	105	130	280	310	/ BOD	
6.32	5.89	4.67	3.98	3.54	1.89	0.58	/ DO	
22	23	23	25	19	24	22	°	4
15	19	18	17	16	18	19	°	
7.0	7.1	7.2	7.3	7.4	7.4	7.5	pH	
0.70	0.90	1.10	1.20	1.30	1.40	1.50	ms	
23.5	39	45	95	165	195	295	NTU	
4.87	4.65	3.01	2.36	1.25	0.96	0.37	/ DO	
30	45	75	115	190	210	285	/ BOD	

50.7 - 4.5 (2)	/	57.1 - 8.6	:NO ₃ ⁻	.1 /
0.71-0.08 (2)	/	0.89 - 0.21	:NO ₂ ⁻	.2 /
(2)	/	21.9 - 12.7	:NH ₄ ⁺ /	.3 81 - 36.8
	/	13.9 - 0	:PO ₄ ⁻³ /	.4 22.4 - 6.3 (2)
	/	692 - 107.3	:SO ₄ ⁻² /	.5 654 - 10.4 (2)

(2)

							/	
17	15	12	9	6	3	0		
23.6	22.8	21.4	17.3	15.8	12.9	7.8	NO ₃ ⁻	1
0.21	0.36	0.49	0.54	0.56	0.35	0.71	NO ₂ ⁻	
431	450	498	512	584	615	654	SO ₄ ⁻²	
13.9	12.5	11.8	9.4	10.4	12.5	14.3	PO ₄ ⁻³	
21.9	22.5	36.7	44.87	52.6	44.6	38	NH ₄ ⁺	
38.7	42.3	48.1	52.6	65.8	80.9	50.7	NO ₃ ⁻	2
0.89	0.81	0.73	0.62	0.59	0.57	0.41	NO ₂ ⁻	
303	321	365	402	422	465	500	SO ₄ ⁻²	
4.9	5.3	9.7	11.6	13.3	18.5	22.4	PO ₄ ⁻³	
12.7	19.6	28.5	36.7	48.5	62.5	74.3	NH ₄ ⁺	
57.1	52.6	42.8	32.5	10	6.7	4.5	NO ₃ ⁻	3
0.53	0.49	0.48	0.65	0.74	0.31	0.25	NO ₂ ⁻	
69	76	81	87	91	93	100	SO ₄ ⁻²	
0	8.4	9.5	12.3	16.5	10.2	6.3	PO ₄ ⁻³	
12.7	18.6	28.3	49.6	53.4	72.3	81	NH ₄ ⁺	
8.6	9.7	11.8	12.7	15.3	18.5	14.7	NO ₃ ⁻	4
0.75	0.67	0.45	0.28	0.25	0.16	0.08	NO ₂ ⁻	
107.3	129.2	165.8	198.4	221.6	268.3	310	SO ₄ ⁻²	
10.9	12.5	13.7	14.6	15.9	17.4	18.6	PO ₄ ⁻³	
17.9	19.9	23.6	25.8	26.4	32.6	36.8	NH ₄ ⁺	

18 : **Viable count VC** .1
8950 – 1950
(3) 95 –
% 98.97

Adaptation

[1990]

Commensalisms

[Feachem 1983, Straus et al. 1994]

:E.coli .2

23.8 – 4.8 2450 – 1005

(3)

% 99.21

:Total Coliform TC .3

1050 – 730

8.500 – 0.930

.% 97.67

(3)

(3)

17	15	12	9	6	3	0			
72	59	205	490	1050	1950	8950	/	V.C	1
4.300	9.300	23	43	430	670	1050	100/	T.C	
23	34	110	210	690	1030	2450	/		2
18	93	180	390	465	1600	2100	\	V.C	
0.930	2.400	4.300	8.700	150	210	820	100/	T.C	
4.800	12.5	95	165	280	780	1005	/		3
95	490	850	940	8950	12750	6950	/	V.C	
2.400	9.500	43	75	120	750	1050	100/	T.C	
8.500	32.5	68	128	340	1155	2200	/		4
20	67	210	467	987	1250	1950	/	V.C	
4.300	9.300	43	93	150	230	730	100/	T.C	
15.3	18.5	94	180	390	615	1100	/		

	WHO		
	:		
1.25			.1
WHO			
	0.70		
		.	
NTU 322			.2
	NTU 8.6		
		.	
/ 42.5		BOD	.3
		% 85.62	
			.4
% 97.67		% 98.97	
	% 99.21		
			.5
		.	
			.6
<i>Butomus umbellatus</i>			.7

	(4)	.1
	BOD pH	
	NH ₄ ⁺ V.C pH	
	(5 6 7 9 11)	
NH ₄ ⁺	T.C V.C BOD	.2
	PO ₄ ⁻³	
	(5 6 7 9 11) NO ₃ ⁻ BOD	
	NH ₄ ⁺ NO ₃ ⁻	.3
	(5 6 7 9 11)	
	BOD V.C	.4
	SO ₄ ⁻² , PO ₄ ⁻³ , NH ₄ ⁺ V.C	
	V.C	
	V.C	
NO ₃ ⁻ V.C	pH V.C	
	T.C V.C	
	(5 6 7 9 11)	.5
NO ₃ ⁻		
NH ₄ ⁺ V.C T.C		
	(5 6 7 9 11)	.6
,PO ₄ ⁻³ , NH ₄ ⁺ , V.C	T.C	
	BOD, SO ₄ ⁻²	
	NO ₃ ⁻ T.C	
	(5 6 7 9 11) pH T.C	

(4)

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() %95

(4)

0.44	189.00	31.00	23.00	8.00	-1.87	0.00	9.67	3.11	23.00	27.00	1.18	27.00		
0.38	159.00	26.00	19.00	7.00	-1.69	-0.03	6.90	2.63	21.00	22.00	0.99	22.71		
0.03	53.20	7.80	7.30	0.50	-1.77	-0.31	0.04	0.21	7.80	7.60	0.08	7.60	PH	
0.02	9.10	1.40	1.10	0.30	-0.15	-0.91	0.01	0.12	1.40	1.30	0.04	1.30		
12.70	2192.00	415.00	187.00	228.00	-1.76	-0.19	7903.14	88.90	187.00	318.00	33.60	313.14		
0.26	20.88	5.61	0.89	4.72	-1.44	0.41	3.22	1.79	0.89	2.62	0.68	2.98	DO	
14.37	1030.00	305.00	45.00	260.00	-1.16	0.67	10123.81	100.62	45.00	110.00	38.03	147.14	BOD	
0.82	121.60	23.60	7.80	15.80	-0.53	-0.62	33.10	5.75	7.80	17.30	2.17	17.37	NO3-	
2.89	56.68	54.00	0.21	53.79	7.00	2.65	409.73	20.24	0.21	0.49	7.65	8.10	NO2-	
12.08	3744.00	654.00	431.00	223.00	-1.58	0.21	7150.14	84.56	431.00	512.00	31.96	534.86	SO4-2	
0.25	84.80	14.30	9.40	4.90	-0.77	-0.37	3.11	1.76	12.50	12.50	0.67	12.11	PO4-3	
1.65	261.17	52.60	21.90	30.70	-1.08	-0.38	133.62	11.56	21.90	38.00	4.37	37.31	NH4+	
459.15	12776.00	8950.00	59.00	8891.00	6.00	2.42	10330044.14	3214.04	59.00	490.00	1214.79	1825.14	V.C	
59.15	2229.60	1050.00	4.30	1045.70	-0.10	1.08	171437.25	414.05	4.30	43.00	156.50	318.51	T.C	
125.68	4547.00	2450.00	23.00	2427.00	3.13	1.77	773963.95	879.75	23.00	210.00	332.52	649.57		

: () (5)
 (r < 0.553) (r)·99 % (0.684 ≤ r)·99.99 % (0.801 ≤ r ≥ 0.553) % 90

	T.C	V.C	NH4+	PO4-3	SO4-2	NO2-	NO3-	BOD	DO			PH			
															1.00
												1.00	-0.76	-0.85	PH
										1.00	0.21	-0.60	-0.56		
									1.00	0.73	0.65	-0.79	-0.81		
									1.00	0.65	0.34	0.92	-0.62	-0.73	DO
								1.00	-0.93	-0.42	0.01	-0.93	0.49	0.62	BOD
							1.00	-0.98	0.94	0.41	0.10	0.91	-0.51	-0.63	NO3-
						1.00	-0.01	-0.16	-0.10	-0.30	-0.76	0.00	0.38	0.29	NO2-
					1.00	-0.11	-0.97	0.98	-0.97	-0.52	-0.12	-0.93	0.52	0.65	SO4-2
				1.00	0.07	-0.68	-0.13	0.22	0.15	0.63	0.94	0.00	-0.47	-0.38	PO4-3
			1.00	-0.62	0.70	0.29	-0.61	0.58	-0.82	-0.87	-0.75	-0.69	0.71	0.78	NH4+
		1.00	0.17	0.51	0.76	-0.18	-0.85	0.83	-0.66	0.12	0.32	-0.60	0.05	0.18	V.C
	1.00	0.89	0.43	0.39	0.94	-0.29	-0.95	0.98	-0.84	-0.24	0.19	-0.86	0.37	0.51	T.C
1.00	0.97	0.97	0.33	0.43	0.88	-0.21	-0.93	0.93	-0.79	-0.08	0.23	-0.76	0.23	0.37	

() %95

(6)

0.28	155.00	26.00	20.00	6.00	2.52	1.42	3.81	1.95	21.00	22.00	0.74	22.14	
0.27	109.00	19.00	13.00	6.00	1.31	0.66	3.62	1.90	16.00	16.00	0.72	15.57	
0.03	52.80	7.80	7.30	0.50	-2.22	0.13	0.05	0.22	7.30	7.50	0.08	7.54	PH
0.02	8.50	1.40	1.00	0.40	-0.30	-0.35	0.02	0.13	1.20	1.20	0.05	1.21	ms
31.59	2755.00	654.00	169.00	485.00	-2.56	0.29	48906.29	221.15	169.00	295.00	83.59	393.57	
0.22	19.46	4.97	0.65	4.32	-1.30	0.10	2.41	1.55	0.65	2.56	0.59	2.78	DO
10.17	835.00	245.00	50.00	195.00	0.12	1.08	5070.24	71.21	50.00	95.00	26.91	119.29	BOD
2.09	379.10	80.90	38.70	42.20	0.82	1.13	213.55	14.61	38.70	50.70	5.52	54.16	NO3-
0.02	4.62	0.89	0.41	0.48	-0.43	-0.05	0.03	0.16	0.41	0.62	0.06	0.66	NO2-
10.35	2778.00	500.00	303.00	197.00	-1.22	0.08	5253.14	72.48	303.00	402.00	27.39	396.86	SO4-2
0.93	85.70	22.40	4.90	17.50	-0.80	0.47	42.07	6.49	4.90	11.60	2.45	12.24	PO4-3
3.23	282.80	74.30	12.70	61.60	-1.16	0.37	509.74	22.58	12.70	36.70	8.53	40.40	NH4+
117.00	4846.00	2100.00	18.00	2082.00	-0.19	1.21	670813.57	819.03	18.00	390.00	309.57	692.29	V.C
42.64	1196.33	820.00	0.93	819.07	5.22	2.24	89107.15	298.51	0.93	8.70	112.83	170.90	T.C
56.83	2342.30	1005.00	4.80	1000.20	-0.40	1.12	158247.87	397.80	4.80	165.00	150.36	334.61	

: () (7)
 (r < 0.553) (r)·99.99% (0.684≤ r)·99%(0.801≤r≥ 0.553)%90

	T.C	V.C	NH4+	PO4-3	SO4-2	NO2-	NO3-	BOD	DO			PH			
															1.00
													1.00	0.92	
												1.00	-0.70	-0.63	PH
											1.00	0.81	-0.49	-0.39	
										1.00	0.90	0.97	-0.62	-0.56	
									1.00	0.93	0.78	0.97	-0.82	-0.73	DO
								1.00	-0.92	-0.76	-0.53	-0.89	0.86	0.82	BOD
							1.00	0.54	-0.67	-0.79	-0.84	-0.78	0.30	0.16	NO3-
						1.00	-0.57	-0.92	0.99	0.88	0.70	0.94	-0.83	-0.74	NO2-
					1.00	-0.98	0.68	0.95	-0.99	-0.90	-0.71	-0.97	0.79	0.70	SO4-2
				1.00	0.99	-0.96	0.63	0.98	-0.96	-0.84	-0.62	-0.94	0.79	0.72	PO4-3
			1.00	0.99	0.99	-0.97	0.67	0.97	-0.98	-0.87	-0.69	-0.96	0.82	0.75	NH4+
		1.00	0.94	0.95	0.91	-0.86	0.53	0.99	-0.87	-0.70	-0.44	-0.85	0.81	0.77	V.C
	1.00	0.89	0.83	0.84	0.79	-0.81	0.17	0.91	-0.77	-0.54	-0.28	-0.68	0.87	0.93	T.C
1.00	0.89	1.00	0.95	0.96	0.93	-0.87	0.56	0.99	-0.88	-0.73	-0.49	-0.87	0.80	0.77	

() %95

(8)

0.49	152.00	27.00	19.00	8.00	-1.15	0.92	11.90	3.45	19.00	20.00	1.30	21.71	
0.31	93.00	16.00	10.00	6.00	-0.77	-0.52	4.57	2.14	14.00	14.00	0.81	13.29	
0.03	49.80	7.40	6.80	0.60	1.05	-0.29	0.03	0.19	7.10	7.10	0.07	7.11	PH
0.02	8.80	1.50	1.00	0.50	1.64	-0.19	0.02	0.15	1.30	1.30	0.06	1.26	
19.30	1428.80	362.00	44.90	317.10	-2.05	-0.08	18244.39	135.07	44.90	203.00	51.05	204.11	
14.91	1035.00	310.00	45.00	265.00	-0.85	0.98	10890.48	104.36	45.00	105.00	39.44	147.86	BOD
0.29	26.87	6.32	0.58	5.74	-0.69	-0.46	4.26	2.06	0.58	3.98	0.78	3.84	DO
3.20	206.20	57.10	4.50	52.60	-2.24	0.03	501.06	22.38	4.50	32.50	8.46	29.46	NO3-
0.02	3.45	0.74	0.25	0.49	-0.75	-0.06	0.03	0.17	0.25	0.49	0.07	0.49	NO2-
1.52	597.00	100.00	69.00	31.00	-0.71	-0.26	113.57	10.66	69.00	87.00	4.03	85.29	SO4-2
0.73	63.20	16.50	0.00	16.50	1.33	-0.53	26.25	5.12	0.00	9.50	1.94	9.03	PO4-3
3.76	315.90	81.00	12.70	68.30	-1.61	0.12	692.01	26.31	12.70	49.60	9.94	45.13	NH4+
726.83	31025.00	12750.00	95.00	12655.00	-1.12	0.80	25885915.48	5087.82	95.00	940.00	1923.02	4432.14	V.C
60.80	2049.90	1050.00	2.40	1047.60	0.19	1.37	181111.91	425.57	2.40	75.00	160.85	292.84	T.C
118.14	3932.00	2200.00	8.50	2191.50	2.18	1.68	683850.15	826.95	8.50	128.00	312.56	561.71	

: () (9)

(r < 0.553) (r) · 99.99% (0.684 ≤ r) · 99% (0.801 ≤ r ≤ 0.553) % 90

	T.C	V.C	NH4+	PO4-3	SO4-2	NO2-	NO3-	DO	BOD			PH														
															1.00											
														1.00	0.60											
												1.00	-0.47	-0.33	PH											
												1.00	0.97	-0.42	-0.41											
												1.00	0.68	0.60	-0.17	-0.24										
												1.00	-0.13	-0.53	-0.65	0.29	0.19									
												1.00	-0.96	0.22	0.53	0.65	-0.30	-0.03								
												1.00	0.93	-0.87	0.47	0.53	0.61	-0.28	-0.12							
												1.00	0.29	0.55	-0.72	-0.39	0.30	0.39	-0.09	-0.22						
												1.00	-0.35	-0.96	-0.97	0.88	-0.36	-0.55	-0.65	0.41	0.05					
												1.00	0.51	0.46	-0.51	-0.29	0.12	-0.81	-0.54	-0.47	0.44	0.22				
												1.00	0.39	0.97	-0.43	-0.96	-0.98	0.93	-0.34	-0.56	-0.68	0.37	0.07			
												1.00	0.80	0.42	0.75	-0.32	-0.89	-0.76	0.79	-0.57	-0.58	-0.60	0.19	0.41		
												1.00	0.69	0.87	-0.07	0.80	-0.79	-0.78	-0.92	0.98	0.07	-0.38	-0.52	0.24	0.13	
												1.00	0.98	0.63	0.85	-0.07	0.81	-0.75	-0.77	-0.91	0.95	0.16	-0.26	-0.41	0.23	0.05

() %95

(10)

0.27	158.00	25.00	19.00	6.00	1.79	-0.97	3.62	1.90	22.00	23.00	0.72	22.57	
0.22	122.00	19.00	15.00	4.00	-0.81	-0.62	2.29	1.51	18.00	18.00	0.57	17.43	
0.03	50.90	7.50	7.00	0.50	-1.13	-0.37	0.03	0.18	7.40	7.30	0.07	7.27	PH
0.04	8.10	1.50	0.70	0.80	-0.55	-0.57	0.08	0.28	0.70	1.20	0.11	1.16	
14.33	857.50	295.00	23.50	271.50	-0.34	0.82	10059.08	100.29	23.50	95.00	37.91	122.50	
0.25	17.47	4.87	0.37	4.50	-1.59	0.35	3.16	1.78	0.37	2.36	0.67	2.50	DO
13.59	950.00	285.00	30.00	255.00	-1.17	0.47	9045.24	95.11	30.00	115.00	35.95	135.71	BOD
0.49	91.30	18.50	8.60	9.90	-0.50	0.30	11.70	3.42	8.60	12.70	1.29	13.04	NO3-
0.04	2.64	0.75	0.08	0.67	-1.33	0.53	0.07	0.26	0.08	0.28	0.10	0.38	NO2-
10.43	1400.60	310.00	107.30	202.70	-1.00	0.28	5334.92	73.04	107.30	198.40	27.61	200.09	SO4-2
0.39	103.60	18.60	10.90	7.70	-0.95	0.01	7.36	2.71	10.90	14.60	1.03	14.80	PO4-3
0.96	183.00	36.80	17.90	18.90	-0.56	0.51	44.81	6.69	17.90	25.80	2.53	26.14	NH4+
102.76	4951.00	1950.00	20.00	1930.00	-0.29	0.86	517412.57	719.31	20.00	467.00	271.88	707.29	V.C
36.53	1259.60	730.00	4.30	725.70	4.84	2.13	65374.49	255.68	4.30	93.00	96.64	179.94	T.C
56.86	2412.80	1100.00	15.30	1084.70	1.27	1.33	158413.27	398.01	15.30	180.00	150.43	344.69	

: () (11)

(r < 0.553)

(r) ,99.%(0.684 ≤ r) ,99.99%(0.801 ≤ r ≤ 0.553)% 90

	T.C	V.C	NH4+	PO4-3	SO4-2	NO2-	NO3-	BOD	DO			PH			
															1.00
													1.00	0.36	
												1.00	0.36	-0.14	PH
											1.00	0.99	0.44	-0.04	
										1.00	0.90	0.92	0.36	-0.20	
									1.00	-0.92	-0.98	-0.99	-0.28	0.14	DO
								1.00	-0.96	0.99	0.94	0.96	0.33	-0.21	BOD
							1.00	0.84	-0.91	0.78	0.89	0.87	0.24	-0.04	NO3-
						1.00	-0.89	-0.93	0.99	-0.89	-0.99	-0.99	-0.33	0.01	NO2-
					1.00	-0.96	0.86	0.98	-0.97	0.97	0.97	0.97	0.42	-0.05	SO4-2
				1.00	0.99	-0.97	0.89	0.98	-0.97	0.96	0.98	0.98	0.46	-0.07	PO4-3
			1.00	0.98	0.99	-0.94	0.83	0.96	-0.94	0.96	0.95	0.94	0.48	0.03	NH4+
		1.00	0.96	0.96	0.97	-0.89	0.78	0.99	-0.92	1.00	0.90	0.92	0.36	-0.20	V.C
	1.00	0.93	0.88	0.82	0.86	-0.73	0.51	0.88	-0.75	0.92	0.75	0.77	0.45	-0.13	T.C
1.00	0.97	0.99	0.95	0.92	0.95	-0.84	0.70	0.96	-0.86	0.98	0.85	0.87	0.41	-0.15	

