

(19)
(12)

(KR)
(B1)

(51) 。 Int. Cl.⁷
C02F 3/30
C02F 3/34

(45)
(11)
(24)

2004 04 03
10-0425552
2004 03 22

(21) 10-2001-0069620
(22) 2001 11 08

(65)
(43)

10-2002-0007252
2002 01 26

(73) 2 970-5

(72) 2 970-5

(54) SBR

[]

SBR

[]

(Bio-React), SBR(Sequencing Batch Reactor) (Fill & React),
 Sludge Selection) 5 (Settle), (Decant), (Ideal) (S
 Bacillus khr-10-mx khr-5-mx SBR DO, pH, ORP, TWL, BWL,
 Fuzzy & PLC 가 (Sludge Selection Time) 가
 SBR (Sludge Volume)

1

1 1 SBR
2 1 SBR

(1)Aqua SBR

Aqua Aerobic Systems,Inc.

가 (Mixed-Fill) (React-Fill) (React) (Settle) 가
 가 (Decant-Sludge Wasts) (Idle)

(2)CASS(Cyclic Activated Sludge System)

Babcock King-Wilkinson,L.P

(Floc) 가 가 가

(3)Jet Tech Omniflo SBR

Jet Tech Omniflo,Inc.

(DO) (Jet Aeration) 가

(4)ICEAS(Intermittent Cyclic Extended Aeration System)

Austgen Biojet Waste System,Inc.

가 (Zooglead Microorganism) (B
 ulking) SBR 가

00-0036569 SBR

01-0028648

NO₃-N

00-0033238

118160

99-015325

가

가

가

2000-001771

가

9-122679

9-174098

9-150196

2000-312895

2001-38397

2001-149998

9979

9-276887

2001-2

가

10-13778

11-216500

2000-202484

2000-237795

SBR

BO

D, SS, T-N

가

(NO-N) N2 가

(PHB)

(NOx-N)

가

SBR

가 가

가

가 가 가

가

SBR

(Bio-Ceramic Ball)

BOD, COD, SS, T-N, T-P
(Selection Time)

SBR

가

SBR

[]

SBR

[1]

1 SBR

[2]

1

SBR

[3]

1
[5]

SBR

1

[4]

1
[6]

1

[8]

1

(10)

(13)

(12)
SBR

(14)

1
(1 Cycle)

(11)
(Baffle Wall)

SBR

(1

5)

SBR
(TWL, BWL)

(15)

(DO)

(Temperature),
(101)

(pH)

(O

RP),

Fuzzy & PLC

가
(102)

, SBR

(15)

SBR
KCTC 8533P)

(15)

kh-5-mx(
(Bacillus sp. Zoothamnium sp.),
(Boda sp. Vorticella spp. Amoeba sp.),
(Bacillus sp.)

kh-10-mx(

KCTC 0078BP)

BOD

(Monassp. Lepadella sp. Epistylis sp.),

(Poly-P) (Pseudomonas sp. Acinetobactor sp.),

(206)

(208)

SBR

SBR

(14)

가

(17)

1

가

SRS

(207)

, SBR

(15)

가

SBR

2

(Sludge Volume)

1

가 [1]

1

() :

(10)

1

. 2

(1.0mm , 2.65)

(12)

2

() :

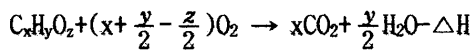
(11)

(101) SBR (102) (14) (13) 가 (11)

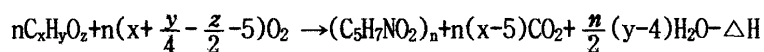
3 (SBR) : 가 SBR (1) (14) SBR (14) SBR (15) SBR (Baffle Wall) (14) SBR 10% 15% SBR (15) SBR (14) 1 SBR (14) BOD 가 (15) F/M SBR (14) F/M 가 (14) (Sludge Selection Zone) SRS (207) 가 (Selecti on Time) 가 (17) 가 (C-BOD) (Bulking)

4 (SBR) SBR (14) 가 1 3 (Fuzzy) PLC(Programmable Logic Controller) (Air-on) 가 (BOD) (Air-off) 가 (C-BOD) 가 (N₂) (CO₂) (Decanter)가 TWL(Top Water Level) BWL(Bottom Water Level) (Weir) 160min / , 50min , 60min 1 (1 Cycle) 4 .0 4.8hr 가 SBR (Storm Flow) (11) 3.4hr SBR Bacillus khr - 10-mx (Poly-P) 1m³ 1 2ppm (206) 1m³ 3 4ppm , 2 BOD, COD, SS, T-N, T-P 가 SBR (208) SBR (14) SBR (15) (208) 가

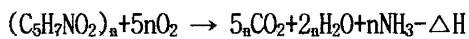
(BOD)



()



()



1) ()

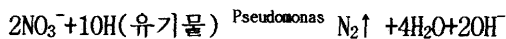
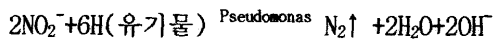
SBR NH₄-N NO₃-N ,
 N₂ gas 가 2 가
 Nitrosomonas가 O₂ ,

2) () (S-BOD) (Short Chain Fatty Acid) SCFA가
 Polyphosphat가 Orthophosphate SCFA PHB(C₆H₆O₂)n

인방출 : 혐기조건 Poly-P + VFA → PHB = PO₄³⁻

) () , Poly-P 가 (가
 : PHB + PO₄³⁻ Poly-P + H₂O + CO₂ (Bacillus sp.)

3) () NO₃⁻ N₂ gas 가
 SBR 가 N₂ Nitrous Oxide(N₂O) Nitric Oxide(NO) . 가
 가



3 CFU

[3] [4]

[3]

탈질용 생균수, 아질산균, 질산균, 탈질균

구 분	생균수	아질산균	질산균	탈질균
무산소	1.8×10 ⁸	3.8×10 ⁴	5.3×10 ³	7.2×10 ³

[4]

탈질용 우점종 미생물

Carchesium ploypinum	Aspidisca costata
Colpidium campyium	Trachlius sp.
Vorticella extensa	Spirostomum sp.
Paramecium caudatum	Monas sp.
Metopus es	Bodo sp.
Colpoda sp.	Amoeba spp.
Trachelophyllum sp.	Arcella vulgaris
Lacrymaria sp.	Lepadella sp.
Euplotes sp.	Rhabdolaimus sp.
Aspidisca lynceus	Philodina sp.
Metous seriatus	Sphaerotilus natans
Vorticella corrvallaria	Filamentous Bacteria
Caenomorpha medusula	Beggiatoa sp.

5 ()

UV (NaOCl)

[1]

[1] 가

[7] [5] [6]
 [5] 가 [1] Pilot Plant Lab Test
 Pilot Plant 50m³/day Lab Test SBR 500 (N) (P)

L, BWL , pH, ORP, DO, TW

(Fuzzy & PLC) DO, pH, ORP, TWL, BWL,
 ORP Controller, Blower, Air-Velve, Pump, Decanter

BOD 120 259ppm 150ppm 가
 , BOD/TKN Ratio 3.0 가
 . 1 COD 7 30
 가 18 가 가 가 50 450ppm
 가 가

[5]

유입수 성상

항 목	유입수 변동농도 (mg/l)	평균농도(mg/l)	비 고
BOD	120~259	150	
COD	119~238	139	
SS	155~280	150	
T-N	31~50	27	
T-P	3~11	5.8	

1 () : (10)
 2 () : (12)
 (13) SBR (14) SBR (15)
 TWL(Top Water Level) (202)가
 (Sludge Selection Time) 가 (17) 가 SRS (207)
 3 () : SBR (14) SBR (15)
 TWL(Top Water Level) (202)가
 DO 4.0 4.8hr (Air - on/off)가 20 25min 4
 DO 3mg/ 6mg/
 (Air - on/off) 가 20 25min 3 50min,
 60min (Storm Flow) 3.0 3.4hr
 [3]
 SBR (15) 1, 2 (Fuzzy) & PLC(P)
 rogrammable Logic Controller) 4.0 4.8hr 가
 [3] (1 Basin)
 (2 Basin)

ORP Controller(104) -50 +300mV (206)
 Bacillus khr-10-mx khr-5-mx 14
 (NO₃-N) N₂ Ga
 s
 4 () : 가
 (Biomass) 가 4.0 4.8hr 50min
 5 () : (Electromotive Effluent Gate) (203)
 (203) 60min TWL(Top Water Level) (203)
 BWL(Bottom Water Level) (203) 60min BWL 3min
 6 () : 가 (17) 가 SRS (207) SBR 가 (17) SBR
 (15) (Cycle) TWL(Top Water Level) (202)가
 SBR (14) SBR 4 S
 BR (14)
 8533P) khr-5-mx(KCTC 0078BP) KCTC
 cillus sp. Zoothagmium sp. Colpada sp.), (Monas sp. Lepadella sp. Epistylis sp.), (Ba
 (Boda sp. Vorticella spp. Amoeba sp.), (Poly-P) (Pseudomonas sp. Acinetobacter sp. B
 acillus sp.) (206) 5ppm/m³.day, 7 14 1 2p
 pm/m³.day 2 1 7 3
 (208) SBR
 (208)
 가
 1 1 336 504 (Peak Time)가 1
 SBR (14) SBR (15) Air-on/off
 pH Controller(103), DO Controller(105), ORP Controller(104), Temperature Sensor(106), TWL Sen
 sor(107), BWL Sensor(108) (101),
 가
 Fuzzy & PLC (102)
 ORP Controller(104) -50 +300mV 가 (202) 가 DO 3 6p
 pm 가 가

(Operating Data & Alarm List)

1) 1.23mg/ 31 50mg/ 0.89mg/ 27mg/ 22.45mg/
 roph , Air-On/Off 가 Heterot
 2) Nitrate 가 가
 4.27 16.38mg/ 3.75mg/ 9.43mg/

te가 , 3 4mg/ 9.48mg/ Nitrate가 (Floc) 가 Nitra
 가 (Organic Carbon Source)
 C-BOD() SRS (207) SBR N₂ gas (14) (Sludge Selection Time)
 3) (EBPR:Biological Phosphorus Removing)
 roxyvalerate) (PHB:Poly- -Hydroxybutyrate) PHV(Poly- -Hyd Polyphosphate
 (Air-off) (S-BOD) Polyphosphate (SCFA : Short Chain Fatty Acid) SCFA
 가 (PHB) (Orthophosphate) SCFA - - (Air-on) 가 PHB
 , Poly-P 가
 3 11mg/ 5.8mg/ COD Air-on/off , NO₃ , DO가
 NO₃ DO가 , 가 Poly-P , NO₃ , DO가
 80% SBR
 Poly-P [6]

[6]

인의 과잉섭취 및 탈질 우점종 미생물

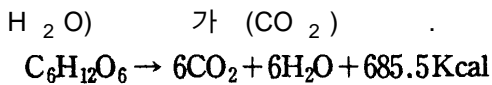
Acetobactor suboxydans	Hydrogenomonas sp
Acinetobactor calcoaceticus	Micrococcus lysodeiکتicus
A. lwoffii	Mucor racemosus
Aeroabctor aerogeneds	M. chelonei
Azotobactor agilisB	M. phlei
Bacillus subtilis	M. smegmatis
Bacterium aerogenes	M. thamnopheos
B. cloacae	M. tuberculosis
B. friedlanderi	Nitrococcus denitrifiers
beggotia	Nitrosococcus
betrinckia	Nitrosomana europeac
Caulobactor vibroides	Nocardia
Chlamydomoda	Pseudomonas vesicularis

4) Poly-P Poly-P Poly-P SBR 가
 가 Poly-P 가 Poly-P 가
 가 Poly-P khr-5-mx 가 D
 PB(Denitrifying Phosphorus Removing Bacteria) , DPB

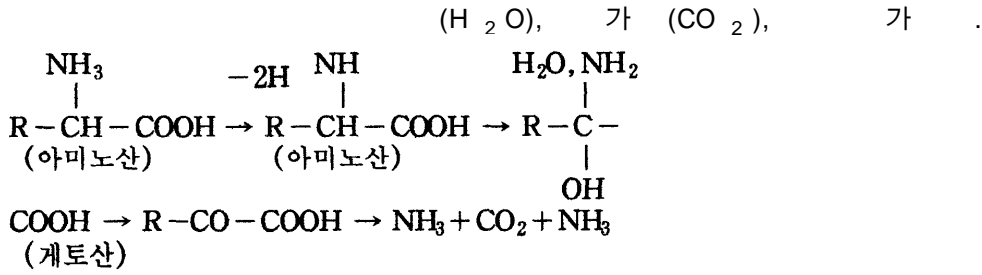
(Sludge Selection Time)
 SRS SBR

5) SBR 1 가
 Air-on/off 가
 (Sludge Volume) 가
 가 (Oxident) , 가 SRS SBR 가
 , SBR (Sludge Volume) (Zero)

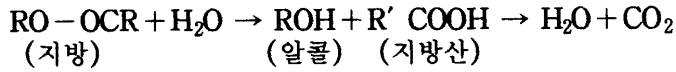
가
 가)
 Bacillus Subtilis Amylase 6% Glucose, 30% Maltose
 , 64% Dextrin 가 가
 Amylase 가 (



)
 Bacillus Subtilis Bacillus Polymyxa N Protease
 가 Bacillus Subtilis Bacillus Polymyxa Protease

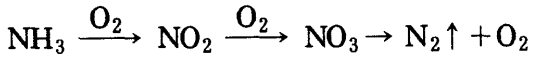


)
 Rodopseudomonas Bacillus Licheniformis Lipase
 가 가 Lipase
 (H₂O) 가 (CO₂)



) 가 (H₂S)
 Autotrophic Bacteria Beggiatoacea HO₄ 가
 $\text{H}_2\text{S} + \text{H}_2\text{O} \rightarrow \text{H}_2\uparrow + \text{H}_2\text{SO}_4$

)
 Nitrobactor, Pseudomonas NO₂ NO₃ N₂ gas



) Trichoderma Viride가 Cellulase C₁

Cellulase Cx
 가

S, TN, TP, [7] Standard Methods BOD, CODcr, CODmn, S

[7]

처리결과

항 목	유입수(mg/l)	처리수(mg/l)	환경기준(mg/l)
BOD	150	4.1	
COD	139	6.7	
SS	150	6.4	
T-N	27	8.5	
T-P	5.8	0.7	

SBR

가

(Selection Time)

SBR

(57)

1.

SBR (10) ; (11) (13) ; (1)

2) ; (11) (13) ; (11) ;

(fill-react) (bio-react) ; SBR (14) SBR (15)

(settle) ; (ideal) ; 1 (203) (decant)

;(storm flow) 1 3.0 3.4 (1 cycle) 4.0 4.8

(16) ; SBR (15)

(207) SBR (14, 15) (S-BOD) 가 (17) 가 ,가 SRS

;(17) 가 1 2 ;

; SBR

2.

SBR (14, 15) (fill-react), (bio-react), (settle),

(decant), (ideal) 1 (1 cycle)

; SBR (14, 15) (206) ,

Bacillus khr-10-mx(KCTC 8533P) , Mixture khr-5-mx(KCTC 0078BP) ,

1m³ 1 2ppm 1 7 1m³ 3 4ppm , 7 14

; SBR (sludge volume)

; DO, pH, ORP, TWL, BWL, (101)

PLC (102) , (200), (202), (201), (203), SRS

(207) 가 가 PLC ;

; 가 가 ;

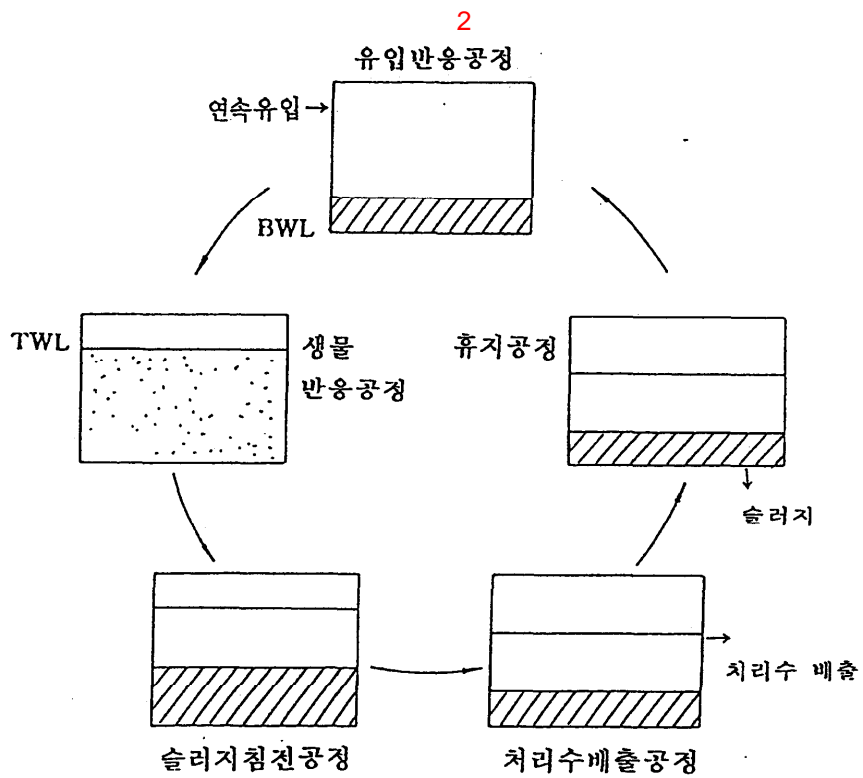
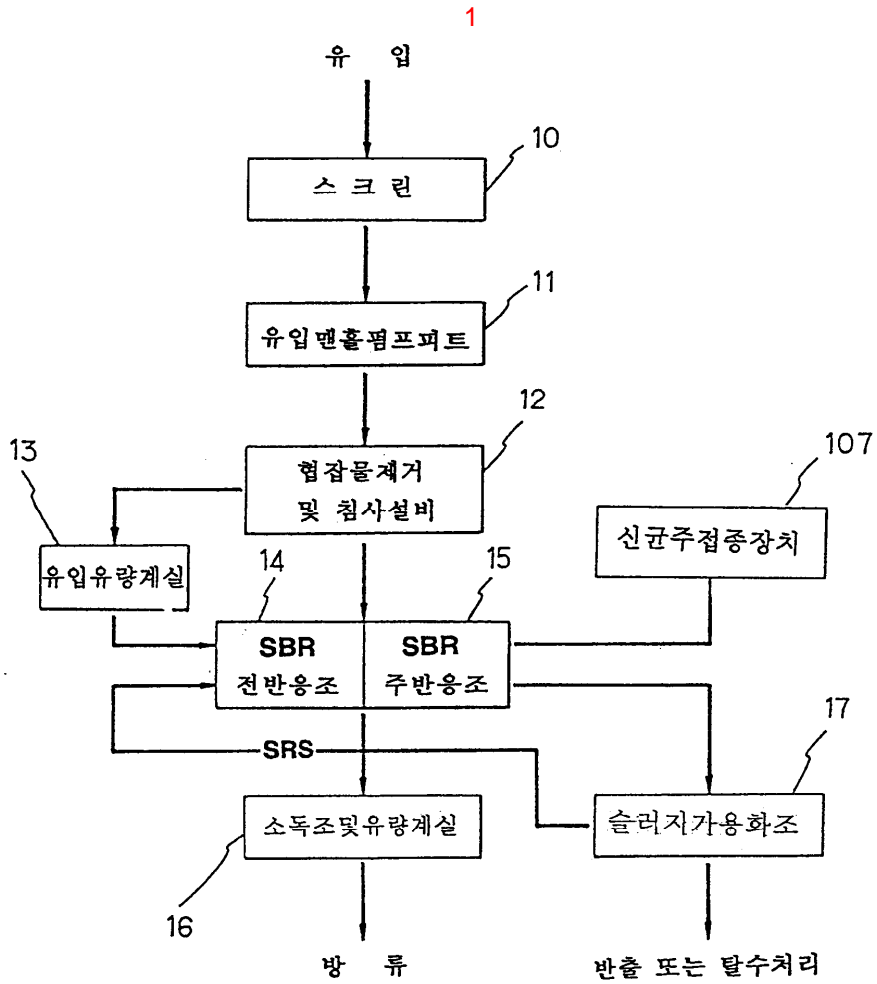
(operating data & alarm list)

- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

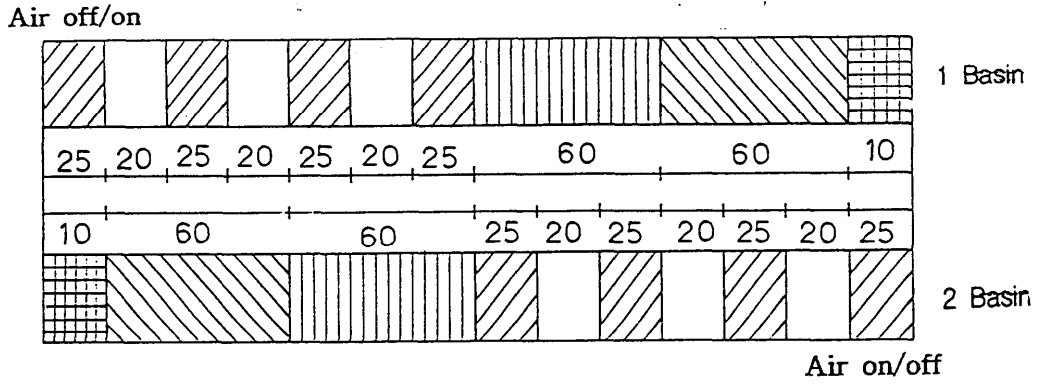
Bacillus khr-10-mx(KCTC 8533P) Mixture khr-5-mx(KCTC 0078BP)

(208) SBR (14, 15)

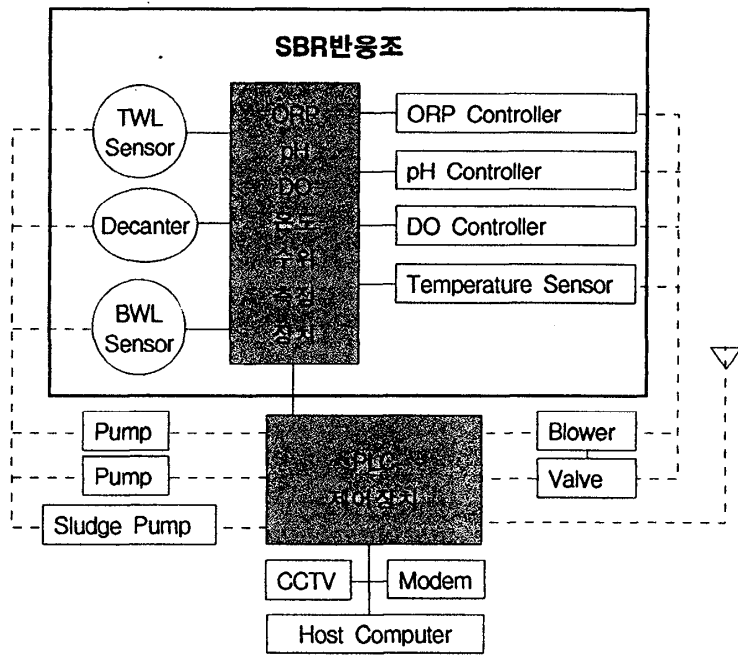
(208)



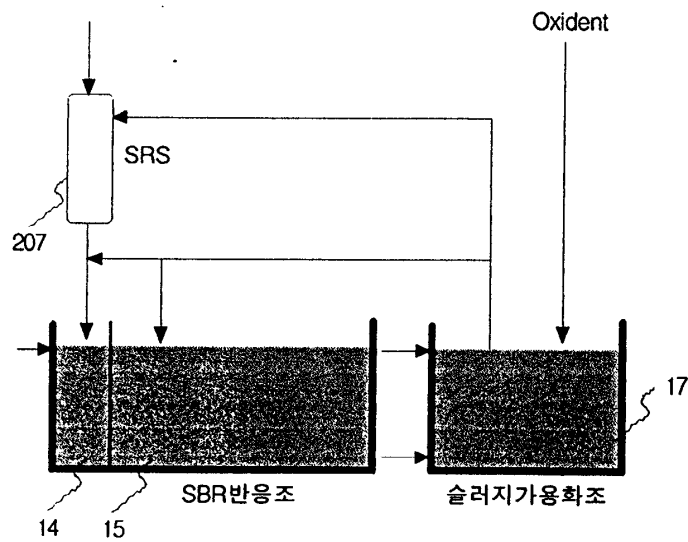
3



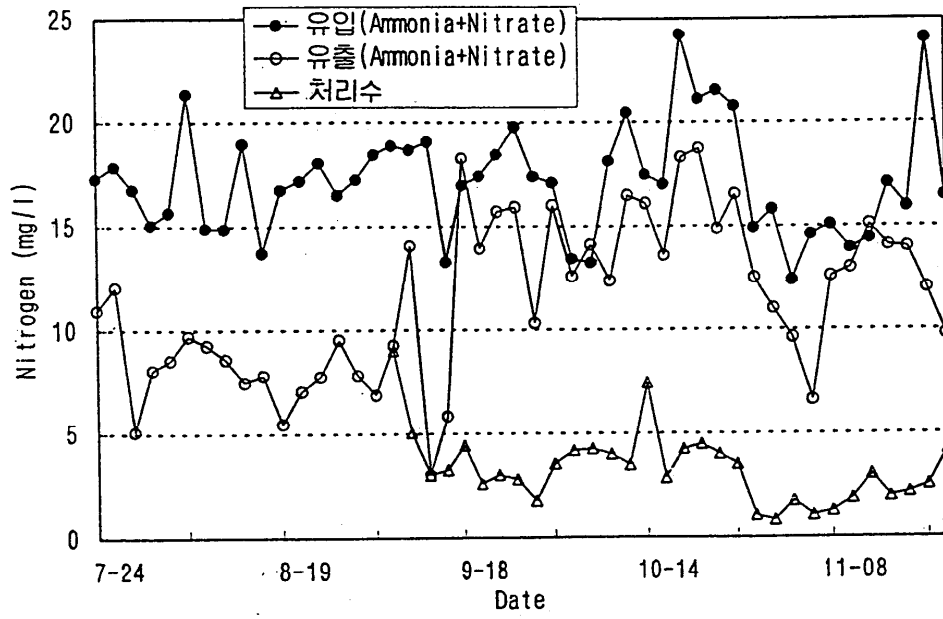
4



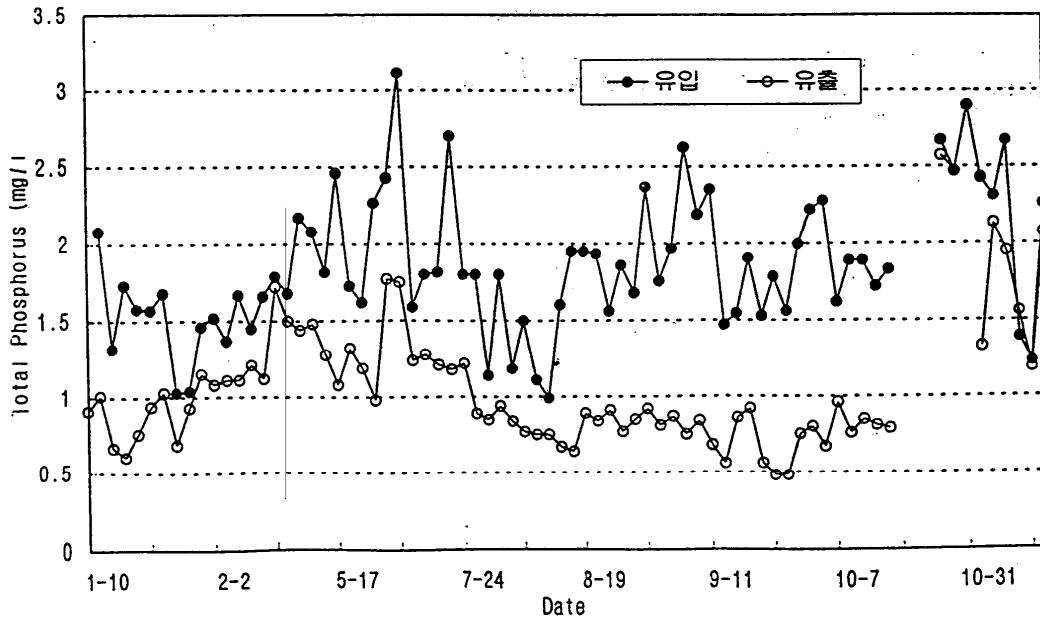
5



6



7



8

