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**NITROGEN AND PHOSPHORUS REMOVAL
FROM DAIRYSHED EFFLUENT
USING A SEQUENCING BATCH REACTOR**

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Applied Science at Massey University

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Abstract

It is apparent that present dairymshed effluent treatment systems are not capable of complying with regulations generated by Regional Councils implementing the Resource Management Act 1991. This has created a need for research into dairymshed effluent treatment.

To develop an improved treatment system for dairymshed effluent, research was conducted with two main study objectives; to characterise effluent from the dairymshed holding yard and anaerobic pond, and to develop a sequencing batch reactor (SBR) for the removal of nitrogen and phosphorus.

The carbon characterisation showed that there was a large difference between dairymshed effluent and domestic effluent in the proportion of carbon in each fraction.

When treating dairymshed wastewater to reduce BOD, nitrogen and phosphorus concentrations it was not possible to treat either the yard effluent or the anaerobic effluent without addition of external materials.

The BOD reaction rate constant for the yard effluent at 0.2 d^{-1} was similar to a typical domestic wastewater value of 0.23 d^{-1} . The anaerobic pond effluent BOD reaction rate constant of 0.16 d^{-1} was lower than the yard effluent value indicating that the anaerobically treated effluent was hard to treat aerobically.

A pilot scale SBR treating dairymshed effluent was operated for 75 days. Startup procedure used a 50/50 mixture of anaerobic pond and aerobic pond effluents which was successful in establishing a biomass capable of nitrifying anaerobic pond effluent. The startup time to establish a nitrifying population was 17 days.

The sludge was found to settle well, with a maximum sludge volume index of 54 ml/g measured during the SBR operation. Sludge bulking was not seen as a problem.

Nitrification performance a large proportion of the bacteria were lost took only 5 days to recover. With the addition of alkalinity nitrification reliably reduced the effluent ammonia concentration to 5 mg/l.

From the cycle analysis the first order reaction rate constants for nitrification were; ammonia reduction 0.7 hr^{-1} , TKN reduction 0.4 hr^{-1} and nitrate formation 0.2 hr^{-1} . These constants could be used in future work to optimise stage times.

KEYWORDS: Sequencing Batch Reactor; Dairyshed effluent characterisation; readily available carbon; nitrogen and phosphorus removal; activated sludge; venturi aerator; Sludge Volume Index.

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TABLE OF CONTENTS

	Page
Abstract.....	ii
Acknowledgements.....	iv
Table of Contents.....	v
List of Figures	ix
List of Tables	x
1. LITERATURE REVIEW.....	1
1.1 INTRODUCTION AND BACKGROUND.....	1
1.1.1 Dairy effluent	1
1.1.2 Why control effluent discharges.....	1
1.1.2.1 Adverse physical effects.....	2
1.1.2.2 Adverse biological effects.....	2
1.1.2.3 Adverse chemical effects	3
1.1.2.4 Adverse social effects	3
1.2 REQUIREMENTS OF LOCAL AUTHORITIES	4
1.3 CURRENT FARM TREATMENT SYSTEMS.	6
1.3.1 Ponds.....	6
1.3.2 Land application	8
1.4 ALTERNATIVE TREATMENT OPTIONS	9
1.4.1 Constructed wetlands.....	9
1.4.2 Rotating biological contactors.....	11
1.4.3 Sequencing batch reactor.....	12
1.5 SEQUENCING BATCH REACTOR TECHNOLOGY	12
1.5.1 Process description.....	14
1.5.1.1 Cycle operation	14
1.5.1.2 Description of the stages	14
1.5.1.3 Advantages.....	18
1.5.2 SBR cycle requirements for nutrient removal	19
1.6 PERFORMANCE OF SBR TECHNOLOGY.....	22
1.6.1 Domestic wastewater	22
1.6.2 Piggery wastewater.....	25
1.6.3 Dairyshed wastewater.....	28
1.6.4 Anaerobically pretreated wastewater	29
1.7 NUTRIENT REMOVAL CONSIDERATIONS	32
1.7.1 Phosphorus.....	32
1.7.2 Nitrogen	35
1.7.2.1 Production of N ₂ O during nitrification and denitrification	38
1.7.3 Carbon requirements for nutrient removal.....	40
1.7.3.1 Carbon characterisation.....	40
1.8 LITERATURE REVIEW SUMMARY.....	44

	vi
2. WASTEWATER CHARACTERISATION	46
2.1 INTRODUCTION.....	46
2.2 RESEARCH METHODS AND TECHNIQUES.....	47
2.2.1 <i>Study farm</i>	47
2.2.2 <i>Sample collection</i>	48
2.2.3 <i>Laboratory procedures:</i>	49
2.2.3.1 Alkalinity.....	49
2.2.3.2 pH.....	49
2.2.3.3 Ammonia.....	49
2.2.3.4 Nitrate Nitrogen	50
2.2.3.5 Total Nitrogen	50
2.2.3.6 Total Phosphorus.....	50
2.2.3.7 Carbon fractionation.....	50
2.2.3.8 Total COD.....	51
2.2.3.9 Soluble COD	51
2.2.3.10 Carbonaceous BOD.....	52
2.2.3.11 Volatile Fatty Acid.....	52
2.3 RESULTS AND DISCUSSION	54
2.3.1 Alkalinity.....	54
2.3.2 pH.....	54
2.3.3 Ammonia Nitrogen	55
2.3.4 Nitrate Nitrogen.....	56
2.3.5 Total Kjeldahl Nitrogen	57
2.3.6 Total Phosphorus	58
2.3.7 Yard effluent COD	59
2.3.8 Anaerobic pond effluent COD.....	60
2.3.9 Carbonaceous BOD	61
2.3.9.1 Yard effluent	61
2.3.9.2 Anaerobic pond effluent.....	62
2.3.10 Volatile fatty acids	63
2.3.11 Carbon fractions	64
2.4 CONCLUSIONS	67
3. OXYGEN TRANSFER.....	69
3.1 INTRODUCTION.....	69
3.2 MECHANISMS OF OXYGEN TRANSFER.....	69
3.3 METHODS OF MEASURING OXYGEN TRANSFER.....	71
3.4 AERATION SYSTEMS.....	72
3.4.1 <i>Jet aeration</i>	73
3.4.2 <i>Submersible aerator</i>	74
3.5 METHODS.....	76
3.6 EQUIPMENT	77
3.6.1 <i>Venturi aerator</i>	77
3.6.2 <i>Submersible aerator</i>	78
3.7 RESULTS.....	78
3.7.1 <i>Venturi aerator</i>	78

	vii
3.7.2 Submersible aerator.....	81
3.8 DISCUSSION.....	81
3.9 CONCLUSIONS	83
4. SEQUENCING BATCH REACTOR DESIGN	84
4.1 PHYSICAL DESIGN	84
4.1.1 Tank design	84
4.1.2 SBR operation	87
4.1.3 Electrical equipment	87
4.1.4 Inlet pump float design.....	88
4.2 PROCESS DESIGN.....	90
4.2.1 Assumptions;	92
4.2.2 Reaction rate kinetics.....	92
4.2.3 Equations	93
5. SEQUENCING BATCH REACTOR OPERATION	96
5.1 INTRODUCTION.....	96
5.1.1 Biological conditions	96
5.1.1.1 Nutrient requirements.....	96
5.1.1.2 Oxygen	97
5.1.1.3 Alkalinity.....	97
5.1.1.4 pH effects on reaction rates	97
5.1.2 Physical conditions	98
5.1.2.1 Sludge settling	98
5.1.2.2 Foam production	98
5.1.2.3 Effluent withdrawal.....	99
5.2 STARTUP PROCEDURE	100
5.2.1 SBR cycle times	100
5.2.2 Analytical methods.....	102
5.3 RESULTS AND DISCUSSION	102
5.3.1 Mixed liquor suspended solids production	103
5.3.2 Sludge Volume Index.....	104
5.3.3 Alkalinity and pH	105
5.3.4 Nitrification performance	106
5.3.5 Phosphorus reduction	107
5.3.6 COD reduction.....	108
5.3.7 Foam formation.....	109
5.4 MAINTENANCE OF NITRIFICATION ACTIVITY	110
5.5 CONCLUSIONS	111
6. CYCLE MONITORING	112
6.1 INTRODUCTION.....	112

	viii
6.2 METHODS.....	113
6.2.1 <i>Sample collection</i>	113
6.2.2 <i>Sample Analysis</i>	113
6.3 RESULTS.....	115
6.3.1 <i>Cycle One</i>	115
6.3.1.1 Oxygen demand.....	115
6.3.1.2 Nitrification performance.....	116
6.3.2 <i>Cycle Two</i>	117
6.3.2.1 pH.....	117
6.3.2.2 Oxygen demand.....	118
6.3.2.3 Nitrification.....	120
6.3.2.4 Phosphorus.....	121
6.3.2.5 COD analysis.....	122
6.4 CONCLUSIONS.....	123
7. RECOMMENDATIONS.....	124
7.1 PROCESS DEVELOPMENT WORK.....	124
7.2 RESIDUAL COD INVESTIGATION.....	124
7.3 TOTAL SYSTEM FOR DAIRY EFFLUENT TREATMENT.....	125
8. CONCLUSIONS.....	126
9. REFERENCES.....	129
10. APPENDICES.....	141

List of Figures

Figure 1 SBR operational sequence (Metcalf & Eddy, 1991).....	16
Figure 2 Suggested SBR sequence for carbon, nitrogen and phosphorus removal (Metcalf & Eddy, 1991).....	21
Figure 3 Alkalinity of the yard and anaerobic pond effluents.....	54
Figure 4 Yard and anaerobic pond effluent pH.....	55
Figure 5 Ammonia concentrations for yard and anaerobic pond effluent.....	56
Figure 6 Nitrate nitrogen concentration for the yard and anaerobic pond effluents.....	56
Figure 7 Total Nitrogen for the yard and anaerobic pond effluents.....	57
Figure 8 Total phosphorus concentration for the yard and anaerobic pond effluents ...	59
Figure 9 Yard effluent Total and Soluble COD.....	60
Figure 10 Anaerobic pond effluent Total and Soluble COD.....	61
Figure 11 Yard effluent Carbonaceous BOD.....	62
Figure 12 Anaerobic pond effluent carbonaceous BOD.....	63
Figure 13 Yard and anaerobic pond effluent volatile fatty acid concentration.....	64
Figure 14 Yard effluent BOD profiles.....	65
Figure 15 Anaerobic pond effluent BOD profiles.....	66
Figure 16 Tsurumi 15 TR 2 aerator.....	75
Figure 17 Air flow and pressure drop though the venturi as a function of water flowrate.....	78
Figure 18 Theoretical pressure drop and actual pressure drop for a venturi aerator.....	79
Figure 19 Air flowrate as a function of depth.....	80
Figure 20 Evolution wastewater treatment SBR.....	85
Figure 21 Pilot scale SBR diagram.....	86
Figure 22 Pilot scale SBR on site.....	86
Figure 23 Pump and float combination on pond.....	89
Figure 24 SBR cycle times.....	100
Figure 25 Mixed liquor suspended solids concentration.....	103
Figure 26 Sludge Settling rate on day 35 of operation.....	104
Figure 27 pH during SBR startup.....	105
Figure 28 Alkalinity consumed during startup.....	106
Figure 29 Nitrogen species during startup.....	107
Figure 30 Phosphorus removal during the startup period.....	108
Figure 31 COD removal during SBR operation.....	109
Figure 32 Nitrogen concentration from day 51.....	110
Figure 33 Oxygen demand for first cycle analysis.....	115
Figure 34 Nitrogen species and phosphorus during monitoring of cycle one.....	116
Figure 35 pH of reactor contents during cycle two.....	117
Figure 36 Reactor dissolved oxygen concentration without aerator set point control	118
Figure 37 Reactor dissolved oxygen concentration with set point control of aerator.	119
Figure 38 Oxygen demand during cycle two.....	119
Figure 39 Total Kjeldahl Nitrogen during cycle two.....	120
Figure 40 Ammonia and Nitrate concentrations during cycle two.....	121
Figure 41 Total Phosphorus concentration during cycle two.....	122
Figure 42 COD concentration during cycle two.....	122

List of Tables

Table 1	Common operating strategies (Ketchum, 1996)	18
Table 2	Performance of SBR systems treating domestic wastewater	24
Table 3	Performance of SBR systems treating piggery wastewater	27
Table 4	Performance of SBR systems treating dairymshed wastewater	29
Table 5	Performance of an SBR system treating anaerobically treated wastewater	31
Table 6	Denitrification rates for different carbon sources	38
Table 7	VFA molecular weights	53
Table 8	Summary of carbon fractions in yard and anaerobic pond effluents.....	67
Table 9	Anaerobic pond effluent data	90
Table 10	BOD:TKN ratio effect on nitrifying bacterial fraction	92
Table 11	Estimated SBR stage times	94
Table 12	Summary of startup cycle times used and estimated times.....	101