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APPENDICES

APPENDIX A

Sequences of ammonia-oxidizing bacteria found in full-scale WWTPs

>AOB-I1-1

NGNNNATCCCTCAACTCAANGGGCNACGGATACAGTAGTTGGTCTGAGAGGACGACCAGCCACACTGGG
ACTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTGGGGAATTTTGGACAATGGGCGCAAGCCTGA
TCCAGCAATGCCGCGTGAGTGAAGAAGGCCTTCGGGTTGTAAAGCTCTTTTAGTTGAAAAGAAAAACA
GCGATTAATAATCGCTGTTATGACGGTATCAACAGAAAAAGCACCGGCTAACTACGTGCCAGCAGCCGC
GGTAATACGTAGGGTGCAGCGTTAATCGGAATTAAGGGTAAAGGGTGCAGGCGGTTTGTAAAG
TCAGATGTGAAATCCCCGGGCTTAACCTGGGAATTGCGTTTGAAGTACAAGGCTAGACCGGT

>AOB-I2-1

ANGNGCCNNTTACGCAAAGGCAATCTGAGCANTAGAAGGTCAGAGAGGACGGCCAACCACACTGGGACT
GAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTGGGGAATTTTGGACAATGGGCGAAAAGCCTGATCC
AGCCATGCCGCGTGAGTGAAGAAG3CCTTCGGGTTGTAAAGCTCTTTTAGTCGGAAAAGAAAGATTGCA
ATGAATAATTGTGATTTATGACGGTACCGACAGAAAAAGCACCGGCTAACTACGTGCCAGCAGCCGCGG
TAATACGTAGGGTGCAGCGTTAATCGGAATTAAGGGTAAAGGGTGCAGGCGGTTTGTAAAGTCA
AGATGTGAAAGCCCCGGGCTTAACCTGGGAATTGCGTTTGAAGTACAAGGCTAGA

>AOB-I3-1

NNNNNCNNTAACCAANGGCGACGACCACTAGCTGGTCTGAGAGGACGATCAGCCACACTGGGACTGAGA
CACGGCCCAGACTCCTACGGGAGGCAGCAGTGGGGAATTTTGGACAATGGGCGGAAAGCCTGATCCAGCA
ATGCCGCGTGAGTGAAGAAGGCCTTCGGGTTGTAAAGCTCTTTTAGTCGAGAAAGAAAAGGCTATGCCGA
ATAAGTATAGTTAATGACGGTATCGAAAGAAGAAGCACCGGCTAACTACGTGCCAGCAGCCGCGGTAAT
ACGTAGGGTGAAGCGTTAATCGGAATTAAGGGTAAAGGGTGCAGGCGGTTACTGTAAAGTCAGAT
GTGAAATCCCCGGGCTTAACCTGGGAATTGCGTTTGAAGTCAAGGCTAGACCGTTTGTAAAGTCA
TTCGAGGTTGGAAGTTCGGAGCTTGATATTTGAAGTTCGGTGTTTTGTCTGTGACGGG

>AOB-I3-2

TATNNGGGCCCTAACCAAGGCGACGATCAGTAGTTGGTCTGAGAGGACGACCAGCCACACTGGGACTGA
GACACGGCCCAGACTCCTACGGGAGGCAGCAGTGGGGAATTTTGGACAATGGGCGCAAGCCTGATCCAG
CAATGCCGCGTGAGTGAAGAAGGCCTTCGGGTTGTAAAGCTCTTTTAGTCGAGAAAGAAAAGGCTGCAGT
GAATAACTGTAGTTTATGACGGTATCGACAGAAGAAGCACCGGCTAACTACGTGCCAGCAGCCGCGGTA
ATACGTAGGGTGCAGCGTTAATCGGAATTAAGGGTAAAGGGTGCAGGCGGTTTGTAAAGTCAAG
ATGTGAAATCCCCGGGCTTAACCTGGGAATTGCGTTTGAAGTACAAGGCTAGACCGTTGGCCTTTGAA
ACTACCAAGGTAGGAGGGTCGAAATTTGAAGCTCCCACTTTTAGAGCTCTCGCAAAATTTGNN

>AOB-I4-1

TNTCGGAACGNATCATCGATNGTTGGGCGGAGAGGACCTACTGCCAAAACGGGACTGAAACACGGCTCA
TACTCCTACGGCAGGCCATGTGGGTAATTTTGGAGATGTGCCAAAAGATTGATCCAACACTGTGGCGAGA
GTGAGGAAGGCCTTCGGTTGCAACCGTGTTGAGTCGGAAAAGAAATATCTATAAAAAATATTTATAGA
GGATGACGGTACCGACATAAGAAGCACCGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGGTGC
AAGCGTTAATCGGAATTAATTTGGGCGTAAAGGGTGCAGGCGGTGCTGTAAGTCAGATGTGAAATCCCC
GGGCTTAACCTGGGAATTGCGTTTGAAGTACAAGGCTAGA

>AOB-LM1-1

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>AOB-LM1-2

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>AOB-LM1-1

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> AOB-LM2-1

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> AOB-LM3-1

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> AOB-LM3-2

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> AOB-LM4-1

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> AOB-SM1-1

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> AOB-SM4-1

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APPENDIX B

Sequences of ammonia-oxidizing archaea found in full-scale WWTPs

>AOA-I3-1

TTGTTGCAGTTAACAGTACGTTGCTAACAATCAACGCAGGAGATTACATCTTCTATACCGACTGGGCGTGG
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>AOA-I3-2

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>AOA-I3-3

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>AOA-I3-4

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>AOA-I3-5

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>AOA-I4-1

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>AOA-LM1-1

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>AOA-LM1-2

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>AOA-LM1-3

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>AOA-LM1-4

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>AOA-LM1-5

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>AOA-LM1-6

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>AOA-LM2-1

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>AOA-LM2-2

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>AOA-LM2-3

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>AOA-LM2-4

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>AOA-LM3-1

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>AOA-LM3-2

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>AOA-LM3-3

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>AOA-LM3-4

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>AOA-LM3-5

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>AOA-LM3-6

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>AOA-LM3-7

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>AOA-LM3-8

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>AOA-LM4-1

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>AOA-LM4-2

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>AOA-SM1-1

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>AOA-SM1-2

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>AOA-SM4-1

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>AOA-SM4-2

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>AOA-SM4-3

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>AOA-SM4-4

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>AOA-SM4-5

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>AOA-SM4-6

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>AOA-SM4-7

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>AOA-SM4-8

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>AOA-SM4-9

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>AOA-SM4-10

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CTGTTCCGGCGGTGACTGGTAGGAATGTCTTTACCATTGTTCAACATGGTAAACCTGATTACGGTCGCA
GACCCACTAGAAACGGCCTTTAAGTATCCAAGACCAACCTTACCACCATACACGACACCAATTGAACCG
CAAGTCGGAAAGTTCTATAACAGTCCGGTTGCGCTCGGTGCTGGTGCTGGTGCAGTTTTGGCATGTACT
TTCATGGCGTAGGGTTGTAACCTCAACACGTGG

APPENDIX C

Sequences of ammonia-oxidizing bacteria found in seed sludge and enriched NAS

>AOB-S-1

CAGGGGATCGAAAGACCTTATGCTTTTNGAGCGGCCGATGTCTGATTAGCTAGTTGGTAGGGTAATGGC
CTACCAAGGCGACGATCAGTAGTTGGTCTGAGAGGATGGCCAGCCACACTGGGACTGAGACACGGCCCA
GACTCCTACGGGAGGCAGCAGTGGGGAATTTTGGACAATGGGCGCAAGCCTGATCCAGCAATGCCGCGT
GAGTGAAGAAGGCCTTCGGGTTGTAAAGCTCTTTCAGTTGAGAGGAAAAGNTTGTGACTAATAATCACA
ATTTCATGACAGTATCAACAGAAGAAGCACC GGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGGT
GCAAGCGTTAATCGGAATTATTGGGCGTAAAGGGTGCGCAGGCGGTTCTGTAAGTCAGATGTGAAATCC
CCGGGCTTAACCTGGGAATTGCGTTTAAAA

>AOB-S-2

GGGGATCGAAAGACCTCGTGCTTTGAGNGTGGCCGATGTCTGATTAGCTAGTTGGTAGGGTAAAGGCCT
ACCAAGGCGACGATCAGTAGCTGGTCTGAGAGGACGATCAGCCACACTGGGACTGAGACACGGCCCA
CTCCTACGGGAGGCAGCAGTGGGGAATTTTGGACAATGGGCGAAAGCCTGATCCAGCCATGCCGCGTGA
GTGAAGAAGGCCTTCGGGTTGTAAAGCTCTTTCGGTTCGGAAGAAAATATCTATAAAAAATATTTATAGA
GGATGACGGTACCGACATAAGAAGCACC GGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGGTGC
AAGCGTTAATCGGAATTATTGGGCGTAAAGGGTGCGCAGGCGGTTGTGTAAGTCAGATGTGAAATCCCC
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>AOB-S-3

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TGAAGAAGGCCTTCGGGTTGTAAAGCTCTTTCGGTTCGGAAGAAAATATCTATAAAAAATATTTATAGAG
GATGACGGTACCGACATAAGAAGCACC GGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGGTGC
AGCGTTAATCGGAATTATTGGGCGTAAAGGGTGCGCAGGCGGTTGTGTAAGTCAGATGTGAAATCCCCG
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>AOB-NAS2-1

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CAGTGGGGAATTTTGGACAATGGGCGCAAGCCTGATCCAGCAATGCCGCGTGAGTGAAGAAGGCCTTCG
GGTTGTAAAGCTCTTTCAGTCGAGAAGAAAAGGCTGCAGTGAATAACTGTAGTTTATGACGGTATCGAC
AGAAGAAGCACC GGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGGTGCAGCGTTAATCGGAAT
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>AOB-NAS10-1

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CCATGCCGCGTGAGTGAAGAAGGCCTTCGGGTTGTAAAGCTCTTTTAGTCGAAAAGAAAGAGTCAATAGT
AAATAGCTATGATTTATGACGGTACCGACAGAAAAGCACC GGCTAACTACGTGCCAGCAGCCGCGGTA
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>AOB-NAS10-2

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gTTTATGACGGTATCGACAGAANAAGCACC GGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGGT
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CCCGGCTTAACCTGGGAATTGCGTTTAAAA

>AOB-NAS10-3

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ACAATGGGCGCAAGCCTGATCCAGCAATGCCGCGTGAGTGAAGAAGGCCTTCGGGTTGTAAAGCTCTTT
CAGTCGAGAAGAAAAGGCTGCAGTGAATAACTGTAGTTTATGACGGTATCGACAGAAGAAGCACC GGCT
AACTACGTGCCAGCAGCCGCGGTAATACGTAGGGTGCAGCGTTAATCGGAATTACTGGGCGTAAAGGG
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AA

>AOB-NAS30-1

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ATGCCCGGTGAGTGAAGAAGGCCCTTCGGGTTGTAAAGCTCTTTTAGTCGGAAAGAAAGAGTTGCAATGA
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TACGTAGGGTGCAGCGTTAATCGGAATTACTGGGCGTAAAGGGTGCAGCGGTTTTGCAAGTCAGA
TGTGAAAGCCCCGGCTTAACCTGGGAATTGCCTTTGAACTAC

APPENDIX D

Sequences of ammonia-oxidizing archaea found in seed sludge and enriched NAS

>AOA-S-1

TAACATCACGCAGGAGATTACATCTTCTACACAGACTGGATGTGGACCTCTTTTGTGGTATTCTCCGTC
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CCCGCATACATGACACCAATAGAGCCCCAGGTAGGTAAGTTCTACAACAGTCCGTGTAGCACTTGGTTCA
GGCGCAGGAGCAGTACTGACAGTCCCCATGGCAGCGTTGGGAGCAAACCTCAACACGTGGACATACAGA
TG

>AOA-S-2

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CCCGCATACATGACACCAATAGAGCCCCAGGTAGGTAAGTTCTACAACAGTCCGTGTAGCACTTGGTTCA
GGCGCAGGAGCAGTACTGACAGTCCCCATGGCAGCGTTGGGAGCAAACCTCAACACGTGGACATACAGA
TG

>AOA-S-3

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AT

>AOA-S-4

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GA

>AOA-S-5

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TG

>AOA-S-6

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GA

>AOA-NAS2-1

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AT

>AOA-NAS2-2

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- 2001 - 2005 B.Sc. in Biochemistry, Faculty of Science, Chulalongkorn University, Thailand

Work experience and Position

- 2005 – 2006 Assistant researcher, Shrimp Molecular Biology and Genomic Research Laboratory, Department of Biochemistry, Faculty of Science, Chulalongkorn University, Thailand

International presentations

- Sonthiphand P. and Limpiyakorn T. Evidence of Ammonia-oxidizing Archaea in Municipal Full-scale Wastewater Treatment Plants in Bangkok. The 6th International Symposium on Southeast Asian Water Environment, Bandung, Indonesia, October 29-31, 2008.
- Sonthiphand P. and Limpiyakorn T. Effect of Ammonium Loads on Communities of Ammonia-oxidizing Bacteria and Archaea in Laboratory-scale Continuous Flow Reactors. The 6th International Symposium on Southeast Asian Water Environment, Bandung, Indonesia, October 29-31, 2008.
- Sonthiphand P. and Limpiyakorn T. Distribution of ammonia-oxidizing bacteria and archaea in full-scale wastewater treatment plants in Thailand. 11th International Conference on Environmental Science and Technology, September 3-5, 2009

Journal publications

- Sonthiphand P. and Limpiyakorn T. Effect of Ammonium Loads on Communities of Ammonia-oxidizing Bacteria and Archaea in enriched nitrifying activated sludge. (in preparation 60% completed submitted to **Applied and environmental microbiology** in **June 2009**)
- Sonthiphand P. and Limpiyakorn T. Evidence of ammonia-oxidizing bacteria and archaea in full – scale municipal wastewater treatment plants in Bangkok. (in preparation submitted to **FEMS Microbiology Ecology** in **September 2009**)
- Sonthiphand P. and Limpiyakorn T. Communities of ammonia-oxidizing bacteria and archaea in full – scale industrial wastewater treatment plants. (in preparation submitted to **Applied and environmental microbiology** in **November 2009**)

