

## **CHUL PARK**

Associate Professor

Department of Civil and Environmental Engineering

University of Massachusetts Amherst

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### **Education**

Ph.D. Civil Engineering, Virginia Tech, 2007

M.S. Environmental Engineering, Virginia Tech, 2002

B.S. Environmental Engineering, Yeungnam University, 2000

Study Abroad Scholar. Civil Engineering, Washington State University, 1998-99

### **Professional Experience**

Associate Professor, Department of Civil and Environmental Engineering, University of Massachusetts Amherst, Sep 2013-present

Visiting Researcher, INRA, Laboratoire de Biotechnologie de l'Environnement (LBE), France, Dec 2013-Aug 2014

Assistant Professor, Department of Civil and Environmental Engineering, University of Massachusetts Amherst, Sep 2007-Aug 2013

Graduate Instructor, Virginia Tech, Spring 2007

Graduate Research Assistant, Virginia Tech, 2001-2006

### **Registration**

Engineer in Training, Virginia, 2008

### **Research Interests**

- Biological water and wastewater treatment
- Recovery of energy and nutrients in wastewater
- Developing novel wastewater treatment processes
- Sanitation in developing countries
- Anaerobic digestion
- Effluent nitrogen and algal blooms in estuarine and coastal systems
- Microbial granulation
- Extracellular polymeric substances and soluble microbial products in bioaggregates

### **Teaching**

- CEE 370 Environmental Engineering Principles
- CEE 471 Water and Wastewater Systems
- CEE 476/575 Solid and Hazardous Waste Management
- CEE 671 Biological Processes in Environmental Engineering

### **Patents**

- Park, C. and Dolan, S. (pending, PCT published in 2015) Algal-sludge granule for wastewater treatment and bioenergy feedstock generation, WO 2015112654 A3.
- Park, C. and Chon, D.H. (2016) Wastewater treatment system to reduce sludge generation. US Patent 9422178.

## Honors & Awards

- MassCEC Catalyst Program Award, Massachusetts Clean Energy Center, 2016
- Manning Proof of Concept Fund Award, University of Massachusetts Amherst, 2015
- Paul L. Busch Award, Water Environment Research Foundation, 2013
- Commercial Ventures & Intellectual Property Technology Development Award, The President's Office, University of Massachusetts, 2010
- Graduate Research & Development Program Award, Virginia Tech, 2006
- Sussman Fellowship, Edna Bailey Sussman Foundation, 2004
- Paul E. Torgersen Research Excellence Award, Virginia Tech, 2003
- International Exchange Program Scholarship, Yeungnam University, 1998

## Advisee Students Honors & Awards

- Ahmed Abouhend, 2015-2016, Egyptian National Student Fellowship, Egypt
- W. Camilla Kuo-Dahab, 2015-2016, STEM Chateaubriand Fellowship, Embassy of France in the U.S.; nine-month visiting research at INRA-LBE, France
- Adam McNair, 2015, Massachusetts Water Resources Research Center Student Travel Scholarship; one-week visiting research at University of Hawaii
- W. Camilla Kuo-Dahab, 2014, Best Poster Award (Investigating anaerobic co-digestion of sewage sludge and food waste using a bench-scale pilot study), Annual Conference NEWEA Student Poster Competition

## Refereed Journal Publications

1. Park, C., Sheppard, D., Yu, D., Dolan, S., Eom, H., Brooks, J., Borgatti, D. (2016) Comparative assessment on the influences of effluents from conventional activated sludge and biological nutrient removal processes on algal bloom in receiving waters. *Environmental Engineering Research* 21(3), 276-283.
2. Kim, D.H., Lee, M.K., Hwang, Y., Lim, W.T., Yune, Y.M., Park, C., and Kim, M.S. (2016) Microbial granulation for lactic acid production. *Biotechnology and Bioengineering* 113, 101-111.
3. Park, C. and Chon, D.H. (2015) High-rate anaerobic side-stream reactor (ASSR) processes to minimize the production of excess sludge. *Water Environment Research* 87, 2090-2097.
4. Wang, M. and Park, C. (2015) Investigation of anaerobic digestion of *Chlorella* sp. and *Micractinium* sp. grown in high-nitrogen wastewater and their co-digestion with waste activated sludge. *Biomass and Bioenergy* 80, 30-37.
5. Wang, M., Kuo-Dahab, W.C., Dolan, S., and Park, C. (2014) Kinetics of nutrient removal and expression of extracellular polymeric substances of microalgae, *Chlorella* sp. and *Micractinium* sp., in wastewater treatment. *Bioresource Technology* 154, 131-137.
6. Nguyen, L.N., Hai, F.I., Nghiem, L.D., Kang, J., Price, W.E., Park, C., Yamamoto, K. (2014) Enhancement of removal of trace organic contaminants by powdered activated carbon dosing into membrane bioreactors. *Journal of the Taiwan Institute of Chemical Engineers* 45(2), 571-578.
7. Baek, K., Wang, M., McKeever, R., Rieber, K., Park, C., and Nüsslein, K. (2014) Biodegradation of low concentration of 1,2-Dibromoethane in groundwater is enhanced by phenol. *Applied Microbiology and Biotechnology* 98, 1329-1338.
8. Wang, M., Sahu, A.K., Rusten, B., and Park, C. (2013) Anaerobic co-digestion of microalgae *Chlorella* sp. and waste activated sludge. *Bioresource Technology* 142, 585-590.
9. Lee, J.W., Jutidamrongphan, W., Park, K.Y., Moon, S., and Park, C. (2012) Advanced treatment of wastewater from food waste disposer in modified Ludzack-Ettinger type membrane bioreactor. *Environmental Engineering Research* 17(2), 59-63.
10. Baek, K., McKeever, R., Rieber, K., Sheppard, D., Park, C., Ergas, S.J., Nüsslein, K. (2012) The potential for aerobic cometabolism of 1,2-dibromoethane in contaminated groundwater. *Bioresource Technology* 123, 207-213.

11. Kim, Y.M., Chon, D.H., Kim, H.S., and Park, C. (2012) Investigation of bacterial community in activated sludge with an anaerobic side-stream reactor (ASSR) to decrease the generation of excess sludge. *Water Research* 46, 4292-4300.
12. Yuan, X., Wang, M., Park, C., Sahu, A.K., and Ergas, S.J. (2012) Microalgae growth using high strength wastewater followed by anaerobic co-digestion. *Water Environment Research* 84(5), 396-404.
13. McKeever, R., Sheppard, D., Nüsslein, K., Baek, K., Rieber, K., Ergas, S.J., Forbes, R., Hilyard, M., and Park, C. (2012) Biodegradation of ethylene dibromide (1,2-Dibromoethane [EDB]) in microcosms simulating in situ and biostimulated conditions. *Journal of Hazardous Materials* 209-210, 92-98.
14. Chon, D.H., Rome, M., Kim, Y.M., Park, K.Y., and Park, C. (2011) Investigation of the sludge reduction mechanism in the anaerobic side-stream reactor process using several control biological wastewater treatment processes. *Water Research* 45, 6021-6029.
15. Chon, D.H., Rome, M., Kim, H.S., and Park, C. (2011) Investigating the mechanism of sludge reduction in activated sludge with an anaerobic side-stream reactor. *Water Science and Technology* 63(1), 93-99.
16. Kim, J., Park, C., and Novak, J.T. (2011) Combination of coagulating agents, alum and cationic polymer, for sludge dewatering and odors. *Korean Society of Civil Engineers Journal of Civil Engineering* 15(3), 447-451.
17. Kim, Y.M., Lee, D.S., Park, C., Park, D., and Park, J.M. (2011) Effects of free cyanide on microbial communities and biological carbon and nitrogen removal performance in the industrial activated sludge process. *Water Research* 45, 1267-1279.
18. Kim, Y.M., Cho, H.U., Lee, D.S., Park, C., Park, D., and Park, J.M. (2011) Response of nitrifying bacterial communities to the increased thiocyanate concentration in pre-denitrification process. *Bioresource Technology* 102(2), 913-922.
19. Gu, A., Nerenberg, R., Sturm, B.M., Park, C., and Goel, R. (2010) Molecular methods in biological systems. *Water Environment Research* 82, 908-930.
20. Baek, K.H., Park, C., Oh, H.M., Yoon, B.D., and Kim, H.S. (2010) Diversity and abundance of ammonia-oxidizing bacteria in activated sludge treating different types of wastewater. *Journal of Microbiology and Biotechnology* 20(7), 1128-1133.
21. Westgate, P. and Park, C. (2010) Evaluation of proteins and organic nitrogen in wastewater treatment effluents. *Environmental Science and Technology* 44, 5352-5357.
22. Park, C., Fang, Y., Murthy, S.N., and Novak, J.T. (2010) Effects of floc aluminum on activated sludge characteristics and removal of 17- $\alpha$ -ethinylestradiol in wastewater treatment systems. *Water Research* 44, 1335-1340.
23. Ostendorf, D., Park, C., Rotaru, C., and Pereira, M. (2009) A case study of steady oxygen concentration gradients in a groundwater plume from a highway infiltration basin. *ASCE Journal of Environmental Engineering* 135, 1237-1243
24. Park, C. and Novak, J.T. (2009) Characterization of lectins and bacterial adhesins in activated sludge flocs. *Water Environment Research* 81, 755-764.
25. Park, C. and Helm, R.F. (2008) Application of metaproteomic analysis for studying extracellular polymeric substances (EPS) in activated sludge flocs and their fate in sludge digestion. *Water Science and Technology* 57, 2009-2015.
26. Park, C., Helm, R.F., and Novak, J.T. (2008) Investigating the fate of activated sludge exocellular proteins in sludge digestion using sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). *Water Environment Research* 80, 2219-2227.
27. Park, C., Novak, J.T., Helm, R.F., Ahn, Y., and Esen, A. (2008) Evaluation of the extracellular proteins in full-scale activated sludges. *Water Research* 42, 3879-3889.
28. Novak, J.T., Park, C., Higgins, M.J., Chen, Y.-C., Morton, R., Gary, D., Forbes, R., and Erdal, Z. (2007) Impacts of the MicroSludge™ process on odor causing compounds in anaerobically digested biosolids. *Water Practice* 1.

29. Park, C. and Novak, J.T. (2007) Characterization of activated sludge exocellular polymers using several cation-associated extraction methods. *Water Research* 41, 1679-1688.
30. Park, C., Muller, C.D., Abu-Orf, M.M., and Novak, J.T. (2006) The effect of wastewater cations on activated sludge characteristics: effects of aluminum and iron in floc. *Water Environment Research* 78, 31-40.
31. Park, C., Abu-Orf, M.M., and Novak, J.T. (2006) The digestibility of waste activated sludges. *Water Environment Research* 78, 59-68.
32. Novak, J.T., Park, C., and Abu-Orf, M.M. (2005) Conditioning and dewatering of digested waste activated sludges-Closure. *Journal of Residuals Science and Technology* 2, 110-112.
33. Novak, J.T. and Park, C. (2004) Chemical conditioning of sludge. *Water Science and Technology* 49, 73-80.
34. Novak, J.T., Park, C., and Abu-Orf, M.M. (2004) Conditioning and dewatering of digested waste activated sludges. *Journal of Residuals Science and Technology* 1, 45-51.
35. Abu-Orf, M.M., Muller, C.D., Park, C., and Novak, J.T. (2004) Innovative technologies to reduce water content of dewatered municipal residuals. *Journal of Residuals Science and Technology* 1, 83-91.

### Conference Proceedings

1. Abouhend, A., Butler, C., El-Moselhy, K.M., and Park, C. (2016) The oxygenic photogranule (OPG) for aeration-free and energy-recovery wastewater treatment process. Oral presentation and conference proceeding, Water Environment Federation 89th Annual Technical Exhibition and Conference (WEFTEC 2016), New Orleans, LA.
2. Park, C., Sauvenheav, L., Sialve, B., and Carrère, H. (2015) The anaerobic digestibility of algal-sludge granules. Oral presentation and conference proceeding, Water Environment Federation Residual and Biosolids Conference, Washington D.C.
3. Kuo-Dahab, W.C., Amirhor, P., Zona, M., Duest, D., and Park, C. (2014) Anaerobic co-digestion of food waste and sewage sludge. Oral presentation and conference proceeding, Water Environment Federation 87th Annual Technical Exhibition and Conference (WEFTEC 2014), New Orleans, LA.
4. Kuo-Dahab, W.C., Amirhor, P., Zona, M., Duest, D., and Park, C. (2014) Investigation of anaerobic co-digestion of sewage sludge and food waste using a bench-scale pilot study. Oral presentation and conference proceeding, Water Environment Federation 28th Annual Residuals and Biosolids Management Conference, Austin, TX.
5. Wang, M., W.C. Kuo-Dahab, and Park, C. (2013) Investigation of characteristics of microalgae grown in different wastewater and their enhancing anaerobic digestibility of waste activated sludge. Oral presentation and conference proceeding, Water Environment Federation 86th Annual Technical Exhibition and Conference (WEFTEC 2013), Chicago, IL.
6. Eom, H., Brennan, A., Watt, C., Chon, D.H., and Park, C. (2013) Performance of a pilot-scale high-rate anaerobic side-stream reactor (ASSR) process: minimized sludge production and generation of biogas. Oral presentation and conference proceeding, Water Environment Federation 86th Annual Technical Exhibition and Conference (WEFTEC 2013), Chicago, IL.
7. Brennan, A., Eom, H., Watt, C., Chon, D.-H., and Park, C. (2013) Achieving biogas generation and minimized sludge production using a high-rate anaerobic side-stream reactor (ASSR) process - pilot study. Oral presentation and conference proceeding, Water Environment Federation 27th Annual Residuals and Biosolids Management Conference, Nashville, TN.
8. Park, C., Sheppard, D., Yu, D., Dolan, S., Eom, H., Brooks, J., and Borgatti, D. (2012) Laboratory investigation on the influences of field BNR and CAS effluents on algal bloom in Connecticut River and Long Island Sound. Oral presentation and conference proceeding, Water Environment Federation 85th Annual Technical Exhibition and Conference (WEFTEC 2012), New Orleans, LA.
9. Chon, D.H. and Park, C. (2012) Activated sludge with a novel high rate anaerobic side-stream reactor (ASSR) for sludge reduction and biogas generation. Oral presentation and conference

- proceeding, Water Environment Federation 85th Annual Technical Exhibition and Conference (WEFTEC 2012), New Orleans, LA.
10. Wang, M., Zhu, Z., Dolan, S., and Park, C. (2012) Investigation of algal cultivation and anaerobic co-digestion of sewage sludge and algae at wastewater treatment plant (WWTP). Oral presentation and conference proceeding, Water Environment Federation 85th Annual Technical Exhibition and Conference (WEFTEC 2012), New Orleans, LA.
  11. Wang, M., Zhu, Z., Dolan, S., and Park, C. (2012) Cultivation and anaerobic co-digestion of microalgae for wastewater treatment systems. Oral presentation and conference proceeding, International Water Association (IWA) Water Congress, Busan, Korea.
  12. Chon, D.H., Rome, M., Park, K.Y., and Park, C. (2012) Investigation of a new anaerobic side-stream reactor process for sludge reduction in biological wastewater treatment. Oral presentation and conference proceeding, International Water Association (IWA) Water Congress, Busan, Korea.
  13. Wang, M. and Park, C. (2012) Improving the digestibility of green algae by anaerobic co-digestion with waste activated sludge. Oral presentation and conference proceeding, Water Environment Federation 26th Annual Residuals and Biosolids Management Conference, Raleigh, NC.
  14. Chon, D.H. and Park, C. (2012) Investigation of a new anaerobic side-stream reactor (ASSR) process for sludge reduction in biological wastewater treatment. Oral presentation and conference proceeding, Water Environment Federation 26th Annual Residuals and Biosolids Management Conference, Raleigh, NC.
  15. Teague, P., Wang, M. and Park, C. (2011) Predicting the digestibility of sludge using EPS analysis. Oral presentation and conference proceeding, Water Environment Federation 84th Annual Technical Exhibition and Conference (WEFTEC 2011), Los Angeles, CA.
  16. Chon, D.H., Rome, M., Park, K.Y., and Park, C. (2011) Investigation of sludge reduction in the activated sludge system with a high rate short SRT anaerobic side-stream reactor. Oral presentation and conference proceeding, Water Environment Federation 25th Annual Residuals and Biosolids Management Conference, Sacramento, CA.
  17. Chon, D.H., Rome, M., Kim, H.S., and Park, C. (2010) Biological solids reduction in activated sludge with an anaerobic side-stream reactor. Oral presentation and conference proceeding, Water Environment Federation 83rd Annual Technical Exhibition and Conference (WEFTEC 2010), New Orleans, LA.
  18. Wang, M., Teague, P., and Park, C. (2010) Effects of feeding patterns on extracellular polymer substances (EPS) and digestibility of activated sludge. Poster presentation and conference proceeding, Water Environment Federation 83rd Annual Technical Exhibition and Conference (WEFTEC 2010), New Orleans, LA.
  19. Yuan, X., Wang, M., Park, C., Sahu, A.K., and Ergas, S.J. (2010) Microalgae growth using high strength wastewater followed by anaerobic co-digestion. Oral presentation and conference proceeding, Water Environment Federation 83rd Annual Technical Exhibition and Conference (WEFTEC 2010), New Orleans, LA.
  20. Chon, D.H., Rome, M., Kim, H.S., and Park, C. (2010) Investigating the mechanism of sludge reduction in activated sludge with an anaerobic side-stream reactor. Oral presentation and conference proceeding, International Water Association (IWA) Water Congress, Montreal, Canada.
  21. Wang, M., Teague, P., and Park, C. (2010) Effects of activated sludge reactor and EPS on anaerobic digestion and sludge pretreatment. Oral presentation and conference proceeding, Water Environment Federation 24th Annual Residuals and Biosolids Management Conference, Savannah, GA.
  22. Chon, D.H., Kim, H.S., and Park, C. (2010) The comparison of biological sludge reduction processes. Oral presentation and conference proceeding, Water Environment Federation 24th Annual Residuals and Biosolids Management Conference, Savannah, GA.
  23. Park, C., Nüsslein, K., Teague, P., and Wang, M. (2009) Effects of feeding patterns on activated sludge characteristics and its digestibility in anaerobic digestion. Oral presentation and conference

- proceeding, Water Environment Federation 82nd Annual Technical Exhibition and Conference (WEFTEC 2009), Orlando, FL.
24. Westgate, P. and Park, C. (2009) Evaluation of effluent proteins: toward characterizing effluent organic nitrogen. Poster presentation and conference proceeding, Water Environment Federation 82nd Annual Technical Exhibition and Conference (WEFTEC 2009), Orlando, FL.
  25. Park, C., Nüsslein, K., Zhang, C., Teague, P., and Wang, M. (2009) Effects of feeding conditions on activated sludge characteristics and anaerobic digestion. Oral presentation and conference proceeding, Water Environment Federation 23rd Annual Residuals Biosolids Management Conference, Portland, OR.
  26. Park, C. and Novak, J.T. (2008) Characterization of lectins and bacterial adhesins in activated sludge flocs. Oral presentation and conference proceeding, Water Environment Federation 81th Annual Technical Exhibition and Conference (WEFTEC 2008), Chicago, IL.
  27. Park, C. and Helm, R.F. (2008) Application of metaproteomic analysis for studying extracellular polymeric substances (EPS) in activated sludge flocs and their fate in sludge digestion. Oral presentation and conference proceeding, International Water Association (IWA) Water Congress, Vienna, Austria.
  28. Park, C. and Novak, J.T. (2007) Investigating the fate of activated sludge exocellular proteins in sludge digestion using sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). Oral presentation and conference proceeding, Water Environment Federation 80th Annual Technical Exhibition and Conference (WEFTEC 2007), San Diego, CA.
  29. Novak, J.T., Park, C., Higgins, M.J., Chen, Y.-C., Morton, R., Gary, D., Forbes, R., and Erdal, Z. (2007) WERF Odor study phase III: Impacts of the microsludge process on odor causing compounds. Oral presentation and conference proceeding, Water Environment Federation 21st Annual Residuals Biosolids Management Conference, Denver, CO.
  30. Muller, C.D., Park, C., Verma, N., and Novak, J.T. (2007) The influence of anaerobic digestion on centrifugally dewatered biosolids odors. Oral presentation and conference proceeding, Water Environment Federation 21st Annual Residuals Biosolids Management Conference, Denver, CO.
  31. Verma, N., Park, C., Novak, J.T., Erdal, Z., Forbes, B., and Morton, R. (2006) Effects of anaerobic digester sludge age on odors from dewatered biosolids. Oral presentation and conference proceeding, Water Environment Federation 79th Annual Technical Exhibition and Conference (WEFTEC 2006), Dallas, TX.
  32. Park, C., Abu-Orf, M.M., and Novak, J.T. (2006) Investigation of extracellular polymeric substances in activated sludge flocs; their structural links with key floc cations and fates in sludge digestion. Oral presentation and conference proceeding, International Water Association (IWA) Specialized Conference-Sustainable sludge management: state of the art, challenges and perspectives, Moscow, Russia.
  33. Park, C., Abu-Orf, M.M., and Novak, J.T. (2005) Activated sludge extracellular polymeric substances extracted by different cation-targeted extraction methods: their key roles in floc structure and sludge digestibility. Poster presentation and conference proceeding, International Water Association (IWA) 3rd Leading Edge Conference on Water and Wastewater Treatment Technology, Sapporo, Japan.
  34. Park, C. and Novak, J.T. (2005) Characterization of floc structure using different extraction methods. Oral presentation and conference proceeding, Water Environment Federation 19th Annual Residuals Biosolids Management Conference, Nashville, TN.
  35. Park, C., Abu-Orf, M.M., and Novak, J.T. (2004) Analysis of floc structure and predicting sludge digestibility using different cation-associated EPS extraction methods. Oral presentation and conference proceeding, Water Environment Federation 77th Annual Technical Exhibition and Conference (WEFTEC 2004), New Orleans, LA.
  36. Abu-Orf, M.M., Laquidara, M., Muller, C.D., Park, C., and Novak, J.T. (2004) Adjusting floc cations to improve effluent quality: the case of aluminum addition at Sioux City wastewater

- treatment facility. Oral presentation and conference proceeding, Water Environment Federation 77th Annual Technical Exhibition and Conference (WEFTEC 2004), New Orleans, LA.
37. Holbrook, R.D., Wagner, M., Mahoney, C., Wight, S., Park, C., and Novak, J.T. (2004) Investigating the structure of activated sludge flocs: morphologic and compositional characterization of surface and bulk components. Oral presentation and conference proceeding, Water Environment Federation 77th Annual Technical Exhibition and Conference (WEFTEC 2004), New Orleans, LA.
  38. Novak, J.T. and Park, C. (2003) Chemical conditioning of sludge. Oral presentation and conference proceeding, International Water Association (IWA)-International Conference on Wastewater Sludge as a Resource - Biosolids 2003, Trondheim, Norway.
  39. Park, C., Abu-Orf, M.M., and Novak, J.T. (2003) Predicting the digestibility of waste activated sludges using cation analysis. Oral presentation and conference proceeding, Water Environment Federation 76th Annual Technical Exhibition and Conference (WEFTEC 2003), Los Angeles, CA.

### **Sponsored Research Projects**

1. Oxygenic Photogranules for Energy Efficient Wastewater Treatment. 2016 MassCEC Catalyst Program Award. **PI**, Aug 2016-July 2017, \$40,000, Massachusetts Clean Energy Center.
2. GOALI: Advancing the oxygenic photogranule process for energy positive wastewater treatment. **PI** (Co-PIs: Caitlyn Butler, Christopher Wilson), June 2016-May 2019, \$330,000, National Science Foundation.
3. Recovery of energy from wastewater using algae-sludge granules. Manning Proof of Concept Fund Award. **PI**, June 2015-Aug 2016, \$45,000, UMass Amherst.
4. Integration of industrial effluents treatment and biofuel production by using microalgal-bacterial consortium: Mr. Ahmed Salah Abdelmongy Abouhend's visiting research at UMass Amherst. **PI**, Feb 2015-Jan 2016, \$4,500, The Egyptian Cultural & Educational Bureau - Embassy of Egypt in the U.S.
5. Removal of water-borne pathogens and heavy metals using novel biogranules. **PI** (Co-PI: Yasu Morita), Mar 2015-Feb 2016, \$13,500, U.S Geological Survey's Water Resources Annual Institute Program from the Massachusetts Water Resources Research Center.
6. MRI: Acquisition of a versatile high resolution MS system for determination of small molecules of environmental and health concern. **Co-PI** (PI: David Reckhow; other Co-PIs: John Tobiason, Caitlyn Butler), Sep 2014-Aug 2016, \$455,000, National Science Foundation.
7. Water innovation network for sustainable small systems. **Co-PI** (PI: David Reckhow; other Co-PIs: John Tobiason, Caitlyn Butler et al.), Jul 2014-June 2017, \$4,100,000, US Environmental Protection Agency.
8. Algal-sludge granules: an innovative wastewater treatment and energy recovery process. 2013 Paul L. Busch Award. **PI**, Oct 2013, \$100,000, Water Environment Research Foundation.
9. Elucidating novel algal-sludge granules for wastewater treatment and biomethane feedstock generation. **PI** (Co-PI: Caitlyn Butler), Sept 2013-Aug 2016, \$334,606, National Science Foundation.
10. Evaluating the effect of upgrading wastewater treatment systems to BNR processes on algal blooms in Long Island Sound. **PI**, July 2013-June 2014, \$20,000, Springfield Water and Sewer Commission.
11. Anaerobic co-digestion of sewage sludge and food wastes. **PI**, Oct 2012-Nov 2013, \$47,108, Massachusetts Water Resources Authority (subcontract through Fay, Spofford & Thorndike).
12. The impact of upgrading municipal wastewater treatment facilities for nitrogen removal on Long Island Sound. **PI**, June 2012-May 2013, \$25,000, Springfield Water and Sewer Commission.
13. Elucidating the impact of upgrading wastewater treatment for nitrogen removal on eutrophication and algal bloom in Long Island Sound. Graduate student project. **PI** (Graduate student: Heonseop Eom), Apr 2012-Mar 2013, \$5,000, U.S Geological Survey's Water Resources Annual Institute Program from the Massachusetts Water Resources Research Center.

14. Assessing the effect of effluent nitrogen released from Western Mass WWTPs on Long Island Sound. **PI**, June 2011-May 2012, \$30,000, Springfield Water and Sewer Commission.
15. Enhanced natural attenuation of ethylene dibromide (1,2-Dibromoethane [EDB]) at MMR. **PI** (Co-PI: Klaus Nüsslein), Apr 2011-Mar 2012, \$135,246, The Air Force Center for Engineering and the Environment.
16. Investigation of advanced adsorbent for arsenic and phosphorous removal. **Co-PI** (PI: John Tobiason), Aug 2010-May 2012, \$94,054, Korea Association of Industry, Academy, and Research Institute (subcontract through Dankook University).
17. Natural attenuation of ethylene dibromide (1,2-Dibromoethane [EDB]) at MMR II. **PI** (Co-PI: Klaus Nüsslein), Sep 2010-Jan 2011, \$53,971, The Air Force Center for Engineering and the Environment.
18. Assessing the effects of conventional and advanced nitrogen removal wastewater treatment on receiving water eutrophication. **PI**, Jul 2010-May 2011, \$25,000, Springfield Water and Sewer Commission.
19. Pilot-scale operation of algae photobioreactor and anaerobic digester at Frevar, Fedrikstad, Norway. **PI**, June 2010-Sep 2010, \$20,072, Aquateam.
20. A new sludge and nutrient reduction method for wastewater treatment. CVIP Technology Development Award. **PI**, Apr 2010, \$25,000, University of Massachusetts.
21. Fate of non-regulated DBPs in distribution systems. **Co-PI** (PI: Dave Reckhow, Co-PI: William Mitch), May 2010-Apr 2012, \$399,127, Water Research Foundation.
22. A sustainable process to capture and store CO<sub>2</sub> to increase production of renewable bioenergy. **PI** (Co-PI: Sarina Ergas), Oct 2009-Sep 2012, \$144,771, Norwegian Research Council (subcontract through Biowater Technology).
23. Natural attenuation of ethylene dibromide (1,2-Dibromoethane [EDB]) at MMR. **PI** (Co-PIs; Sarina Ergas and Klaus Nüsslein), Jul 2009-June 2010, \$183,111, The Air Force Center for Engineering and the Environment.
24. Assessing the transport and fate of effluent organic nitrogen in the Connecticut River and Long Island Sound using mass-mapping proteomics technology. **PI**, Apr 2009-Mar 2010, \$30,000, Springfield Water and Sewer Commission.
25. Assessing the transport and fate of effluent organic nitrogen in the Connecticut River and Long Island Sound using mass-mapping proteomics technology. **PI**, Apr 2009- Mar 2010, \$30,000, U.S Geological Survey's Water Resources Annual Institute Program from the Massachusetts Water Resources Research Center.
26. Phenotypic characteristics of activated sludge generated under different feeding conditions and implications for wastewater treatment performance and sludge treatment. Faculty Research Grant/Healey Endowment Grant. **PI**, Sep 2008-Aug 2009, \$15,000, UMass Amherst.
27. Characterization of wastewater effluent from Western Massachusetts publicly owned treatment works using metaproteomic analysis. Graduate student project. **PI** (Graduate student: Pamela Westgate), Apr 2007-Mar 2008, \$5,000, U.S Geological Survey's Water Resources Annual Institute Program from the Massachusetts Water Resources Research Center.

## **Student Advising**

### *Committee Chair*

1. Joseph Gitau Gikonyo (Ph.D. student; co-advised by Dr. John Tobiason), Research topic: Oxygenic photogranules
2. Ahmed S. Abouhend (Ph.D. student), Research topic: Oxygenic photogranules
3. Abeera S. Ansari (Ph.D. candidate), Research topic: Oxygenic photogranules
4. Camilla Kuo-Dahab (Ph.D. candidate), Research topic: Oxygenic photogranules
5. Adam McNair (M.S. student), Research topic: Oxygenic photogranules



6. Heonseop Eom (Ph.D. 2016), PhD Dissertation: Investigation of effluent nitrogen derived from conventional activated sludge (CAS) and biological nutrient removal (BNR) systems and its impact on algal growth in receiving waters
7. Meng Wang (Ph.D. 2013): currently Postdoc at University of South Florida, PhD Dissertation: Investigation of microalgae cultivation and anaerobic co-digestion of algae and sewage sludge for wastewater treatment facilities
8. Dong-Hyun Chon (Ph.D. 2012): currently at Environmental Business Specialists, LLC, PhD Dissertation: Investigation of excess sludge reduction by an anaerobic side-stream reactor (ASSR): the role of EPS and enzymes in sludge floc
9. Chris Watt (M.S. 2015): currently at Blueleaf Incorporated, MS Thesis: Using novel algae-sludge granules in sequencing batch reactors to treat wastewater
10. Arianne Bazilio (M.S. 2012): currently PhD student at UMass Amherst, MS Thesis: Biodegradation of disinfection by-products in drinking water systems
11. Aaron Brennan (M.S. 2012): currently at Woodard & Curran, MS Thesis: Investigating pilot scale performance of an activated sludge wastewater treatment system with a high rate anaerobic side stream reactor
12. Dongke Yu (M.S. 2011): currently at Yu & Associates, MS Thesis: Evaluation of effluent organic nitrogen and its impacts on receiving water bodies
13. Diane Sheppard (M.S. 2011): currently at Hazen and Sawyer, MS Thesis: An evaluation of the effects of wastewater treatment plant effluent in eutrophication in receiving waters
14. Philip Teague (M.S. 2011): currently at Jones and Henry Engineering, MS Thesis: The role of substrate gradient in determining EPS generation, sludge properties, and the anaerobic digestibility of activated sludge
15. Robert McKeever (M.S. 2011): currently at AECOM, MS Thesis: Biodegradation of ethylene dibromide (EDB) under in situ and biostimulated conditions at MMR
16. Pamela Westgate (M.S. 2009): currently at S E A/Kleinfelder Consultants, MS Thesis: Characterization of proteins in effluents from three wastewater treatment plants that discharge to the Connecticut River

#### *Committee Member*

1. Kristie Stauch-White (M.S. 2016; Chair: Caitlyn Butler)
2. Joshua Jack (M.S. 2015; Chair: Caitlyn Butler)
3. Chen Wu (M.S. 2012; Chair: Dave Reckhow)
4. Camelia Rotaru (Ph.D. 2012; Chair: Dave Ostendorf)
5. Zachary Monge (M.S. 2010; Chair: Erik Rosenfeldt)
6. Xin Yuan (M.S. 2010; Chair: Sarina Ergas)
7. Matt Hross (M.S. 2010; Chair: Erik Rosenfeldt)
8. Marina Pereira (M.S. 2008; Chair: Dave Ostendorf)
9. Ryan Siegel (M.S. 2008; Chair: Sarina Ergas)

#### *Research Experience for Undergraduates (REU)*

- Jack Barry: Commonwealth Honors College REU, Community Research, Summer 2012
- Thomas Gostanian: NSF REU, Summer 2010
- Philip Teague: NSF REU, Summer 2008

#### *Undergraduate Research Assistants*

- Patrick Hanlon (B.S. 2012), Honor's Thesis: Comparison of activated sludge characteristics in light and dark condition: Commonwealth College Honor's Thesis
- Meghan Krupka (B.S. 2010), Honor's Thesis: Bench-scale co-anaerobic digestion of microalgae and wastewater sludge

Caitline Barber (Spring 2016-present); Mason Saleeba (Summer 2014-Spring 2015); Joseph Murphy (Fall 2013-Fall 2014); Jack Barry (Spring 2012-Summer 2013); Alex Surreira (Spring 2012-Fall 2012); Brian Tafe (Spring 2012-Summer 2013); Chris Watt (Spring 2012-Summer 2013); Patrick Hanlon (Honors Student, Summer 2011-Spring 2012); Zhiren Zhu (Honors Student, Summer 2011-Summer 2012); David Choi (Spring 2011); Meghan Krupka (Honors Student, Summer 2009-Summer 2010); McNamara Rome (Spring 2009-Spring 2010); Anna May Tilley (Chemical Engineering; Summer 2009); Philip Teauge (Fall 2007-Summer 2009); Chengyan Zhang (Fall 2007-Summer 2008)

### **Supervising Research Fellows**

- Ahmed S. Abouhend: Nov 2015-June 2016
- Dr. Sona Dolan (Senior Research Fellow, Ph.D. Department of Biology, Clark University, 2003): April 2012-Feb 2014
- Dr. Young Mo Kim (Postdoc. Ph.D. School of Environmental Engineering, POSTECH, 2010): Aug 2010-July 2011

### **Visiting Scholars**

- Ahmed S. Abouhend (Visiting PhD Student, Marine Environment Division. National Institute of Oceanography and Fisheries, Egypt): Feb 2015-present
- Dr. Jeongmi Seo (Postdoc, University of Seoul, Korea): Feb 2015-Jan 2016
- Dr. Ki Young Park (Associate Professor, Konkuk University, Seoul, Korea): Jul 2010-Jul 2011
- Dr. Hee Sik Kim (Principal Investigator, Korea Research Institute of Bioscience and Biotechnology, Daejeon, Korea): Aug 2008-Jul 2009

### **Keynote Speech**

1. Park, C. (2015) Recovery of chemical energy in wastewater using a new biogranule process: oxygenic photogranules (OPGs). 2015 International Environmental Engineering Conference & Annual Meeting of Korean Society of Environmental Engineers (IEEC2015), Busan, Korea.
2. Park, C. (2016) Photogranules and wastewater treatment with bioenergy recovery. Asian Biohydrogen and Biogas Symposium. Jeju, Korea

### **Abstracts and Presentations**

1. Park, C. (2016) Photogranules and wastewater treatment with bioenergy recovery. Asian Biohydrogen and Biogas Symposium. Jeju, Korea
2. Milferstedt, K., Park, C., and Hamelin, J. (2016) Oxygenic photogranules may shake sewage treatment up. International Society for Microbial Ecology. Montreal, Canada
3. Kuo-Dahab, W.C., Stauch-White, K., Butler, C., Dolan, S., and Park, C. (2015) Photosynthetic sludge granule for wastewater treatment. New England Graduate Student Water Symposium, Amherst, MA, September 2015.
4. Stauch-White, K., Kuo-Dahab, C., Milferstedt, K., Hamelin, J., Park, C. and Butler, C. (2015) Filamentous cyanobacteria in granular biofilms containing microalgae and bacteria, Meeting of the American Chemical Society, Denver, CO March 2015
5. Stauch-White, K., Kuo-Dahab, C., Park, C and Butler, C. (2015) The ecology of granular biofilms containing microalgae and bacteria used for treating wastewater, Association of Environmental Engineering and Science Professor Conference, Yale University, New Haven, CT, June 2015
6. Park, C. (2015) Recovery of chemical energy in wastewater using a new biogranule process: oxygenic photogranules (OPGs). 2015 International Environmental Engineering Conference & Annual Meeting of Korean Society of Environmental Engineers (IEEC2015), Busan, Korea, Oct 2015

7. Stauch-White, K., Park, C., and Butler, C. (2014) Investigation of DNA extraction protocols for granular biofilms containing microalgae and bacteria, New England Graduate Student Water Symposium, Amherst, MA, September 2014
8. Eom, H., Barry, J., Brooks, J., Borgatti, D., and Park, C. (2013) Evaluating the impact of upgrading wastewater treatment to BNR process on algal blooms in the receiving estuary. Oral presentation and abstract, Water Environment Federation 86th Annual Technical Exhibition and Conference (WEFTEC 2013), Chicago, IL.
9. Bazilio, A., Park, C., and Reckhow, D. (2013) Biodegradation of disinfection by-products in drinking water systems, AWWA ACE, Denver, CO.
10. Wang, M. and Park, C. (2011) Anaerobic co-digestion of microalgae and activated sludge from wastewater treatment systems. Oral presentation, Annual Northeast Residuals & Biosolids Conference, Seekonk, MA.
11. Chon, D.H. and Park, C. (2011) Sludge reduction in the high rate anaerobic side-stream process, Oral presentation, Annual Northeast Residuals & Biosolids Conference, Seekonk, MA.
12. Chon, D.H., Rome, M., Park, K.Y., and Park, C. (2011) Development of a high rate anaerobic side-stream reactor. Poster presentation, Water Environment Federation 84th Annual Technical Exhibition and Conference (WEFTEC 2011), Los Angeles, CA.
13. Park, C., Borgatti, D., Nowak, M., Yu, D., and Westgate, P. (2011) Evaluation of effluent organic nitrogen and proteins and their fate in receiving waters for three WWTPs in Western Massachusetts. 2011 NEWEA Annual Conference and Exhibition, Boston, MA.
14. Teague, P., Wang, M., and Park, C. (2010) The effect of iron concentration and aeration basin configuration on susceptibility to sonication pretreatment and subsequent anaerobic digestion. Poster presentation, Water Environment Federation 83rd Annual Technical Exhibition and Conference (WEFTEC 2010), New Orleans, AL.
15. Gostanian, T., Teague, P., and Park, C. (2010) Investigation of relationship between extracellular polymeric substances and digestibility of sludge. Poster presentation, 2010 REU Poster Session at UMass Amherst.
16. Westgate, P. and Park, C. (2009) Characterizing the proteins in domestic wastewater effluent discharged to the Connecticut River using proteomics technology. Oral presentation, 2009 Sixth Annual Massachusetts Water Resources Research Conference: Integrating Water Resources Management at UMass Amherst.
17. Teague, P., Zhang, C., and Park, C. (2008) Effect of reactor configuration on activated sludge characteristics and subsequent anaerobic digestion. Poster presentation, 2008 REU Poster Session at UMass Amherst.
18. Park, C. (2008) Impact of wastewater metals on bioflocculation of activated sludge and its effect on wastewater effluent quality. Oral presentation, 2008 Fifth Annual Massachusetts Water Resources Research Conference: Integrating Water Resources Management at UMass Amherst.

### **Seminars & Invited Presentations**

- Photogranules: biogranules formed without hydrodynamic selection pressures and application for wastewater treatment. Graduate program seminar. Department of Microbiology, University of Massachusetts Amherst, Nov 2016.
- Formation of LMW-DON in BNR and its Impact on Estuarine Eutrophication: Comparison with CAS. Presentation. HRSD, June 2016
- Formation of LMW-DON in BNR and its Impact on Estuarine Eutrophication: Comparison with CAS. Presentation. MassDEP, June 2016
- Algal-sludge granules: an innovative wastewater treatment and energy recovery process. Monitoring and Research Department 2015 Seminar Series. Metropolitan Water Reclamation District of Greater Chicago, Apr 2015.

- Minimizing excess sludge generation and introduction of algal-sludge. Department of Chemical Engineering, Tokyo University of Agriculture and Technology, Japan, Dec 2014.
- Recovery of bioenergy from waste solids and wastewater. Korean-Danish Green Technology Bioenergy Project. Research symposium at KIER, Dajeon, Korea, Oct 2014. (workshop at KIER)
- Novel bio-granule technology for renewable bioenergy production and waste reclamation. UKC-KIER research forum, San Francisco, Aug 2014.
- Algae-based wastewater treatment and introduction of algal-sludge granules. URS Ltd., Webinar presentation, June 2014.
- High-rate anaerobic side-stream reactor (ASSR) processes to degrade extracellular polymeric substances (EPS) and minimize the production of excess sludge. INRA-LBE, Narbonne, France, Jan 2014.
- Connecticut River and Long Island Sound nitrogen research: the influences of BNR and CAS effluent on eutrophication in receiving waters of varying salinity. US EPA Region 1 Science Council, Webinar presentation, June 2012.
- Evaluation of proteins and organic nitrogen in wastewater treatment effluents and their impact on receiving water productivity. Graduate program seminar, Department of Civil and Environmental Engineering, University of Massachusetts Amherst, Oct 2010.
- Assessing the role of activated sludge microbial physiology in sludge treatment, three talks at Korea Institute of Science and Technology, Seongkyunkwan University, and Samsung Engineering, Jul 2009.
- Novel and better H<sub>2</sub> yielding wastewater treatment technology, University Research Entrepreneur Symposium, Cambridge, MA, Mar 2009.
- Flocs, metals, extracellular polymers, and metaproteomics in biological wastewater engineering, Graduate program seminar, Department of Microbiology, University of Massachusetts Amherst, Oct 2007.
- Exocellular polymers and cations: their impact on activated sludge flocs and a vision for the future of wastewater treatment, Graduate program seminar, Department of Civil and Environmental Engineering, University of Massachusetts Amherst, Sep 2007.
- The impact of metals on activated sludge characteristics and sludge digestibility, Graduate program seminar, Department of Civil and Environmental Engineering, Virginia Tech, Sep 2004.
- Cations and Activated sludge floc structure, Department of Civil and Environmental Engineering, Korea University, Jul 2004.
- The role of cations in bioflocculation of activated sludge, Paul E. Torgersen Research Excellence Award Ceremony, Virginia Tech, Sep 2003.

### **Committee**

- WEFTEC Program Committee, Research Symposium Subcommittee, Nov 2011-Oct 2015
- Environmental and Water Resources Institute (EWRI) Residuals Management Technical Committee (RMTC), Secretary, Nov 2010-Oct 2011
- New England Water Environment Association Residuals Management Committee, Feb 2008-2010
- International Water Association, Membrane Conference, Program Committee, Aug 2008

### **Conference Abstract/Proceeding Reviews & Moderators**

- Water Environment Federation 26th Annual Residuals and Biosolids Management Conference, 2012, Raleigh, NC.
- Water Environment Federation 84th Annual Technical Exhibition and Conference (WEFTEC), 2011, Los Angeles, CA.
- Water Environment Federation 25th Annual Residuals and Biosolids Management Conference, 2011, Sacramento, CA.

- Water Environment Federation 84th Annual Technical Exhibition and Conference (WEFTEC), 2010, New Orleans, LA.
- Water Environment Federation 24th Annual Residuals and Biosolids Management Conference, 2010, Savannah, GA.
- Water Environment Federation 82nd Annual Technical Exhibition and Conference (WEFTEC), 2009, Orlando, FL.
- International Water Association Water Congress, 2010, Montreal, Canada.
- International Water Association Water Congress, 2008, Vienna, Austria.
- International Water Association Membrane Conference, 2008, Amherst, MA.

### **Journal Review**

- Applied Microbiology
- Applied Microbiology and Biotechnology
- Bioenergy and Biomass
- Bioresource Technology
- Biotechnology Advances
- Biotechnology and Bioengineering
- Chemical Engineering Journal
- Energy and Fuels
- Environmental Engineering Research
- Environmental Engineering and Science
- Environmental Monitoring and Assessment
- Environmental Progress
- Environmental Science and Technology
- Environmental Science: Water Research & Technology
- Journal of Applied Microbiology
- Journal of Environmental Management
- Journal of Hazardous Materials
- KSCE Journal of Civil Engineering
- Waste Management
- Water Environment Research
- Water Practice
- Water Research

### **Proposal Review**

- National Science Foundation (NSF) Review Panel (2013, 2016), USA
- Natural Environment Research Council (NERC), UK
- The Danish Council for Independent Research, Denmark
- Fonds National de la Recherche (FNR), Luxembourg
- Illinois-Indiana Sea Grant / Illinois Water Resources Center, USA
- Korea Institute of Construction Technology (KICT), Korea
- Ontario Centres of Excellence (OCE), Canada

### **Affiliations**

- Association of Environmental Engineering and Science Professors (AEESP)
- International Water Association (IWA)
- Korean-American Scientists and Engineers Association (KSEA)
- New England Water Environment Association (NEWEA)
- Water Environment Federation (WEF)

**Current Collaborators**

- Caitlyn Butler, Civil & Environmental Engineering, UMass Amherst
- David Reckhow, Civil & Environmental Engineering, UMass Amherst
- John Tobiason, Civil & Environmental Engineering, UMass Amherst
- Yasu Morita, Microbiology, UMass Amherst
- Albert S. Kim, Civil & Environmental Engineering, University of Hawaii Manoa
- Mary Jo Kirisits, Civil & Environmental Engineering, University of Texas Austin
- Kim Milfersted, INRA-LBE, France
- Jérôme Hamelin, INRA-LBE, France
- Hélène Carrère, INRA-LBE, France
- Bruno Sialve, INRA-LBE, France
- Yves Gerand, Montpellier SupAgro, France
- Arnaud Hélias, Montpellier SupAgro, France
- Dong Hoon Kim, Inha University, Korea