CARLOS M. CORVALAN
Associate Professor of Food Science
Purdue University, West Lafayette, IN 47907

Education
Ph.D. Chemical Engineering, National University of Littoral, Argentina.
B.S. Chemical Engineering, National University of Technology, Argentina.

Professional Experience
Associate Professor of Food Science, Purdue University, 2009-present
Associate Professor of Biological Engineering by courtesy, Purdue University, 2009-present
Associate Professor of Mechanical Engineering by courtesy, Purdue University, 2009-present
Assistant Professor of Food Science, Purdue University, 2003-2008
Assistant Professor of Biological Engineering by courtesy, Purdue University, 2003-2008
Postdoctoral Fellow, Purdue University, 2000-2002

Peer-reviewed Journal Articles

Lu, Jiakai, Carlos M. Corvalan, and Jen-Yi Huang. "Deformation and removal of viscous thin films by submerged jet impingement." AIChE Journal 66, no. 1 (2020): e16745.

Lu, Jiakai, and Carlos M. Corvalan. "Dynamical transitions during the collapse of inertial holes." Nature Scientific Reports 9, no. 1 (2019): 1-7.

Lu, J., Corvalan, C.M., Chew, Y.J. and Huang, J.Y., 2019. Coalescence of small bubbles with surfactants. Chemical Engineering Science, 196, 493-500.

Lu, Jiakai, Michele Ferri (2), Sebastian Ubal (3), Osvaldo Campanella, and Carlos M. Corvalan. "Contraction of a shear-thinning axisymmetric cavity." Physics of Fluids 31, no. 12 (2019): 123103. (Invited, Editor's Pick)

Lu, J., Campana, D.M. and Corvalan, C.M., 2018. Contraction of surfactant-laden pores. Langmuir, 34(15), 4701-4706.

Spotti, M.J., Tarhan, Ö., Schaffter, S., Corvalan, C. and Campanella, O.H., 2017. Whey protein gelation induced by enzymatic hydrolysis and heat treatment: Comparison of creep and recovery behavior. Food Hydrocolloids, 63, 696-704.

Lu, J. and Corvalan, C.M., 2016. Soft food microrheology. Current Opinion in Food Science, 9, 112-116.

Tarhan, O., Spotti, M.J., Schaffter, S., Corvalan, C.M. and Campanella, O.H., 2016. Rheological and structural characterization of whey protein gelation induced by enzymatic hydrolysis. Food Hydrocolloids, 61, 211-220.

Lu, J., Fang, S. and Corvalan, C.M., 2016. Coalescence dynamics of viscous conical drops. Physical Review E, 93, 023111-023117

Lu, J., Yu, J. and Corvalan, C.M., 2015. Universal Scaling Law for the Collapse of Viscous Nanopores. Langmuir, 31(31), 8618-8622.

Lu, J. and Corvalan, C.M., 2015. Free-surface dynamics of small pores. Chemical Engineering Science, 132, 93-98.

Lu, J. and Corvalan, C.M., 2014. Influence of viscosity on the impingement of laminar liquid jets. Chemical Engineering Science, 119: 182-186.

Muddu, R.J., Lu, J., Sojka, P.E. and Corvalan, C.M., 2012. Threshold wavelength on filaments of complex fluids. Chemical engineering science, 69(1), 602-606.

Lu, J; Corvalan, CM. 2012. Coalescence of viscous drops with surfactants. Chemical Engineering Science, 78 (20): 9-13.

Dechelette, A; Campanella, OH; Corvalan, CM; Sojka, PE. 2011. An experimental investigation on the breakup of surfactant-laden non-Newtonian jets. Chemical Engineering Science 66 (24): 6367-6374.

Vaidya, NA; Corvalan, CM. 2009. An integral model of microbial inactivation taking into account memory effects: Power-law memory kernel. Journal of Food Protection 72 (4): 837-842.

Chen, G; Campanella, OH; Corvalan, CM; Haley, T. 2008. On-line correction of process temperature deviations in continuous retorts. Journal of Food Engineering 84 (2): 258-269.

Busto-Ramos, M; Budzik, J; Corvalan, CM; Morgan, MT; Nivens, DE; Applegate, BM; Turco, R. 2008. Development of an online biosensor for in situ monitoring of chlorine dioxide gas disinfection efficacy. Applied Microbiology and Biotechnology 78 (4): 573-580.

Mahmoud, BS; Vaidya, NA; Corvalan, CM; Linton RH. 2008. Inactivation kinetics of inoculated Escherichia coli O157:H7, Listeria monocytogenes and Salmonella Poona on whole cantaloupe by chlorine dioxide gas. Food Microbiology 25 (7): 857-865.

Xue, Z; Corvalan, CM; Dravid, V; Sojka, PE. 2008. Break up of shear-thinning liquid jets with surfactants. Chemical Engineering Science 63 (7): 1842-1849.

Dravid, V; Loke, PB; Corvalan, CM; Sojka, PE. 2008. Drop Formation in Non-Newtonian Jets at Low Reynolds Numbers. Journal of Fluid Engineering 130: 081504.1-081504.8.

Gandolph, J., G. Chen, I. Weiss, M. Perchonok, W. Wijeratne, S. Fortune, C. Corvalan, O. Campanella, M. Okos, and L.J. Mauer. 2007. Foods for a Mission to Mars: Equivalent System Mass and Development of a Multipurpose Small-Scale Seed Processor. World of Food Science. Volume 2 Food and Space.

Banerjee, P; Morgan, MT; Rickus, JL; Ragheb, K; Corvalan, C; Robinson, JP; Bhunia, AK. 2007. Hybridoma Ped-2E9 cells cultured under modified conditions can sensitively detect Listeria monocytogenes and Bacillus cereus. Applied Microbiology and Biotechnology 73 (6): 1423-1434.

Chen, G., Campanella, O., Corvalan, C. 2007. A numerical algorithm for calculating microbial

survival curves during thermal processing. Food Research International, 40 (1), 203-208.

Vaydia, N; Mathias, K; Ismail, B; Hayes, K; Corvalan CM. 2007. Kinetic modeling of malonylgenistin and malonyldaidzin conversions under alkaline conditions and elevated temperatures. Journal of Agricultural and Food Chemistry 55 (9): 3408-3413.

Dravid, V; Songsermpong, S; Xue, ZJ; Corvalan, CA; Sojka, PE. 2006. Two-dimensional modeling of the effects of insoluble surfactant on the breakup of a liquid filament. Chemical Engineering Science 61 (11): 3577-3585.

Mathias, K; Ismail, B; Corvalan, CM; Hayes, KD. 2006. Heat and pH effects on the conjugated forms of genistin and daidzin isoflavones. Journal of Agricultural and Food Chemistry 54 (20): 7495-7502.

Dravid, V; Loke, P; Corvalan, CM; Sojka, PE. 2006. Drop Formation in Non-Newtonian Jets at Low Reynolds Number. ASME 47705:505-513.

Selby, TL; Berzins, A; Gerrard, DE; Corvalan, CM; Grant, AL; Linton, RH. 2006. Microbial heat resistance of Listeria monocytogenes and the impact on ready-to-eat meat quality after post-package pasteurization. Meat Science 74 (3): 425-434.

Haddish-Berhane, N; Nyquist, C; Haghighi, K; Corvalan, C; Keshavarzian, A; Campanella, O; Rickus, J; Farhadi, A. 2006. A multi-scale stochastic drug release model for polymer-coated targeted drug delivery systems. Journal of Controlled Release 110 (2): 314-322.

Chen, G; Corvalan, C; Campanella, O; Haley, T. 2005. An improved method to estimate temperatures and lethality during the cooling stage of sterilized cylindrical cans. Food and Bioproducts Processing 83 (C1): 36-42.

Singh, PP; Maier, DE; Cushman, JH; Haghighi, K; Corvalan, C. 2004. Effect of viscoelastic relaxation on moisture transport in foods. Part I: solution of general transport equation. Journal of Mathematical Biology 49 (1): 1-19.

Levine, L., O. H. Campanella, C. Corvalan, and M. R. Okos. 2004. A model for predicting forces and work inputs of cereal flaking. Cereal Food World 49(1)11-19.

Reid, JD; Campanella, OH; Corvalan, CM; Okos, MR. 2003. The influence of power-law rheology on flow distributions in coathanger manifolds. Polymer Engineering and Science 43 (3): 693-703.

Levine, L., O. H. Campanella, C. Corvalan, M. R. Okos, and D. Gonzalez. 2003. A model for predicting the aspect ratio of cereal flakes. Cereal Food World 48(6):289-295.

Levine, L; Corvalan, CM; Campanella, OH; Okos, MR. 2002. A model describing the two-dimensional calendering of finite width sheets. Chemical Engineering Science 57 (4): 643-650.

Levine, L; Corvalan, CM; Campanella, OH; Okos, MR. 2002. A model for the formation of multiple flakes during cereal flaking. Cereal Food World 47:210-223.

Reid, JD; Corvalan, CM; Levine L; Campanella, OH; Okos, MR. 2001. Estimation of final sheet width and forces exerted by sheeting rolls. Cereal Food World 46(2):63-69.

Corvalan, C; Di Paolo, J; Saita, FA. 1999. Elasto-hydrodynamic lubrication of porous substrates: application to synovial joint analysis. Computer Methods in Biomechanics and Biomedical Engineering 2 (4): 309-320.

Corvalan, CM; Saita, FA. 1995. Blade Coating on a compressible substrate. Chemical Engineering Science 50 (11): 1769-1783.

Di Paolo, J; Corvalan, CM; Saita, FA. 1995. Reynolds equation: integral vs. differential formulation. International Journal of Numerical Methods in Engineering and Design 11 (3): 303-322.

Corvalan, CM; Saita, FA. 1991. Automatic step-size control in continuation procedures. Computers and Chemical Engineering 15 (10): 729-739.

Book Chapters

Ubal, S., Corvalan, C., Giavedoni, M. D., & Saita, F. A. (2001). A numerical study on two-dimensional Faraday waves. In: Computational Fluid and Solid Mechanics, 1000-1005. Ed. K.J. Bathe, MIT Press, Cambridge, MA.

Carlos Corvalan & Osvaldo Campanella (2004). Food Rheology and Texture. In: Encyclopedia of Life Support Systems. Oxford, UK: UNESCO Publishers.

Carlos Corvalan & Osvaldo Campanella (2005). Squeezing and Elongational Flow. In: Food Processing. Paris, France: UNESCO Publishers.

Sumali, H., Koch, S. J., Thayer, G. E., Corwin, A., de Boer, M. P., Campanella, O. H., Werely, S., Nivens, D., & Corvalan, C. (2006). A Few Nascent Methods for Measuring Mechanical Properties of the Biological Cell. In: SAND2006-0249, Sandia National Laboratories, Albuquerque NM.

Nirupama Vaidya, Carlos C. Corvalan, Georgios N. Yannakakis, Vasilis P. Valdramidis. Models of thermal inactivation accounting for memory effects. (2011). Vasilis P. Valdramidis & Jan F. M. Van Impe (Eds.), In: Progress on Quantitative Approaches of Thermal Food Processing. New York, NY: Nova Science Publishers.

Research Abstracts (30 prior to 2007)

31. Co, B., Corvalan, C., Bassam, A. & Nivens, D. Optimization of intervention strategies for pathogens in protective environments on food and food-contact surfaces. Institute of Food Technologists Annual Meeting, July-August 2007, Chicago, IL.
32. Vaidya, N. & Corvalan, C. A closed analytical solution for non-isothermal inactivation of L. monocytogenes and Salmonella sp based on non-linear isothermal survival data. Institute of Food Technologists Annual Meeting, July-August 2007, Chicago, IL.

33. Vaidya, N., Shen, X. & Corvalan, C. Validation of scaling methods to estimate non-linear microbial survival curves from incomplete data. Institute of Food Technologists Annual Meeting, July-August 2007, Chicago, IL.
34. Shen, X., Vaidya, N., Nivens, D., Campanella, O. & Corvalan C. Microrheology for food applications. Institute of Food Technologists Annual Meeting, July-August 2007, Chicago, IL.
35. Xue, Z. & Corvalan, C. Coalescence dynamics of a pendant and a sessile drop. American Institute of Chemical Engineers Annual Meeting, November 2007, Salt Lake City, UT.
36. Xue, Z., Vaidya, N., Corvalan, C. & Sojka, P. Shear-thinning effect on nonlinear stability of an annular film covered with insoluble surfactant. American Institute of Chemical Engineers Annual Meeting, November 2007, Salt Lake City, UT.
37. Zhao, J., Xue, Z., Haddish-Berhane, N., Corvalan, C.M. Stanciu, L., Bhunia, A. & Rickus, J.L. A Computational Model of Listeriolysin O Pore Formation in Liposome-doped Sol-gel Nanocomposites. 12th Annual Meeting Institute of Biological Engineering, March 29 - April 1, 2007, St. Louis, MI.
38. Vaidya, N., Xue, Z., Campanella, O. H. & Corvalan, C. M. Moisture induced caking in powder food systems - A numerical study. Institute of Food Technologists Annual Meeting, June-July 2008, New Orleans, LA.
39. Vaidya, N., & Corvalan, C. M. Kinetic analysis of the non-isothermal inactivation of Listeria monocytogenes taking into account the microbial response to increasing temperatures. Institute of Food Technologists Annual Meeting, June-July 2008, New Orleans, LA.
40. Vaidya, N., & Corvalan, C. M. Interfacial Mass Transfer and Emulsion Stability. Conference of Food Engineering, April 2009, Columbus, OH.
41. Dechelette, A., Muddu, R., Corvalan C.M., & Sojka, P.E. 2009. Breakup of Shear-Thinning Liquid Sprays Subject to Controlled Disturbances, International Congress on Liquid Atomization and Spray Systems (ICLASS-2009), Vail CO.
42. Dechelette, A., Corvalan C.M., & Sojka, P.E. 2010. An experimental investigation on the breakup of surfactant-laden shear-thinning jets, International Congress on Liquid Atomization and Spray Systems, ILASS – Europe 2010, 23rd Annual Conference on Liquid Atomization and Spray Systems, Brno, Czech Republic.
43. Bhagat, A., Mahmoud, B., Linton, R., & Corvalan, C. Effect of gaseous chlorine dioxide treatment on quality parameters of tomatoes, oranges and alfalfa sprouts using integrated response surface methodology. Institute of Food Technologists Annual Meeting, July 17-20, 2010, Chicago, IL.
44. Vaidya, N., Lu, J., & Corvalan, C.M. Caking of amorphous food powders: a direct numerical simulation. Institute of Food Technologists Annual Meeting, July 17-20, 2010, Chicago, IL.
45. Corvalan, C.M., Gel atomization. Army Research Office, Battelle Eastern Science and Technology Center, 2010, Aberdeen, MD.

46. Muddu, R., Lu, J., Vaidya, N., Sojka, P.E., & Corvalan, C.M. Replacement of interfacial proteins by waves of surfactant. Institute of Food Technologists Annual Meeting, July 17-20, 2010, Chicago, IL.
47. Muddu, R., Lu, J., Corvalan C.M. & Sojka, P.E., Effect of Perturbation Wavelength On Jets of Complex Fluids, AIChE Annual Meeting, November 7-12, 2010, Salt Lake City, UT.
48. Lu, J. & Corvalan, C.M., Surfactant Effects on the Dynamics of Drop Coalescence, AIChE Annual Meeting, October 16-21, 2011. Minneapolis, MN.
49. Dechelette, A., Corvalan, C.M. & Sojka, P.E. 2011. Effect of Surfactant Solubility and Adsorption Kinetics on Satellite Droplet Formation. International Conference on Liquid Atomization and Spray Systems, Estoril, Portugal.
50. Corvalan, C. M., Multiphase flow through porous food matrices. 4th International Conference on Porous Media & Annual Meeting of the International Society for Porous Media, May 14-16, 2012. West Lafayette, IN.
51. Corvalan, C. M., Free surfaces on fluid foods. SHPE 2012 National Conference, November 14-18, 2012. Fort Worth, TX.
52. Lu, J. & Corvalan, C.M., Impinging jets of complex fluids, SIAM Fifth Computational Science and Engineering Conference (CSEC), April 1st, 2014. West Lafayette, IN.
53. Eren, N.M., Schaffter, S.W., Corvalan C.M. & Campanella, O.H., Revisiting methods of dynamic light scattering data analysis for food applications, Institute of Food Technologists Annual Meeting, July 11-14, 2015, Chicago, IL.
54. Jiakai Lu, Carlos M Corvalan, Jen-Yi Huang, Application of jet impingement for biofouling characterization and its effective cleaning., Conference of Food Engineering 2016. Columbus, USA. September 12-14, 2016.
55. Jiakai Lu, Carlos M Corvalan, Jen-Yi Huang, Effect of external geometry of impinging jet nozzle on the cohesive removal of fouling layers. 18th World Congress of Food Science and Technology. Dublin, Ireland. August 21-25, 2016.
56. Diego Campana, Jiakai Lu, Carlos M. Corvalan, Dynamics of surfactant laden micropores. IV Argentine Meeting on Microfluidics, University of Entre Rios, Parana, Entre Rios, Argentina. October 30-31, 2017.
57. Jiakai Lu, Carlos Corvalan, Jen-Yi Huang, Application of jet impingement for biofouling characterization. Fouling and Cleaning in Food Processing, Lund University, Lund, Sweden. April 17-20, 2018.
58. Lu, J., Corvalan, C.M., Huang, J.-Y. Modeling of coalescence of surfactant-laden microbubbles. Conference of Food Engineering, Minneapolis, USA. September 9-12, 2018.
59. Jiakai Lu, Nathaniel Brown, Carlos M. Corvalan, Inverse Estimation of Flow Index for Non-Newtonian Fluids from Free Surface Dynamics of Pore Contraction. 32nd Inverse Problem Symposium, Purdue University, West Lafayette, Indiana. May 29-31, 2019.
60. Jen-Yi Huang, Osvaldo H. Campanella, Carlos M. Corvalan, Natalie Carroll, Dharmendra Mishra, Innovative Green Clean-in-Place Technology with Micro-bubbles. A1363 USDA

Food Manufacturing Technologies Annual Conference, New Orleans, Louisiana. June 2, 2019.

61. Jiakai Lu, Carlos M. Corvalan, Jen-Yi Huang, Inverse Estimation of Soft Biofilm Viscosity from Submerged Jet Impingement. 32nd Inverse Problem Symposium, Purdue University, West Lafayette, Indiana. May 29-31, 2019.

Grants

Agency: National Institute of Food & Agriculture. AFRI Competitive Grants Program: Foundational Program FY2017
Title of Grant: Innovative Green Clean-in-Place Technology with Micro-bubbles

Sponsor: Beijing Yan Hong Da Railway Equipment Co.
Title of Grant: Unrestricted gift

Agency: Army Research Office (ARO-DOD), Multidisciplinary University Research Initiative (MURI)
Title of Grant: Spray and combustion of hypergolic gels

Agency: U.S. Department of Agriculture (USDA), Agriculture and Food Research Initiative (AFRI)
Title of Grant: Understanding interfacial phenomena to mitigate the formation of satellite drops

Agency: U.S. Department of Agriculture (USDA) - NAFSS
Title of Grant: Inactivation of Pathogens in Protected Environments on Food and Food Contact Surfaces Using Reactive Gases

Agency: National Aeronautics and Space Administration (NASA) - SBIR Phase II
Title of Grant: Development of a Small Scale Multipurpose Seed Processor

Agency: U.S. Department of Agriculture (USDA) - ARS
Title of Grant: Detection and Control of Foodborne hazards: Continuous Monitoring of Chemical Agents in Aqueous Media Using Bioreporter-Based Sensors

Agency: Purdue Agricultural Research Programs
Title of Grant: Effects of surfactants on the breakup of non-Newtonian liquid jets

Agency: Purdue Provost Office
Title of Grant: Shared Resource for Advancing Simulation-based Science and Engineering

Media Coverage

- American Institute of Physics (AIP) Scilight "Understanding how cavities collapse in non-Newtonian fluids," 12-04-2019. DOI: 10.1063/10.0000371
- Microbubble findings could reduce chemical, water use in food processing, 01-09-2020, Phys.org. https://phys.org/news/2020-01-microbubble-chemical-food.html
- Microbubble findings could reduce chemical, water use in food processing, 01-08-2020, Purdue Research News. https://www.purdue.edu/newsroom/purduetoday/research.html
- Viscous nanopores collapse according to universal law. Purdue University News, December 2, 2015.
- Engineers, Food Scientists Explore Possibilities of Gelled Fuel. 2009. The Exponent, 123 (16) p.1.
- Rocket Marmalade. Mechanical Engineering Magazine: The Magazine of ASME, March 2009 Issue.
- Plans for new rocket fuel are beginning to gel, R&D Magazine, January 2009 Issue.
- Researchers cooking up new gelled rocket fuels. 2009. Eureka Alert, Science, American Association for Advancement of Science (AAAS).
- Cooking Up Gelled Fuels. Defense News, 2 Feb 2009.
- Gelled Fuel Development Requiring Varied Expertise. 2009. Perspective, Purdue University 36 (1) p.12.
- Problem of pesticide drift studied. United Press International UPI - World News & U.S News, March. 20, 2012.
- Surfactant additives cause drifting droplets, Ag Professional Magazine, March. 20, 2012.
- Pesticide additives cause drifting droplets, but can be controlled. Purdue University News, March 20, 2012.
- Engineers, Scientists Collaborating to Cook New Gelled Rocket Fuels. Times of India, 22 Jan 2009.

Courses taught at Purdue

Food Processing and Packaging (FS), Statistical Process Control (FS), Interfacial Transport Phenomena (FS/ABE), Kinetics in Food and Biological Systems (FS/ABE), Food Processing I (FS), Numerical Methods for Food and Biological Systems (FS/ABE), Principles of Turbulence (ME), Mechanical Engineering Project (ME), Microbiological Models (FS), Analytical and Computational Techniques in Interfacial Fluid Dynamics (ABE), Food Rheology (ABE, invited lectures), Food Processing II (FS, invited lectures).

Reviewer

Journals: Journal of Food Engineering, Journal of Food Science, Journal of Food Protection, Journal of Texture Studies, Cereal Chemistry, Chemical Engineering Science, Food Chemistry, Industrial & Engineering Chemistry Research, International Journal of Food Properties, Food and Bioprocess Technology, Journal Microfluidics and Nanofluidics, Journal of Fluids

Engineering, Applied Mathematics and Computation, Acta Mechanica, Canadian Journal of Chemical Engineering, Experimental Thermal and Fluid Science, Food Research International, International Journal of Food Science and Technology, Journal of Cereal Science.
Grants: Panel Reviewer for USDA/NIFA/AFRI-A1361-Improving Food Quality; Panel Reviewer for USDA/NIFA/AFRI Function and Efficacy of Nutrients Program; Reviewer USDA-NRI Nanoscale Science and Engineering Program; Reviewer USDA Bioactive Food Components for Optimal Health Program; Reviewer National Science Foundation of Israel.

Professional Memberships and Awards
Gamma Sigma Delta Honorary Agricultural Society
Institute of Food Technologists (IFT)
American Institute of Chemical Engineers (AIChE)
Purdue University Seed for Success Award, 2005–2010
Purdue College of Agriculture Millionaire's Club Award, 2005-2010
C.R. Stumbo Award, Institute for Thermal Processing Specialists, 2006 (co-author)

University Committees
Purdue University Senate,
Purdue University Graduate School,
Purdue Academic Affairs Committee,
Purdue Computer Science and Engineering Multidisciplinary Program,
College of Agriculture Grade Appeals Committee,
College of Agriculture Graduate Council,
Food Science Graduate Committee,
Food Science Pilot Plant Committee,
Food Science Space Committee,
Faculty search committees