Ashwin Kumar RAJAGOPALAN

SNSF Early Postdoc.Mobility Fellow, Imperial College London

Born on December 23rd, 1991 in Neyveli, Tamil Nadu, INDIA
Citizen of INDIA

ash23win@gmail.com +44 (0)7485 683 036 ash23win
0000-0001-8306-455X bit.ly/akrgscholar

SUMMARY

Seven years of research experience in the field of chemical process engineering, particularly on gas adsorption and crystallization. Highly skilled in utilizing experimental, modeling, and data analytics techniques for chemical processes. A "Do it yourself" engineer with a drive to design and build experimental setups for academic research. Published 10+ articles in peer-reviewed scientific journals. Three years of teaching experience on core chemical engineering courses.

EDUCATIONAL QUALIFICATIONS

Doctor of Sciences of ETH Zurich (Dr. sc. ETH Zurich) **(Oct. 2015 - Jul. 2019)**
Thesis Title: "*A Dual Projection Imaging System To Characterize Crystallization Processes: Design and Applications*"
Advisor: Prof. Dr. Marco Mazzotti
Co-advisor: Prof. Dr. Manfred Morari
Separation Processes Laboratory, Institute of Process Engineering
Department of Mechanical and Process Engineering
ETH Zurich, Zurich, SWITZERLAND
Date of doctoral examination: July 23rd, 2019

Master of Science (MSc) in Chemical Engineering **(Sept. 2013 - Aug. 2015)**
Thesis Title: "*Material selection and process design for adsorptive CO_2 capture*"
Advisor: Prof. Dr. Arvind Rajendran
Laboratory for Advanced Separation Processes
Department of Chemical and Materials Engineering
University of Alberta, Edmonton, Alberta, CANADA
GPA: 3.60/4.00

Bachelor of Technology (B. Tech.) in Chemical Engineering **(Aug. 2009 - May 2013)**
Department of Chemical Engineering
National Institute of Technology Tiruchirappalli
Tiruchirappalli, Tamil Nadu, INDIA
GPA: 8.76/10.00

PROFESSIONAL APPOINTMENTS

Lecturer (Academic & Research) **(Aug. 2021 -)**
School of Chemical Engineering and Analytical Science
The University of Manchester, Manchester, UNITED KINGDOM

SNSF Early Postdoc.Mobility Fellow **(Oct. 2020 - July 2021)**
Funding Agency: Swiss National Science Foundation (SNSF)
Advisor: Dr. Camille Petit
Multifunctional Nanomaterials Group
Faculty of Engineering, Department of Chemical Engineering
Imperial College London, London, UNITED KINGDOM

Postdoctoral Research Associate **(Aug. 2019 - Sept. 2020)**
Advisor: Prof. Dr. Marco Mazzotti
Separation Processes Laboratory, Institute of Process Engineering
Department of Mechanical and Process Engineering
ETH Zurich, Zurich, SWITZERLAND

FELLOWSHIPS & GRANTS

- Swiss National Science Foundation *Early.Postdoc Mobility* fellowship, **2020-2022**. (Secured CHF 84,400)

AWARDS & RECOGNITION

- EFCE Excellence Award in Crystallization for the best doctoral thesis, European Federation of Chemical Engineering, **2020**.
- S. H. Ibrahim Memorial Award for Best Outgoing Student in Chemical Engineering, National Institute of Technology Tiruchirappalli, **2013**.

TEACHING EXPERIENCE

ETH Zurich

- Rate Controlled Separations in Fine Chemistry (151-0927-00L), **2017-2019**. (Class of 30, delivering one or two lectures per semester)
- Separation Process Technology (151-0926-00L), **2017-2019**. (Class of 30, delivering one or two lectures per semester)
- Practica in Process Engineering II (151-0958-00L), **2016-2018**

University of Alberta

- Mass Transfer (CHE318), **2014**. (Class of 50, delivering seminars during exercise hours)

MENTORING

M11. Anna Jaeggi (Doctoral student), ETH Zurich, **2020** (*ongoing*).
M10. Selin Güngör (MSc), Process Design for Lactose Crystallization, *Research Assistant*, ETH Zurich, **2020**.
M9. Anna Jaeggi (MSc), How Well Can We Characterize Platelet Dimensions?, *Research Assistant*, ETH Zurich, **2019**.
M8. Nick McDonald (MSc), Dilution Loop: Enhanced Monitoring of Dense Particle Suspensions using Imaging, *Semester Thesis*, ETH Zurich, **2019**.
M7. Ayoung Song (BSc), Study on the Solubility, Antisolvent Nucleation and Steady-State Shape of Sodium Acetate, *Research Assistant*, ETH Zurich, **2019**.
M6. Marta Fochesato (MSc), Technical Assessment of Downstream Processes in Tablet Manufacturing, *Research Assistant*, ETH Zurich, **2019**.
M5. Bianca Popa (BSc), Study on the Solubility, Anti-Solvent Nucleation and Steady State Shape of Sodium Acetate, *Research Assistant*, ETH Zurich, **2019**.
M4. Igor Rombaut (MSc), Feedback Control for the Size and Shape Evolution of Needle-like Crystals in Suspension: Multistage Process, *Master Thesis*, ETH Zurich, **2019**.
M3. Johann Bartenstein (MSc), Study on the Solubility and Nucleation of Acetates, *Semester Thesis*, ETH Zurich, **2018**.
M2. Ramona Achermann (MSc), Feasibility Study for Measuring *n*D PSSD of Dense Suspensions, *Semester Thesis*, ETH Zurich, **2017**.
M1. Janik Schneeberger (MSc), 3D Reconstruction and Classification of Crystals for Chemical Process Control, *Master Thesis*, ETH Zurich, **2016**.

RESEARCH OUTPUT

Publications in Peer-reviewed Scientific Journals (* indicates shared authorship, # indicates mentee)

J13. Jaeggi, A.[#]; **Rajagopalan, A. K.**; Morari, M.: Mazzotti, M. Characterizing Ensembles of Plate-like Particles via Machine Learning. *Ind. Eng. Chem. Res.* **2021**, 60 (1), 473-483.

J12. Bötschi, S.*; **Rajagopalan, A. K.***; Rombaut, I.[#]; Morari, M.; Mazzotti, M. From needle-like toward equant particles: A controlled crystal shape engineering pathway. *Comput. Chem. Eng.* **2019**, 131, 106581.

J11. Subraveti, S. G.; Pai, K. N.; **Rajagopalan, A. K.**; Wilkins, N. S.; Rajendran, A.; Jayaraman, A.; Alptekin, G. Cycle design and optimization of novel PSA cycles for pre-combustion CO_2 capture. *Appl. Energy* **2019**, 254, 113624.

J10. Bötschi, S.; **Rajagopalan, A. K.**; Morari, M.; Mazzotti, M. Feedback Control for the Size and Shape Evolution of Needle-like Crystals in Suspension. IV. Modeling and Control of Dissolution. *Cryst. Growth Des.* **2019**, 19 (7), 4029-4043.

J9. **Rajagopalan, A. K.**; Bötschi, S.; Morari, M.; Mazzotti, M. Feedback Control for the Size and Shape Evolution of Needle-like Crystals in Suspension. III. Wet Milling. *Cryst. Growth Des.* **2019**, 19 (5), 28452861.

J8. Balashankar, V. S.; **Rajagopalan, A. K.**; De Pauw, R.; Avila, A. M.; Rajendran, A. Analysis of a Batch Adsorber Analogue for Rapid Screening of Adsorbents for Postcombustion CO_2 Capture. *Ind. Eng. Chem. Res.* **2019**, 58 (8), 3314-3328.

J7. **Rajagopalan, A. K.**; Rajendran, A. The effect of nitrogen adsorption on vacuum swing adsorption based post-combustion CO_2 capture. *Int. J. Greenh. Gas Control* **2018**, 78, 437447.

J6. **Rajagopalan, A. K.**; Bötschi, S.; Morari, M.; Mazzotti, M. Feedback Control for the Size and Shape Evolution of Needle-like Crystals in Suspension. II. Cooling Crystallization Experiments. *Cryst. Growth Des.* **2018**, 18 (10), 6185-6196.

J5. Bötschi, S.; **Rajagopalan, A. K.**; Morari, M.; Mazzotti, M. Feedback Control for the Size and Shape Evolution of Needle-like Crystals in Suspension. I. Concepts and Simulation Studies. *Cryst. Growth Des.* **2018**, 18 (8), 4470-4483.

J4. Bötschi, S.*; **Rajagopalan, A. K.***; Morari, M.; Mazzotti, M. An Alternative Approach to Estimate Solute Concentration: Exploiting the Information Embedded in the Solid Phase. *J. Phys. Chem. Lett.* **2018**, 9 (15), 4210-4214.

J3. **Rajagopalan, A. K.***; Schneeberger, J.*[#]; Salvatori, F.; Bötschi, S.; Ochsenbein, D. R.; Oswald, M. R.; Pollefeys, M.; Mazzotti, M. A comprehensive shape analysis pipeline for stereoscopic measurements of particulate populations in suspension. *Powder Technol.* **2017**, 321, 479-493.

J2. **Rajagopalan, A. K.**; Avila, A. M.; Rajendran, A. Do adsorbent screening metrics predict process performance? A process optimisation based study for post-combustion capture of CO_2. *Int. J. Greenh. Gas Control* **2016**, 46, 76-85.

J1. **Kumar, A.**; Srivastava, D.; Agrawal, M.; Goel, A. Snapshot of PM Loads Evaluated at Major Road and Railway Intersections in an Urban Locality. *Int. J. Environ. Prot.* **2014**, 4 (1), 23-29.

Contributions to International Conferences (* indicates presenting author)

Oral Presentations

O17. Jaeggi, A.*; **Rajagopalan, A. K.**; Mazzotti, M. Size and Shape Characterization of Plate-like Crystals. *American Institute of Chemical Engineers (AIChE) Annual Meeting,* San Francisco, USA, Nov. **2020**

O16. Bötschi, S.; **Rajagopalan, A. K.***; Morari, M.; Mazzotti, M. Controlled Manipulation of the Size and Shape of Needle-like Compounds in a Cyclic Process. *American Institute of Chemical Engineers (AIChE) Annual Meeting,* Orlando, USA, Nov. **2019**.

O15. **Rajagopalan, A. K.***; Bötschi, S.; Morari, M.; Mazzotti, M. Controlled Manipulation of Size and Shape of Needle-like Compounds Using Wet-Milling. *12th European Congress of Chemical Engineering (ECCE),* Florence, Italy, Sept. **2019**.

O14. **Rajagopalan, A. K.**; Bötschi, S.; Morari, M.; Mazzotti, M.* On the Manipulation of the Size and Shape of Needle-like Crystals. *British Association of Crystal Growth (BACG) 50th Annual Conference,* London, UK, Jul. **2019**. **INVITED TALK**

O13. Balashankar, V. S.*; De Pauw, R.; **Rajagopalan, A. K.**; Avila, A. M.; Rajendran, A.* Batch Adsorber based PSA Model for Rapid and Efficient Screening of Adsorbents in Post-Combustion CO_2 Capture. *68th Canadian Chemical Engineering Conference,* Toronto, Canada, Oct. **2018**.

O12. **Rajagopalan, A. K.***; Bötschi, S.; Morari, M.; Mazzotti, M. Experimental Implementation of a Model-Free Feedback Controller for the Size and Shape of Needle-like Crystals Growing in Suspension. *American Institute of Chemical Engineers (AIChE) Annual Meeting,* Pittsburgh, USA, Oct. **2018**.

O11. Bötschi, S.*; **Rajagopalan, A. K.**; Morari, M.; Mazzotti, M. Two Feedback Control Schemes for the Size and Shape of Needle-like Crystals Growing in Suspension. *American Institute of Chemical Engineers (AIChE) Annual Meeting,* Pittsburgh, USA, Oct. **2018**.

O10. Bötschi, S.; **Rajagopalan, A. K.**; Morari, M.; Mazzotti, M.* Size and shape feedback control for growth-dominated batch crystallization processes. *25th International Workshop on Industrial Crystallization (BIWIC),* Rouen, France, Sept. **2018**.

O9. Salvatori, F.*; **Rajagopalan, A. K.**; Bötschi, S.; Schneeberger, J.; Mazzotti, M. Selective manipulation of crystal shape by combined crystallization, milling, and dissolution stages - An approach for robust process design. *Separations Technology IX: New Frontiers in Media, Techniques, and Technologies,* Albufeira, Portugal, Mar. **2017**.

O8. **Rajagopalan, A. K.**; Avila, A. M.; Rajendran, A.* The importance of nitrogen co-adsorption on effectiveness of post-combustion CO_2 capture materials: A process optimization study, *American Institute of Chemical Engineers (AIChE) Annual Meeting,* San Fransisco, USA, Nov. **2016**.

O7. **Rajagopalan, A. K.**; Wilkins, N.; Pai, K. N; Subraveti, S. G. ; Rajendran, A.*; Jayaraman, A.; Alptekin, G. Optimization of a High Temperature PSA Process for Pre-Combustion CO_2 Capture., *American Institute of Chemical Engineers (AIChE) Annual Meeting,* San Fransisco, USA, Nov. **2016**.

O6. **Rajagopalan, A. K.**; De Pauw, R; Avila, A. M.; Rajendran, A.* Batch adsorber analogs for rapid screening of adsorbents for CO_2 capture. *American Institute of Chemical Engineers (AIChE) Annual Meeting,* San Fransisco, USA, Nov. **2016**.

O5. **Rajagopalan, A. K.**; De Pauw, R.; Avila, A. M.; Rajendran, A.* Screening Tools for adsorption based post-combustion CO_2 capture. *66th Canadian Chemical Engineering Conference,* Quebec City, Canada, Oct. **2016**.

O4. **Rajagopalan, A. K.***; Salvatori, F.; Ochsenbein, D. R.; Mazzotti, M. Toward the mitigation of growth rate dispersion through pretreatment of seed crystals. *30th Meeting of the European Crystallographic Association,* Basel, Switzerland, Aug. **2016**.

O3. Makhtoumi, P.*; Hejazi, S. A. H.; **Rajagopalan, A. K.**; Rajendran, A. Zero Length Column Measurements of Ethane in Na-ETS-10. *65th Canadian Chemical Engineering Conference,* Calgary, Canada, Oct. **2015**.

O2. **Rajagopalan, A. K.***; Estupinan, L.; Avila, A. M.; Rajendran, A. Process optimization based selection of adsorbents for post-combustion CO_2 capture. *65th Canadian Chemical Engineering Conference,* Calgary, Canada, Oct. **2015**.

O1. **Rajagopalan, A. K.***; Estupinan, L.; Avila, A. M.; Rajendran, A. A process optimization approach for adsorbent screening for post-combustion capture of CO_2. *Faculty of Engineering Graduate Research Symposium, University of Alberta,* Edmonton, Canada, Jun. **2015**.

Poster Presentations

P9. Binel, P.; Bötschi, S.; **Rajagopalan, A. K.**; Salvatori, F.; Morari, M.; Mazzotti, M. Monitoring Critical Process Parameters to Design and Control a Crystallization Process. *Foundations of Process Analytics and Machine Learning (FOPAM),* Raleigh, USA, Aug. **2019**.

P8. **Rajagopalan, A. K.**; Rajendran, A.* Its the Nitrogen, Stupid - The Importance of N_2 Adsorption on Adsorptive Postcombustion CO_2 Capture. *13th International Conference on the Fundamentals of Adsorption,* Cairns, Australia, May **2019**.

P7. **Rajagopalan, A. K.***; Rajendran, A. Adsorptive Postcombustion CO_2 Capture: Using Process Optimization to Guide Material Development. *Gordon Research Conference on Carbon Capture, Utilization and Storage,* Les Diablerets, Switzerland, May **2019**.

P6. Balashankar, V. S.*; De Pauw, R.; **Rajagopalan, A. K.**; Avila, A. M.; Rajendran, A.* Simplified Model: Post-Combustion Adsorbent Screening. *67th Canadian Chemical Engineering Conference,* Edmonton, Canada, Oct. **2017**.

P5. **Rajagopalan, A. K.***; Schneeberger, J.; Salvatori, F.; Bötschi, S.; Ochsenbein, D. R.; Oswald, M.; Mazzotti, M. 3D reconstruction and shape classification of crystals for measuring multi-dimensional particle size and shape distribution. *20th International Symposium on Industrial Crystallization (ISIC-20),* Dublin, Ireland, Sep. **2017**.

P4. **Rajagopalan, A. K.***; Bötschi, S.; Ochsenbein, D. R.; Morari, M.; Mazzotti, M. Characterizing and mitigating growth rate dispersion effects. *12th International Workshop of the Crystal Growth of Organic Materials,* Leeds, United Kingdom, Jun. **2016**.

P3. Avila, A. M.; **Rajagopalan, A. K.***; De Pauw, R.; Rajendran, A. Batch analogues and improved metrics for rapid screening of adsorbents for post-combustion CO_2 capture. *12th International Conference on the Fundamentals of Adsorption,* Friedrichshafen, Germany, May **2016**.

P2. **Rajagopalan, A. K.***; Avila, A. M.; Rajendran, A. Process Optimization based screening and design of adsorbent materials for post-combustion CO_2 capture. *12th International Conference on the Fundamentals of Adsorption,* Friedrichshafen, Germany, May **2016**. **AWARDED BEST-POSTER PRIZE**

P1. Goel, A.; **Ashwin Kumar, R.***; Agrawal, M.; Goel, N.; Yadav, N. Assessment of the air quality in Kanpur city 2011: Impact of traffic and construction activities near major intersections. *International Congress for Environment Research,* Surat, India, Dec. **2011**.

Softwares with Documented Use

S2. Simulator of the batch adsorber analogue model proposed in "Analysis of a Batch Adsorber Analogue for Rapid Screening of Adsorbents for Postcombustion CO_2 Capture. *Ind. Eng. Chem. Res.* **2019**, 58 (8), 3314-3328."

S1. Maintainer and developer of the *Crystallization Analysis Toolbox* (CAT) developed in the group Prof. Mazzotti at ETH Zurich. CAT is an open-source software used by the crystallization community to solve population balance equations.

PUBLIC PRESENTATIONS

T2. **Rajagopalan, A. K.**. Toward Sustainable Separation Processes: The Role of Process Monitoring, Design, and Control. *Amirkabir University of Technology,* Tehran, Iran (webinar), Feb. 2021.

T1. **Rajagopalan, A. K.**. 888 Days: Carbon capture to crystal growth. *National Institute of Technology Tiruchirappalli,* Trichy, India, Jan. 2016.

REVIEWING ACTIVITIES

- ACS Omega, **2020 - present**
- Energies, **2020 - present**
- Adsorption, **2019 - present**
- Chemical Engineering Science, **2018 - present**
- Separation Science and Technology, **2018 - present**

MEMBERSHIPS

- International Adsorption Society (IAS), **2020 - present**
- American Institute of Chemical Engineers (AIChE), **2018 - present**

SKILLS

Programming Languages	: MATLAB (expert), C/C++ (competent), Python (competent), R (advanced beginner), Julia (advanced beginner)
Software Packages	: LaTeX, COMSOL, Igor Pro, Adobe Creative Suite, Arduino IDE, Eagle, Git
Languages	: Tamil (native), English (expert), Hindi (expert), German (beginner)

March, 2021
London, United Kingdom