

CURRICULUM VITAE

Dr. Irena Grgić

Senior Scientist
National Institute of Chemistry, Slovenia
Department of Analytical Chemistry, D04

Head of the group
Atmospheric Chemistry Group

Scientific Councilor
University of Ljubljana, Slovenia
Faculty of Chemistry and Chemical Technology (FCCT)

Research interests: Tropospheric multiphase chemistry, formation of acidic components in atmospheric aqueous phase, secondary organic aerosol (SOA) formation, kinetic & mechanistic studies of atmospheric aqueous-phase processes, aerosol particles measurements (size-segregated aerosol sampling & nanoparticles), physico-chemical characterization of aerosol particles, analytical methods development for environmentally important constituents.

Irena Grgić (born Lapanja)

Born: Čezsoča, Bovec, Slovenia; Married, two sons.

Education

1972–1976: High School, Gimnazija Tolmin, Slovenia

1976–1981: University Edvard Kardelj Ljubljana, Faculty of Natural Sciences and Technology (FNT), Department of Chemistry.

07/1981: Diploma in Chemistry (Analytical Chemistry), Title: "Hair as an indicator for human exposure to the mercury: Application of Atomic Absorption Spectrometry and comparison with Neutron Activation Analysis", supervised by Prof. Dr. L. Kosta.

1981–1984: Master thesis at the Boris Kidrič Institute of Chemistry (KIBK), Ljubljana, on "Atomization of Mercury in a Graphite Tube Furnace for Atomic Absorption Spectrometry", supervised by Prof. Dr. S. Gomišček.

03/1984: Master of Chemical Sciences, University Edvard Kardelj Ljubljana, FNT.

1986–1990: Ph.D. thesis at the KIBK, Ljubljana, on "Study of the Catalytic Role of Metal Species and their Synergistic Effects in the SO₂ Oxidation in Aqueous Phase", supervised by Dr. V. Hudnik and Prof. Dr. J. Levec.

09/1990: Ph.D. in Chemistry (Atmospheric Chemistry), University of Ljubljana, FCCT.

Professional Experience

- 10/1981–03/1984: M.Sc. Student in the Laboratory for Analytical Chemistry, Boris Kidrič Institute of Chemistry (KIBK), Ljubljana, Slovenia.
- 10/1986–09/1990: Ph.D. Student in the Laboratory for Analytical Chemistry, KIBK, Ljubljana, Slovenia.
- 10/1982–10/1985: Research Assistant II, Laboratory for Analytical Chemistry, KIBK, Ljubljana, Slovenia.
- 11/1985–10/1988: Research Assistant I, Laboratory for Analytical Chemistry, KIBK, Ljubljana, Slovenia
- 11/1988–02/1992: Senior Research Assistant, Laboratory for Analytical Chemistry, KIBK, Ljubljana, Slovenia
- 1992–2004: Associate Scientist, Laboratory for Analytical Chemistry, National Institute of Chemistry (NIC), Ljubljana, Slovenia.
- 06–07/1997: Visiting Associate at the Institute for Inorganic Chemistry, University Erlangen - Nürnberg, Germany, with Prof. Dr. Rudi van Eldik.
- 01/1998: Visiting Associate at the Institute for Inorganic Chemistry, University Erlangen - Nürnberg, Germany.
- Since 05/2005: Senior Scientist, Laboratory for Analytical Chemistry, National Institute of Chemistry, Ljubljana, Slovenia.
- 06/2007: Visiting Scientist at Université de Provence, Laboratoire de Chimie de l'Environnement, Marseille, France
- 2003–2008: Associate Scientist for the Environmental chemistry at the Faculty of Chemistry and Chemical Technology, University of Ljubljana, Slovenia.
- 2009–2014: Senior Scientist at the Faculty of Chemistry and Chemical Technology, University of Ljubljana, Slovenia.
- Since 01/2015: Scientific Councillor (Environmental chemistry), University of Ljubljana, Slovenia.
- 2009–2015: Assistant Professor at the Faculty for Environmental Sciences, University of Nova Gorica, Slovenia.

Prizes and Research Grants

- DAAD (Deutscher Akademischer Austausch Dienst) foundation: award for 2 months research visit 1997; Institute for Inorganic Chemistry, University Erlangen - Nürnberg, Germany with Prof. Rudi van Eldik.
- ESF- Exchange Grant in the frame of INTROP (Interdisciplinary Tropospheric Research: from the Laboratory to Global Change) Networking Programme; June 2007 - One month research visit, Université de Provence, Laboratoire de Chimie et Environnement, Marseille, France; Project title: »In-Cloud Evaporation-Condensation Cycles as a Possible Source of Secondary Organic Aerosols (SOA)«.
- Co-financing the scientific cooperation of foreign citizens in Slovenia (Javni sklad RS za razvoj kadrov in štipendije); Postdoctoral project for Dr. Maryline Pflieger, from 1.02.2010 to 30.04.2011.

- Prešeren's student award for 2016: Jožica Bratec. (Irena Grgić: mentor): *Measurements of nanoparticles emitted during laser printing: Master Thesis*. Ljubljana: [J. Bratec], 2015

Research interests and experience

Multiphase atmospheric chemistry, with emphasize on:

- Oxidation reactions of trace gases (SO₂, NO_x) in atmospheric aqueous phase and formation of acidifying substances in atmospheric aqueous phase.
- Catalytic activity of Transition metal ions (TMIs) in SO₂ oxidation; redox cycling of TMIs in atmospheric aqueous phase;
- Organic compounds, their influence on redox cycling and catalytic activity of TMIs;
- Reactivity of atmospheric aerosol particles (under cloud & haze conditions);
- Processes leading to the (trans)formation and aging of secondary organic aerosols (SOA); the emphasis on colored and toxic nitroaromatic constituents of biomass-burning organic aerosol (OA).
- Aerosol measurements (size-segregated sampling; measurements of nanoparticles) & physico-chemical characterization.
- Development of methods for determination of environmentally important species (water-soluble organic compounds-WSOC in aerosols, e.g. carboxylic acids, nitroaromatic compounds)

Leading functions/Projects

- **1992–1995:** EUROTRAC (EUREKA - Environmental Project), Principal Investigator in subproject HALIPP (Heterogeneous and Liquid-Phase Processes);
- **1997-2002:** EUROTRAC-2/CMD (The EUREKA Project 1489 on the Transport and Chemical Transformation of Environmentally Relevant Trace Constituents in the Troposphere over Europe; Second Phase), Principal Investigator in subproject CMD (Chemical Mechanism Development). My contribution: "The Role of Soluble Constituents of Atmospheric Aerosols in Aqueous Phase Oxidation Mechanisms of Trace Gases"
- **2002–2003** Principle investigator in bilateral project SLO-A-2002/14, entitled "Heterogeneous reactions of aerosols under controlled experimental conditions typical for haze". Project Partner: Prof. Dr. Regina Hitzenberger, Institute for Experimental Physics, University of Vienna, Austria.
- **2004-2005:** Principle investigator in bilateral project SI-AT/04-04/02 in the frame of S&T cooperation between the Republic of Slovenia and the Republic of Austria, entitled "Heterogeneous reactions of aerosols under controlled experimental conditions typical for haze - second part". Project Partner: Prof. Dr. Regina Hitzenberger, Institute for Experimental Physics, University of Vienna, Austria.
- **2004–2007:** Principal Investigator of an applied research project L1-6100-0104-04: "Influence of emission on ambient air pollution by particulate matter"; A collaborative research between National Institute of Chemistry, Electroinstitute "Milan Vidmar" and Thermopower plant Šoštanj

- **2011-2012:** Principle investigator in bilateral project no. BI-BE/11-12-F-012 in the frame of S&T cooperation between the Republic of Slovenia and the Flemish region, Belgium. Project Partner: Prof. Dr. Magda Claeys, Department of Pharmaceutical Sciences, University of Antwerp, Belgium.
- **Februar 2010 – April 2011:** Scientist in charge for postdoctoral project of Dr. Maryline Pflieger, entitled »Heterogeneous reactivity of semi-volatile organic compounds (SVOC) adsorbed on mineral particles»; co-financing the scientific cooperation of foreign citizens in Slovenia (Javni sklad RS za razvoj kadrov in štipendije).
- **Oktober 2014 – September 2016:** I. Grgić was a scientist in charge at the National Institute of Chemistry for International Fellowship Mobility Program for Experienced Researchers in Croatia – NEWFELPRO, a fellowship project of the Government of the Republic of Croatia and the Ministry of Science, Education and Sport. The postdoc project was co-financed through the Marie Curie FP7-PEOPLE-2011-COFUND program. The principal investigator was Dr. Sanja Frka Milosavljević, title: »Chemical nature of size segregated water-soluble organic aerosols and their nitro-aromatic constituents« (AERONAR).
- **Februar–July 2015:** Collaborative project with Prof. Marin Sands Robinson from Northern Arizona University, financing through Fulbright Scholar Program; title: “Chemical Speciation of Particulate using LA-ICPMS and Raman Analysis of Coarse Aerosols in Heterogeneous Ice Nucleation«.
- **October 2017 - October 2021:** Co-mentor to Kumar Sarang; PhD in the frame of H2020-MSCA-COFUND-2015 project (acronym NaMeS); research project on “Secondary organic aerosol formation: Kinetic and chemical studies of aqueous-phase reactions of selected plant volatiles in nanodroplets.” Institute of Physical Chemistry of the Polish Academy of Sciences (IPC PAS) and National Institute of Chemistry, Slovenia.

Teaching/Lecturing

- In the years 2008/2009, 2009/2010 and 2010/2011: Lecturer, subject Environmental chemistry/Atmospheric chemistry at the Faculty of Environmental Sciences, University of Nova Gorica. From 2010 responsible for the subject Environmental Chemistry.

Invited lectures

- *Laboratory studies of homogeneous and heterogeneous aqueous phase S(IV) oxidation catalyzed by different metal ions:* [lecture at] Joint CEC - EUROTRAC Workshop, Lactoz/Halipp working group, Chemical mechanisms describing tropospheric processes. Leuven, Belgium, 23-25 September 1992.
- *The effect of atmospheric organic compounds on the Fe-catalyzed S(IV) autoxidation in aqueous solution.* Nürnberg, Germany: Institut für Anorganische Chemie der Universität Erlangen-Nürnberg, June 1997.
- *Oxidation of sulfur (IV) species in tropospheric aqueous phase as a source of sulfate aerosols: Lecture in the frame of post-graduate studies, School of Environmental Sciences, Gorica: Politehnika (Polytechnic), January 2005*

- *Oxidation of sulfur (IV) species in tropospheric aqueous phase*. University of Ljubljana, Faculty of Health Sciences, Ljubljana, 2005.
- *Oxidation of SO₂ in tropospheric aqueous phase as a source of sulfate aerosols*. University of Ljubljana, Faculty of Health Sciences, Ljubljana, 2007.
- *Trace metals in aerosols and their role in atmospheric chemistry = Suivi de particules métalliques dans les aérosols et leur rôle dans la chimie atmosphérique*: [invited lecture = conférence] Réunion annuelle du Group Français de Cinétique et Photochimie. Marseille: Université de Provence, Laboratoire de Chimie et Environnement, 4-5 juin 2007.
- *Kovine v sledovih v aerosolskih delcih in njihova vloga v atmosferski kemiji = Trace metals in aerosols and their role in atmospheric chemistry*. Slovenski kemijski dnevi 2009, Maribor, 24. in 25. september 2009. [Maribor]: FKKT, [2009].
- *Trace metals in aerosol particles and their role in atmospheric chemistry*, International Summer School on Atmospheric pollution: Chemistry, Transport and Monitoring; 5.-18. Junij 2011, Nova Gorica/Gorica, Slovenia/Italy.
- *Organic compounds in clouds: lecture at ESF Strategic Workshop on The Molecular Identification of Organic Compounds in the Atmosphere*, University of Cambridge (UK), March 26, 2013. Cambridge, England.
- *Biomass burning organic aerosols in the atmosphere: Molecular markers*: Lecture at the University of Nova Gorica, FZO, 23. 5. 2013, Nova Gorica, Slovenia
- *Marker compounds for biomass burning organic aerosols in the atmosphere*. Slovenski kemijski dnevi 2013, Maribor, 10.-12. September 2013. Maribor: FKKT, 2013.
- *Organic aerosols in the atmosphere as a result of biomass burning*: Predavanje na delavnici Primerljivost meritev na področju odpadnih vod, 28. 1. 2016, National Institute of Chemistry, Ljubljana.
- *Seasonal variability of nitroaromatic compounds in ambient size-resolved water-soluble organic aerosols*. 25th Annual Meeting of the Slovenian Chemical Society, 25.-27. September 2019, Maribor, Slovenija.
- *Nitroaromatic compounds in ambient size-resolved water-soluble organic aerosols*: Online lecture at the Grupo de Estudos em Química Atmosférica, Universidade de São Paulo, Instituto de Química, São Paulo, Brazil, 16.10.2020.
- *Atmospheric Aqueous-Phase Brown Carbon Formation from Aromatic Precursors*: Online lecture at the Grupo de Estudos em Química Atmosférica, Universidade de São Paulo, Instituto de Química, São Paulo, Brazil, 23.4.2021.

Organization of meetings/conferences

- Workshop: *Interdisciplinary tropospheric research: from laboratory to global change - INTROP: 5th steering committee meeting*. Ljubljana [Slovenia]: National Institute of Chemistry, 30 Nov - 1 Dec 2006
- Final conference: ESF INTROP, Portorož, April 2009. Local organizer and member of organizing committee for: *Interdisciplinary tropospheric research: from the laboratory to global change: [conference] Tropospheric chemistry*. Portorož [Slovenia]: European Science Foundation (ESF), April 14th-17th 2009.

Professional Memberships and Boards

- National coordinator and member of Steering Committee of the ESF Research Networking Programme INTROP (Interdisciplinary Tropospheric Research from the Laboratory to Global Change, <http://www.esf.org/>) (2004–2009).
- Membership: GAeF (Gesellschaft Für Aerosolforschung - Association for Aerosol Research).
- Membership: Slovenian Chemical Society; President of the programme board for the Environmental chemistry and technology (Slovenian Chemical Days) (2009 – 2014).
- Member of editorial board: *ISRN Atmospheric Sciences*. Grgić, Irena (2012-2014). New York: International Scholarly Research Network. Cairo: Hindawi, 2012-. ISSN 2314-4645. <http://www.isrn.com/journals/as/>, doi: [10.5402/AS](https://doi.org/10.5402/AS).
- Guest Editor: *Atmosphere. Special Issue "Atmospheric Aqueous-Phase Chemistry"* 2018-2020; Basel: MDPI AG, 2010-. ISSN 2073-4433. https://www.mdpi.com/journal/atmosphere/special_issues/Aqueous_Phase_Chemistry
- Member of Editorial Board: *Atmosphere*. 2020-; Basel: MDPI AG, 2010-. ISSN 2073-4433.
- Member of Tribunal for Scientific Integrity, National Institute of Chemistry (February 2018 – February 2022).

Mentorship/Supervision

Postdoctoral projects:

- Dr. Maryline Pflieger: "Heterogeneous reactivity of semivolatile organic compounds (SVOC) adsorbed on atmospheric particles" (Mentor)
- Dr. Sanja Frka Milosavljević: Postdoctoral project in the frame of NEWFELPRO -: »Chemical nature of size segregated water soluble organic aerosols and their nitro-aromatic constituents« (AERONAR) (Scientist in charge)

Doctoral Dissertations:

- Co-mentor to *Janja Turšič*: "*Investigation on heterogeneous sulfate formation in polluted atmosphere*". *Doctoral Dissertation*. Ljubljana, 2002.
- Mentor to *Boštjan Podkrajšek*: "*Influence of manganese and carboxylic acids on oxidation of S(IV) species in tropospheric aqueous phase*". *Doctoral Dissertation*, Ljubljana, 2004.
- Mentor to *Zoran Kitanovski*: "*Characterization of water-soluble organic compounds and their multiphase chemistry as a source of secondary organic aerosols in the atmosphere*". *Doctoral dissertation*. Ljubljana, 2013.
- Mentor to *Kristijan Vidović*: October 2015 - October 2019, "*Formation and ageing of nitroaromatic compounds as important constituents of atmospheric brown carbon*." *Doctoral dissertation*. Ljubljana, 2020.

- Co-mentor to *Kumar Sarang*: October 2017 – October 2021, “*Atmospheric Secondary Organic Aerosol: Kinetic and Chemical Studies of in-Cloud Reactions of Selected Plant Volatiles*”, Institute of Physical Chemistry of the Polish Academy of Sciences (IPC PAS) and National Institute of Chemistry. *Doctoral Dissertation*, Warsaw 2022.

Master & Diploma students:

Master students: Faculty of Chemistry and Chemical Technology, University of Ljubljana, Slovenia:

- Mateja Poje
- Andreja Dovžan
- Marjeta Poznič
- Janja Turšič
- Boštjan Podkrajšek
- Jožica Bratec (Bolonia study)
- Peter Kastrin (Bolonia study)

Diploma students:

- Lidija Kozole - Faculty of Chemistry and Chemical Technology, University of Maribor Slovenia;
- Simon Jurman - Faculty of Environmental Sciences, University of Nova Gorica, Slovenia).
- Peter Kastrin-Bolonia study - Faculty of Chemistry and Chemical Technology, University of Ljubljana, Slovenia.
- 6 Research projects (Faculty of Chemistry and Chemical Technology, University of Ljubljana, Slovenia & Faculty of Environmental Sciences, University of Nova Gorica, Slovenia).

Total: Supervision of 2 Postdocs, (co)supervision of 5 Ph.D. students, 7 M.Sc. students & 3 Diploma students; Supervision of 6 Master and/or Diploma students in their research projects.

Important Publications (selection of 10):

1. Frka, S., Šala, M., Brodnik, H., Štefane, B., Kroflič, A., Grgić, I. Seasonal variability of nitroaromatic compounds in ambient aerosols: Mass size distribution, possible sources and contribution to water-soluble brown carbon light absorption. *Chemosphere* 299, July 2022, p. [1-36]. ISSN 0045-6535. DOI: [10.1016/j.chemosphere.2022.134381](https://doi.org/10.1016/j.chemosphere.2022.134381).
2. Vidović, K., Kroflič, A., Jovanovič, P., Šala, M., Grgić, I. Electrochemistry as a tool for studies of complex reaction mechanisms: The case of the atmospheric aqueous-phase aging of catechols. *Environmental Science & Technology* 53, 11195-11203, 2019. DOI: [10.1021/acs.est.9b02456](https://doi.org/10.1021/acs.est.9b02456).
3. Vidović, K., Lašič Jurković, D., Šala, M., Kroflič, A., Grgić, I. Nighttime aqueous-phase formation of nitrocatechols in the atmospheric condensed phase. *Environmental Science & Technology* 52, 9722-9730, 2018. DOI: [10.1021/acs.est.8b01161](https://doi.org/10.1021/acs.est.8b01161).

4. Frka, S., Šala, M., Kroflič, A., Huš, M., Čusak, A., Grgić, I. Quantum chemical calculations resolved identification of methylnitrocatechols in atmospheric aerosols. *Environmental Science & Technology* 50 (11), 5526-5535, 2016. DOI: [10.1021/acs.est.6b00823](https://doi.org/10.1021/acs.est.6b00823).
5. Kitanovski, Z., Čusak, A., Grgić, Irena, Claeys, M. Chemical characterization of the main products formed through aqueous-phase photonitration of guaiacol. *Atmospheric Measurement Techniques* 7 (8), 2457-2470, 2014. DOI: [10.5194/amt-7-2457-2014](https://doi.org/10.5194/amt-7-2457-2014).
6. Kitanovski, Z., Grgić, I., Vermeylen, R., Claeys, M., Maenhaut, W. Liquid chromatography tandem mass spectrometry method for characterization of monoaromatic nitro-compounds in atmospheric particulate matter. *Journal of Chromatography A*, 1268, 35-43. ISSN 0021-9673, 2012. DOI: [10.1016/j.chroma.2012.10.021](https://doi.org/10.1016/j.chroma.2012.10.021).
7. Grgić, I., Nieto-Gligorovski, L., Net, S., Temime-Roussel, B., Gligorovski, S., Wortham, H. Light induced multiphase chemistry of gas-phase ozone on aqueous pyruvic and oxalic acids. *PCCP. Physical Chemistry Chemical Physics* 12, 698-707, DOI: [10.1039/b914377g](https://doi.org/10.1039/b914377g).
8. Gligorovski, S., Elteren, J. T. van, Grgić, I. A multi-element mapping approach for size-segregated atmospheric particles using laser ablation ICP-MS combined with image analysis. *Science of the Total Environment* 407, 594-602, 2008. DOI: [10.1016/j.scitotenv.2008.09.017](https://doi.org/10.1016/j.scitotenv.2008.09.017).
9. Grgić, I., Podkrajšek, B., Barzagli, P., Herrmann, H. Scavenging of SO₄⁻ radical anions by mono- and dicarboxylic acids in the Mn(II)-catalyzed S(IV) oxidation in aqueous solution. *Atmospheric Environment* 41, 9187-9194, 2007.
10. Grgić, I., Berčič, G. A simple kinetic model for autoxidation of S(IV) oxides catalyzed by iron and/or manganese ions. *Journal of Atmospheric Chemistry* 39, 155-170, 2001.

Reviewer for the following Journals:

ACS Books Chapter	International Journal of Environmental
Atmosphere	Analytical Chemistry
Atmospheric Chemistry and Physics	ISNR Atmospheric Sciences
Atmospheric Environment	Journal of Aerosol Science
Atmospheric Research	Journal of Atmospheric Chemistry
Chemosphere	Journal of Environmental Sciences
Environmental Science: Processes & Impacts (RSC)	Journal of Geophysical Research – Atmospheres
Environmental Science and Technology (ACS)	Journal of Physical Science
Environmental Science and Technology Letters (ACS)	Science of the Total Environment
Environmental Chemistry	Slovenica Chimica Acta
Environmental Science and Pollution Research	Talanta