

Mattia Bartoli

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Nationality: Italian



Skills

- Biofuels production
- Thermal and microwave pyrolysis
- Development, maintenance and upgradings of thermal plants
- Development of quantitative and qualitative analysis for organic mixtures
- Heterogenous Catalysis

Education

- 2013-2016** **Doctorate of Philosophy in Chemical Science, curriculum of Organic chemistry (University of Florence, IT)**
•Microwave assisted pyrolysis
•Quantitative and qualitative analysis of biooils (GC-MS, GC-FID/MS, HPLC-UV/MS, HPLC-MS/MS)
•Polymers characterization (NMR, FT-IR ATR, GPC)
•Heterogenous catalysis (palladium and platinum nanoparticles, metal supported complexes)
- 2013** **M.Sc. in Chemical Science cum laude, curriculum of Organic chemistry (University of Florence, ICCOM-CNR, IT)**
•Development of end-capped poly(lactic acid) polymers and copolymers stereocomplexes as support for nanostructured palladium catalysts for selective hydrogenation of alkynes
- 2011** **B.Sc in Chemical Science (University of Florence, IT)**
•Synthesis of fullerene and carbon nanotubes nitroisoxazolidine derivatives
- 2010** **Course on energy marketplace sponsored by Eni, Toscana Energia and CESIFIN foundation**

Academic appointments

- 2018-current** **Research assistant at Polytechnic University of Turin (Turin, IT)**
•Biomass pyrolysis
•Biochar production
•Production of composites for electromagnetic and nuclear shielding
•Electrocatalysis
- 2017-2018** **Postdoc research fellow at University of Alberta (Edmonton, Alberta, CA)**
•Pyrolysis of wasted fatty acids
•Development of biosolids based catalysts
- 2015** **Visiting Ph.D. student at Institute for Chemical and Fuels from Alternative Resources (Western Ontario University, CA)**
•Biomass pyrolysis
•Biochar production
•Development of analytical methods for qualitative and quantitative analysis of biofuels (GC-FID/MS, HPLC-MS/MS, liquid-liquid extractions, ultimate and proximate analysis)
•Biomass upgrading for sugar production
- 2013** **Graduated fellow (University of Florence, IT)**

- Synthesis of end-capped poly(ethylene glycol) functionalized with pyridine and bipyridine derivatives*
- Development of palladium based hydrosoluble catalyst for nitrile hydrolysis*

Honours, awards and grants

2013	<i>Ph.D. fellowship from Chemistry Department of University of Florence</i>
2013	<i>Prize for best elaborate in the field of catalysis by Interdivisional Group of Catalysis of Italian Chemical Society</i>
2008-2013	<i>European fellowships for deserving students (Chemical sciences)</i>
2008	<i>First prize for deserving students in the field of sciences by Rotary club (Provincial section of Pistoia, IT)</i>

Memberships

- *Italian chemical society (SCI)*
- *Italian transhumanist society*
- *Italian transhumanist network*

Research projects

2018	<i>Biochar as cheap and high performances filler for composites applications and electrocatalysis</i>
2017	<i>Incorporation of biosolids from municipal wastewater processing facilities into Lipid-to-Hydrocarbon (LTH) methodologies for production of biofuels</i>
2017	<i>Upgrade of Lipid-to-Hydrocarbon (LTH) technologies for pilot plant scale-up</i>
2013-2016	<i>Zero waste : microwave approach to pyrolysis of polymeric materials</i>
2013-2016	<i>End-capped nitrogen containing PLA-based ligand: synthesis, characterization and catalytic applications</i>

Teaching experiences

2018-current	<i>Teaching for the graduate class of "Laboratory of chemistry" (Polytechnic of Turin, IT)</i>
2018-current	<i>Teaching assistant for the graduate class of "Physics I" (Polytechnic of Turin, IT)</i>
2018-current	<i>Teaching assistant for the graduate class of "Physics II" (Polytechnic of Turin, IT)</i>
2014-2016	<i>Teaching assistant for the graduate class of "Advance material for cultural heritage applications"(University of Florence, IT)</i>
2014-2016	<i>Mentoring for undergraduate teaching qualification class(University of Florence, IT)</i>
2013-2016	<i>Laboratory trainer of undergraduate and graduate students for Industrial chemistry group (University of Florence, IT)</i>
2013-2016	<i>Teaching assistant for the graduate class of "Biorganic chemistry" (University of Florence, IT)</i>

Supervision and mentoring experiences

- *Ivana Ropus, Ph.D. Candidate, DISAT, Polytechnic of Turin (IT), 2017*
- *Giorgio Petrucci, Ph.D. Candidate, Chemistry Department “Ugo Schiff”, University of Florence (IT), 2013-2015*
- *Giulia Barbero, Ph.D. Candidate, ICFAR, Western Ontario University (CA), 2015*
- *Abid Muhammad, Master student, DISAT, Polytechnic of Turin (IT), 2017*
- *Yeye Lu, Master student, Department of agricultural, food and nutritional science, University of Alberta, (CA), 2017*
- *Damiano Bandelli, Master student, Chemistry Department “Ugo Schiff”, University of Florence (IT), 2014-2015*
- *Jacopo Lardori, Master student, Industrial Chemistry Department “Toso Montanari”, University of Bologna (IT), 2014-2015*
- *Marta Priori, Master student, Chemistry Department “Ugo Schiff”, University of Florence (IT), 2014*
- *Benedetta Mini, Master student, Chemistry Department “Ugo Schiff”, University of Florence (IT), 2014*
- *Alfredo Maione, Master student, Chemistry Department “Ugo Schiff”, University of Florence (IT), 2014*
- *Giulia Mencherini, Bachelor student, Chemistry Department “Ugo Schiff”, University of Florence (IT), 2016*
- *Stefano Bonacchi, Bachelor student, Chemistry Department “Ugo Schiff”, University of Florence (IT), 2015-2016*
- *Costanza Vanni, Bachelor student, Chemistry Department “Ugo Schiff”, University of Florence (IT), 2013*

Work experiences

2018	<i>Editor for “International Journal of Management Science and Engineering”</i>
2017	<i>Internship at ForgeHydrocarbon (Edmonton, Alberta, CA)</i>
2017	<i>Palladium venture funding consultant</i>
2008	<i>Chemical laboratory technician at “Laboratorio di studi ambientali”(Pistoia, IT)</i>

Contacts for references

- Dr.Marco Frediani, University of Florence, e-mail: marco.frediani@unifi.it, phone: +390554573459
- Prof. Luca Rosi, University of Florence,, e-mail: luca.rosi@unifi.it, phone:+390554573458
- Dr. Werner Oberhauser, ICCOM-CNR e-mail: werner.oberhauser@iccom.cnr.it, phone: +390555225284
- Prof. David C. Bressler, University of Alberta, e-mail: dbressle@ualberta.ca, phone:+17804924986
- Prof. Alberto Tagliaferro, Polytechnic of Turin, e-mail: alberto.tagliaferro@polito.it, phone:+390110907347

Peer reviewed papers

- **“Nitrile hydration to amide in water: Palladium-based nanoparticles vs molecular catalyst”**, W.Oberhauser, M. Bartoli, G.Petrucci, D.Bandelli, M.Frediani, L.Capozzoli, C.Cepek, S.Bhardwaj, L.Rosi, Journal of molecular catalysis A: chemicals, *410*, **2015**, 26-33 DOI: 10.1016/j.molcata.2015.09.003
- **“Palladium-nanoparticles on end-functionalized poly(lactic acid)-based stereocomplexes for the chemoselective cinnamaldehyde hydrogenation: Effect of the end-group”** W. Oberhauser; C. Evangelisti; R.P. Jumde; G. Petrucci; M. Bartoli; M. Frediani; M. Mannini; L. Capozzoli; E. Passaglia; L. Rosi, Journal of Catalysis, *330*, **2015**, 187-196 DOI: 10.1016/j.jcat.2015.07.012
- **“Depolymerization of polystyrene at reduced pressure through a microwave assisted pyrolysis”** M.Bartoli, L.Rosi, M.Frediani, A.Undri, P.Frediani, Journal of Analytical and Applied Pyrolysis *113*, **2015**, 281-287 DOI: 10.1016/j.jaap.2015.01.026
- **“A simple procedure for chromatographic analysis of bio-oils from pyrolysis”** A.Undri, M. Abou-Zaid, C.Briens, F.Berruti, L.Rosi, M.Bartoli, M.Frediani, P. Frediani, Journal of Analytical and Applied Pyrolysis, *114*, **2015**, 208-221 DOI: 10.1016/j.jaap.2015.05.019
- **“Synthesis of Dianols or BPA through catalytic hydrolysis/glycolysis of waste polycarbonates using a microwave heating”** L.Rosi, M.Bartoli, A.Undri, M.Frediani, P.Frediani Journal of molecular catalysis A: chemicals, *408*, **2015**, 278-286 DOI: 10.1016/j.molcata.2015.07.027
- **“Pyrolysis of α -cellulose using a multimode microwave oven”** M.Bartoli, L.Rosi, A.Giovannelli, P. Frediani, M.Frediani, Journal of Analytical and Applied Pyrolysis *120*, **2016**, 284-296 DOI: 10.1016/j.jaap.2016.05.016
- **“Bio-oil from residues of short rotation coppice of poplar using microwave assisted pyrolysis”** M.Bartoli, L.Rosi, A.Giovannelli, P.Frediani, M.Frediani Journal of Analytical and Applied Pyrolysis *119*, **2016**, 224-232 DOI: 10.1016/j.jaap.2016.03.001
- **“Production of bio-oils and biochar through microwave assisted pyrolysis of *Arundo donax* in a multi mode batch reactor”** M.Bartoli, L.Rosi, A.Giovannelli, P. Frediani, M.Frediani, Journal of Analytical and Applied Pyrolysis, *120*, **2016**, 479-489 DOI: 10.1016/j.jaap.2016.10.016
- **“Platinum nanoparticles onto pegylated poly(lactic acid) stereocomplex for highly selective hydrogenation of aromatic nitrocompounds to anilines”** W. Oberhauser, C. Evangelisti, C. Tiozzo; M. Bartoli; M. Frediani; E. Passaglia; L. Rosi, Applied Catalysis A: General, *537*, **2017**, 50-58 DOI: 10.1016/j.apcata.2017.03.003
- **“Microwave assisted pyrolysis of halogenated plastics recovered from waste computers”** L. Rosi, M.Bartoli, M.Frediani, Waste management, *73*, **2018**, 511-522 DOI: 10.1016/j.wasman.2017.04.037
- **“Bio-oil from pyrolysis of wood pellets using a microwave multimode oven and different microwave absorbers”** A.Undri, M.A. Zaid, C.Briens, F.Berruti, L.Rosi, M.Bartoli, M.Frediani, P.Frediani, Fuel, *153*, **2015**, 464-482 DOI: 10.1016/j.fuel.2015.02.081
- **Pd-nanoparticles supported onto functionalized poly(lactic acid)-based stereocomplexes for partial alkyne hydrogenation”** G. Petrucci, W. Oberhauser, M. Bartoli, G. Giachi, M. Frediani, E. Passaglia, L. Capozzoli, L. Rosi, Applied Catalysis A: General *469*, **2014**, 132– 138 DOI: 10.1016/j.apcata.2013.09.053
- **“Design and Synthesis of New DOTA Conjugated (+)-Biotin Dimers to Develop High Affinity in Vitro Tumor Pretargeting Based on MW-Tuned Avidin Oligomers”** A.Pratesi, M. Ginanneschi, F.Melani, M. Chinol, A.Carollo, G. Paganelli, M.Lumini, M.Bartoli, M. Frediani, L.Rosi, G.Petrucci, L.Messori, A.M.Papini, Organic & biomolecular chemistry, *13*, **2015**, 3988-4001 DOI: 10.1039/C4OB02685C
- **“An easily recoverable and recyclable homogeneous polyester-based Pd catalytic system for the hydrogenation of α,β -unsaturated carbonyl compounds”** M. Bartoli, L. Rosi, G. Petrucci, W. Oberhauser, M. Frediani, O. Piccolo, V.D. Rathod, S. Paganelli, Catalysis communications, *69*, **2015**, 228-233 DOI: /j.catcom.2015.07.002
- **“A simple protocol for quantitative analysis of bio-oils through gas-chromatography/mass spectrometry”** M.Bartoli, L.Rosi, M. Frediani, M.Frediani, European Journal of Mass Spectrometry, *20* (1), **2016**, 1-14 DOI: 10.1255/ejms.1432
- **“Palladium nanoparticles supported onto stereocomplexed poly (lactic acid)-poly (ϵ -caprolactone) copolymers for selective partial hydrogenation of phenylacetylene”** M.Frediani, W. Oberhauser, L. Rosi, M. Bartoli, E. Passaglia, L. Capozzoli, Rendiconti dei Lincei, **2017**, 1-8 DOI: 10.1007/s12210-017-0600-8

- **“Microwave assisted pyrolysis crop residues of *Vitis vinefera*”** M.Bartoli, L.Rosi, A.Giovannelli, Maurizio Passaponti, P. Frediani, M.Frediani, *Journal of Analytical and Applied Pyrolysis*, *130*, **2018**, 305-313, **DOI:** 10.1016/j.jaap.2017.12.018
- **“Value-added products from urea glycerolysis using a heterogeneous biosolids-based catalyst”** M.Bartoli, C.Zhu, M.Chae, D.C.Bressler, *Catalysts*, *8(9)*, **2018**, **DOI :**10.3390/catal8090373

Book chapters

- **“Pyridine and Bipyridine End-functionalized Polylactide: Synthesis and Catalytic Applications”** M.Frediani, W.Oberhauser, L.Rosi, E.Passaglia, D.Bandelli, M.Bartoli, G.Petrucci, in “Handbook of Composite from Renewable Materials”, *vol.4* Wiley, 2017 ISBN 978-1-119-22376-4
- **“Palladium-based catalysts-supported onto end-functionalized poly(lactide) for C-C double and triple bond hydrogenation reactions”**, M.Frediani, W.Oberhauser, L.Rosi, E.Passaglia, M.Bartoli, in “New Advances in Hydrogenation Processes - Fundamentals and Applications”, InTech, 2016 ISBN 978-953-51-2870-0
- **“A friendly management of waste/contaminated polymeric materials from differentiated waste collection through microwave pyrolysis”**L. Rosi, M. Frediani1, A. Undri, M. Bartoli, Piero Frediani, NovaPublisher in “Municipal Solid Waste: Management Strategies ” 2017 ISBN 978-1-53611-865-0
- **“Challenges and opportunities in the field of energy storage: supercapacitors and activated biochar”** M.Bartoli, L.Rosi, P. Frediani, M.Frediani, NovaPublisher in “Biochar for non soil application ” 2018 ISBN 978-1-53613-937-2
- **“Synthesis and Applications of Unsaturated Polyester Composites”**M.Bartoli, L.Rosi, M.Frediani, Elsevier, 2019

Conference contributions

- **NANOTECH 2013** (“Poly(lactic acid)-Based Stereocomplexes as Recyclable Organic Support for Pd-Nanoparticles”)
- **XVIII New trends in organic synthesis, 2013**, (“PLA stereocomplex like support for nanostructured palladium catalysts : synthesis and catalysis applications”)
- **PYRO 2014-20th International Symposium on Analytical & Applied Pyrolysis**, (“Microwave pyrolysis as tool for recycling waste/contaminated polystyrene”)
- **XXV Conference of Italian Chemical Society, 2014**, (“Green catalytic hydrolysis of polycarbonate through microwave heating “)
- **XVIII National conference on catalysis, 2015**, (“Nitrile Hydration to Amide in Water: Palladium-Based Nanoparticles versus Molecular catalyst“)
- **XIX Conference of Italian Chemical Society-Industrial Chemistry division, 2015**(“Microwave assisted pyrolysis of cellulose in a multimode batch oven”)
- **17th International symposium on relations between homogeneous and heterogeneous catalysis 2015**, (“ Pd-nanoparticles on end-functionalized poly (lactic acid)-based stereocomplexes: Selectivity in C=C bond hydrogenation reactions)
- **BioFuelNet symposium, 2015**, (“Jumbo MFR: continuous pyrolysis unit”)
- **PYRO 2016-21th International Symposium on Analytical & Applied Pyrolysis, 2016** (“ Production of biooils and biochar through microwave assisted pyrolysis of *Arundo donax* in a multi mode batch reactor”, “Acid treatment of Phragmites for sugar and sugar derivatives production”)
- **5TH International Green processing engineering, 2016** (“Bio-oils from microwave assisted pyrolysis of cellulose using a multi mode batch reactor”, “Microwave assisted pyrolysis of kraft lignin at reduce pressure in a multimode oven”, “Microwave assisted pyrolysis of waste from short rotation coppice of poplar”)
- **XIX Conference of Italian Chemical Society-Catalysis division, 2016**, (“ Palladium-nanoparticles on end-functionalized poly(lactic acid)-based stereocomplexes for the chemoselective cinnamaldehyde hydrogenation: Effect of the end-group”)
- **6th International symposium on energy from biomass and waste, 2016**, (“Microwave assisted pyrolysis of halogenated plastics recovered from waste computers”)

- **EuropaCat 2017, 2017** (“Platinum nanoparticles onto pegylated poly(lactic acid) stereocomplex for highly selective hydrogenation of aromatic nitrocompounds to anilines”, “Pd-based catalysts supported onto PLA stereocomplexes: overview on synthesis, characterization and application in selective hydrogenation reactions”, “Water-soluble nanostructured palladium catalysts: synthesis, characterization and application for nitrile hydrolysis”)
- **Spark 2017, 2017**(“ Biofuels from inedible fatty acids : the use of biosolids and the sulfur issue”)
- **26th Annual International Conference on Composites/Nano Engineering, 2018**(“ BIOCHAR: The New Low Cost Carbon Filler Able To Improve Mechanical Proprieties In Epoxy Resins”)
- **Merck & Elsevier young chemists symposium, 2018** (“Biochar from pyrolysis of olive waste: natural template for nanostructured polymer filler ”)

Activity plan

Research activity

There is a finite supply of crude oil in the world, yet the request for raw materials and fuels from the fossil fuel industry is growing every year, especially in the developing world. As a consequence, research into renewable resources that are able to supply alternatives to oil has become very attractive. Biomass is a very promising source to satisfy the growing requirement for energy and raw materials and additionally offers benefits in the reduction of environmental impact. During the last twenty years, the increase of companies accountability for environmental issues has represented a formidable driving force for the development of sustainable industrial. Thus, fuels and chemicals production have started to replace oil based raw material with recycled or renewable feedstocks trying to conjugate the process sustainability with performances of traditional commodities. This goal is far to be properly achieved and my research will focused on the following points

1. Waste to raw chemicals

Actually, biorefinery platforms produce plenty of side products and waste. As an example biodiesel is one of the most well established technology based on renewable resources but, increasing of biodiesel production has made available abundant amount of glycerol, produced as byproduct, exploitable as feedstock for several chemical synthesis.

The first step of research will be focused on the identification and exploitation through chemical conversion of waste from sustainable process improving the overall procedures.

In this research framework, compounds like glycerol from biodiesel production, lignin and waste from pulp&mill industry and wasted polymeric materials will be the starting materials to produce new raw chemicals as glycerol carbonate, levoglucosenone, furfural and phenols using catalytic conversions.

2. Biobased high performances materials development

Generally, costs of sustainable processes represent the main obstacle to dissemination of production based on green chemistry criteria. Despite this, biobased material with high performances could be a reliable solution to this issue. To accomplish this purpose, several option will investigated:

- Incorporation of commercial biochar from thermal treatment of woody biomasses in electrochemical devices (*i.e.* supercapacitors, fuel cells) and for composite production with several applications (*i.e.* insulation, electromagnetic shielding)
- Use of biobased chemicals as glycerol for production of high mechanical properties polymers (*i.e.* vitrimers) or cellulosic residues from pulp&mill industry for elastomeric polymers production.

3. Bio- and waste based catalysts

Heterogeneous catalysis is a very attractive way for several industrial applications. Despite this, the most performance effective catalysts are based on noble metal and high costly materials. So, the use of alternative sources for developing of heterogeneous catalysts is very attractive. For achieving this aim I will consider the use of:

- Carbonized metal reached materials (*i.e.* WEEE, tires) fro electrochemical applications (*i.e.* electro Fenton processes)
- Chemical modification of waste biomass (*i.e.* food waste, residue of pulp&mill industry)

Establish research collaborations

To promote the dissemination of knowledge and the improvement of research activity, collaboration with national and international research group will activated. In this way, different expertise and experiences could join together to reach common research goals enriching all groups involved.

Teaching of philosophy

Science is an amazing instrument to understand the world. But, the use science is not easy. Handle scientific instruments is an hard path and chemistry is not an exception. Despite this, the knowledge of chemistry could give a deep look insight the world. This belief has guided me during the mentorship of several students and teaching of different courses. In my opinion, the teaching experience should be focused , in the very first place, on giving the correct instruments to handle easily, but without doubts, the topic. In the case of chemistry, the

are four main possible approaches. The first is about general and inorganic chemistry and should be focused on periodic table and properties of elements in order to understand the very basic concepts. The second regard the organic chemistry and it should be focused on the reactivity of carbon as hydrocarbon, oxidised forms (ethers, alcohols, carbonyl and carboxylic compounds) and as aromatic structures. The third one is about the analytical analysis and it should be based more on the practical aspect of the topic with a particularly emphasis on laboratory activity. The final one is the most theoretical and it is not fit for all courses but only for those that require a full knowledge of the chemistry. I am talking about physical chemistry. These basic teaching concepts could be applied to undergraduate and graduate classes stressing different points promoting personal insights. In my experience these methods could positively used to promote an efficient learning. Sustainable chemistry requires all the competences above together a greater enthusiasm. It was been and it will be my main aim to teach the first and to share the second with my students.