



PAOLA FERMO

Place and date of birth: Milan, 12-22-1969

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Scopus Author ID: 6701742333

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ACADEMIC

1993 Degree in Chemistry, University of Milan (110/110)

1997 PhD in Chemistry, University of Milan

1997– 1999 Technical collaborator in the Department of Inorganic, Metallorganic and Analytical Chemistry, University of Milan

1999 – 2014 Researcher in Analytical Chemistry, Department of Inorganic, Metallorganic and Analytical Chemistry, University of Milan

since 2015 - Associate Professor of Analytical Chemistry, Department of Chemistry, University of Milan

National Scientific qualification (ASN) as PO: sector 03/A1 – SSD CHIM01 (call 2016-2018, primo quadrimestre)

PRINCIPAL FIELDS OF RESEARCH

Atmospheric and environmental chemistry:

Characterization of aerosol particulate matter (PM) carried out by different analytical techniques for the quantification and speciation of main species (carbonaceous fraction and ions); analysis of specific markers for the identification of aerosol PM sources.

Effect of environmental pollution on cultural heritage: study of black crust present on historical monuments in polluted environments; indoor air quality assessment in museums and art galleries.

Chemical characterization of biomarkers of environmental pollution (honey or plant leaves); food analysis and food safety control.

Analytical chemistry applied to cultural heritage:

provenance and technological study of archaeological and Renaissance ceramics, paintings, mortars, etc.; new coatings based on nano-materials for the protection of materials of artistic-historical-interest (marbles, mortars).

PUBLICATIONS

111 scientific publications on international peer-review journals (Scopus and Web of Science) in the field of environmental and analytical chemistry as well as archaeometry; 20 conference proceeding; 16 book chapters; more than 200 communications in national and international congresses; invited speakers in national and international congresses.

Scopus

h- index=29

Citations= 2449

ASSOCIATIONS

Member of SCI (Divisione di Chimica Analitica e Divisione di Chimica dell'Ambiente e dei Beni Culturali)

AIAR (Italian Association of Archaeometry), ACE (Association of Chemistry and the Environment)

Secretary of the SCI Interdivisional Group of Aerosol Science and Technologies (2009-2012)

Member of consortium INSTM (consorzio internazionale per la scienza e la tecnologia dei materiali)

Member of CRC (centro di ricerca coordinato) Beni Culturali, University of Milan (<http://www.crc-beniculturali.unimi.it>)

SCIENTIFIC COMMITTEES

Member of the scientific committee of the Workshop “Sustainable knowledge and preservation of Cultural Heritage for future generations”; 2-4/05/2016, E-MRS (Materials Research Society) Spring Meeting, Lille (France)

Organizer of the section entitled: Measurements for ceramics and glasses
International congress: Metrology for Archaeology, 19-21/10/2016, Torino

Member of the scientific committee of YOCOCU congress (Youth in Conservation of Cultural Heritage), Matera, 23-25/05/2018

Member of the scientific committee of SIMA (Società Italiana di Medicina Ambientale) (<http://www.simaonlus.it>)

EDITORIAL SERVICE AND PARTICIPATION IN EDITORIAL BOARDS

Reviewer of international journals: Environ. Pollution, Atm. Env., Journal Of Cultural Heritage, Atm. Chem. and Physics, Science Of The Total Env., Env. Sc. And Pol. Res., Prog. In Organic Coatings, etc.

Member of the Editorial Board of international journals: Mediterranean Journal of Chemistry, Annals of Chromatography and Separation Techniques, Journal of Analytical and Bioanalytical Techniques, American Journal of Analytical Chemistry

FUNDED NATIONAL AND INTERNATIONAL RESEARCH PROJECTS AS PRINCIPAL INVESTIGATOR

2004-2006: FIRB2003: *Archaeology, Archaeometry and archeoinformatica for knowledge, conservation and enhancement of ancient Mediterranean landscape*; PI of the research unit; budget for the unit: € 162.300

2004-2007: Parfil 2004, Fine Particulate Matter in the Lombardy Region; PI of the research unit of UniMi; budget €1.050.000

2007-2009: Tender 17/07 - EUROPEAN COMMISSION; contract number – 383493

Carbon Speciation and Levoglucosan Analysis of Particulate matter from Lombardy Region” - JRC Joint Research Centre, Ispra, 2007-2009; principal investigator; budget € 58.500

2010-2011: CARIPO: "Il cortile del Richini (Università degli Studi di Milano, Via Festa del Perdono)", 1 January 2010 - 30 June 2011; PI of the research unit; budget € 353.750

2015: Contract For Research Activities: Set-up of a methodology for the analysis of ions, organic carbon (OC) and elemental carbon (EC) in aerosol particulate matter samples; funded by: Paul Scherrer Institute-PSI, Switzerland; project coordinator; budget € 29.000

2014-2016: CARIPO: “TOxicity of BIomass COmbustion generated by Ultrafine Particles (TOBICUP)”, June 2014 - June 2016; PI of the research unit; budget € 202.000

2017-2018: Contract For Research Activities: Caratterizzazione delle bottom ash (IBA) provenienti dagli impianti di incenerimento dei rifiuti urbani e simili ai fini della definizione della loro pericolosità secondo le categorie HP (hazardous properties)
Funded by A2A; project coordinator; budget €18.000

PARTECIPATION IN RESEARCH PROJECTS AS MEMBER OF RESEARCH UNIT OR SUB-

CONTRACTOR

2001-2002: involvement inside the regional project PUMI (Particolato fine nell'area urbana Milanese)

2004-2006: PRIN 2004 (2004037331_009): participation in the research unit of UniMiB; project: Integrated Study on the National Territory for Characterization and Control of Atmospheric Pollutants (Sitecos); budget € 430.000

2005: participation at a Trans-national action (access to the AGLAE accelerator, Louvre Museum-Paris) within the European Project Artech (Access, Research and Technology for the conservation of the European Cultural Heritage) - sixth framework programme

2008-2010: PRIN 2007 (2007XRNRJ_001): participation in the research unit of UniMi; title: Innovative Physical Methodologies for the determination of carbon components in atmospheric aerosol; budget € 166.000

2009-2010: involvement in PRIN 2008; title: LENS: Legna, ENergia, Salute; budget € 155.000

2011: collaboration as sub-contractor in the frame of the MED-APICE european project (Mediterranean strategy and local practical Actions for the mitigation of Port, Industries and Cities Emissions)

2014: Analysis of OC / EC and levoglucosan in samples of airborne particulate matter in Vado Ligure; prestazione per la Procura di Savona (ausiliario del CTU); € 40.500

2014: Analysis of OC / EC and levoglucosan in samples of airborne particulates; prestazione per la Procura di Gorizia (ausiliario del CTU); € 27.000

2015: CTP Procura of Brescia SEZIONE LAVORO, CAUSA N° 3500-1/2011 R.G

2016: Determination of OC / EC and levoglucosan ; prestazione per la Procura di Brindisi (ausiliario del CTU); € 66.490

2017-2018: responsible for UniMi of the diagnostic activity: Misure del particolato atmosferico e della qualita' dell'aria della sala del Cartone di Raffaello in Pinacoteca Ambrosiana
Funded by Fondazione Cardinale Federico Borromeo; budget € 6500

ACKNOWLEDGEMENTS

- Invited paper: G. Pdeletti, P. Fermo *How the Masters in Umbria, Italy, generated and used nanoparticles in art fabrication during the Renaissance period* Applied Physics A 76 (2003) 515-525

- Selected to be included in the data-base "100 donne contro gli stereotipi" (www.100esperte.it) including 100 women in Italy with expertise in the STEM areas (Science, Technology, Engineering and Mathematics)

- Co-author of the "Decalogo della qualità dell'aria indoor" and invited to present it at the Camera dei Deputati (Rome, 15 December 2016)

MORE SIGNIFICANT INVITED ORALS AT NATIONAL AND INTERNATIONAL CONGRESSES

P. Fermo, *The damage induced by atmospheric pollution on stone surfaces: the chemical characterization of black crusts* ; Workshop "Mathematical Modeling and Analysis of degradation and restoration in Cultural Heritage MACH2019 INdAM - Roma, March 25-29, 2019

P. Fermo, "*I traccianti della biomassa nel PM per la stima del contributo delle varie fonti*" Il ruolo del riscaldamento domestico nell'ambito della qualità dell'aria a scala locale e regionale, Milano, 23-10- 2017, Camera di Commercio di Milano, sala Conferenze

P. Fermo, *The degradation induced by air pollution on stone surfaces: from characterization to conservation*, XVI CONGRESSO NAZIONALE Chimica dell'Ambiente e dei Beni Culturali, Lecce, 26-29/06/2016

P. Fermo, *Estimation of wood burning contribution to PM in Northern Italy: a review on recent results*, International Conference on Turbulence, Transfer, Transport and Transformation (T4 Conference) Budapest, Eotvos University, 24-25/05/2012

P. Fermo, *Study of Renaissance lustred shards: principal results* International Symposium: "Mastro Giorgio da Gubbio: Art, Science and Technology of Lustred Majolicas", 9–11/11/2005, Gubbio, Italy

P. Fermo, *Metodologie per l'individuazione dei "traccianti" della legna nel particolato atmosferico*, Le emissioni dalla combustione della legna in piccoli impianti domestici e la qualità dell'aria, 23/05/2011, Milano

P. Fermo, *Beni culturali e inquinamento atmosferico*, La chimica incontra i beni culturali, un viaggio in Lombardia, Politecnico di Milano, 11/01/2011, Milano

P. Fermo, *Inquinamento atmosferico in ambiente museale: il caso della Pietà Rondanini di Michelangelo al Castello Sforzesco di Milano* Incontro: "Prospettive analitiche innovative applicate ai settori ambientale, beni culturali e alimentare", 21/06/2005, Milan

PARTICIPATION IN EVALUATION COMMISSIONS

1. Selection of 1 researcher sector CHIM/01, l'Università dell'Insubria, 2005

2. Committee for the Ph.D. final examination:

PhD in Materials Science and Engineering (XXV ciclo) Università di Trento, 2014

School of Material Engineering, Milan Polytechnic, 2016

PhD in Chemical sciences and technologies, University of Cagliari, XXIX cycle, 2017, Cagliari

PhD in Chemistry University of Bologna, XXIX cycle, 2017, Bologna

3. Member of the committee for the selection of 1 researcher RTDB at the Department of Chemistry, University of Milan, 2018

TEACHING ACTIVITY

Adjoint Professor 2001-2013; since 2015 Associate Professor of Analytical Chemistry (CHIM01). Since 1999 teaching activity for undergraduate and graduate courses leading to Bachelor of Science (BS) and Master of Science (MS) degrees in Chemistry and Industrial Chemistry

Member of the board of professors of PhD in Chemistry, University of Milan; supervisor of students (more than 60 Master's theses in Chemistry; supervisor of 4 PhD students)

Teaching activity for PhD: 2003-2016

A. A. 2003-2004 - Topic of the course: *Carbonaceous aerosols in the atmosphere: from sources to remote areas; the carbonaceous fraction of PM*; visiting professor Prof. Hélène Cachier, Laboratoire des Sciences du Climat et de l'Environnement (LSCE), laboratoire mixte CEA-CNRS, Gif sur Yvette Cedex (France);

A. A. 2004-2005: Topic of the course: *Advances in tropospheric aerosol*; visiting professor Prof. Himre Salma, Eötvös University, Environmental Chemistry, Budapest, Hungary;

A. A. 2007-2008: Topic of the course: *Investigation of particulate sources emissions; the impact of biomass combustion on the European aerosol background*; visiting professor Prof. Hans Puxbaum, Technical University Vienna Austria

A. A. 2010-2011: Topic of the course; *Spettroscopia di fotoelettroni a raggi X (XPS). Tecnica per lo studio delle superfici in campo ambientale*; visiting professor Prof. Davide Atzei, Università di Cagliari

A. A. 2012-2013: Topic of the course: *Advances In Atmospheric Aerosol Research*; visiting professor Prof. Imre Salma Eotvos University, Institute of Chemistry, Budapest, Hungary,

A. A. 2014-2015: Topic of the course: *Advances In Atmospheric Aerosol Research*; visiting professor Prof. Imre Salma Eotvos University, Institute of Chemistry, Budapest, Hungary,

A.A. 2015-2016: Topic of the course: *Organic Emerging Contaminants: Analytical Methodologies And Presence In The Environment*; visiting professor Prof. J- Santana Rodríguez Institute of Environmental Studies and Natural Resources, Director University of Las Palmas de G.C. Las Palmas de G.C. , Spain

A.A. 2017-2018: Topic of the course: *Air and water pollutants: impact on health and climate* visiting professor Prof. J- Santana Rodríguez Institute of Environmental Studies and Natural Resources, Director University of Las Palmas de G.C. Las Palmas de G.C., Spain

Recent Publications

(2019) Atzei, D., Fermo, P., Vecchi, R., Fantauzzi, M., Comite, V., Valli, G., Cocco, F., Rossi, A. *Composition and origin of PM 2.5 in Mediterranean Countryside Environmental Pollution*, Environmental Pollution, pp. 294-302

(2019) Ielpo, P., Mangia, C., Marra, G.P., Comite, V., Rizza, U., Uricchio, V.F., Fermo, P. *Outdoor Spatial distribution and indoor levels of NO₂ and SO₂ in a high environmental risk site of the South Italy* Science of the Total Environment, 648, pp. 787-797

(2019) Amadori, M.L., Fermo, P., Raspugli, V., Comite, V., Mini, F.M., Maekawa, Y., Russa, M.L. *Integrated scientific investigations on the constitutive materials from Me-taw-ya Temple, Pagán Valley, Burma (Myanmar)* Measurement: Journal of the International Measurement Confederation, 131, pp. 737-750

(2018) Comite, V., Fermo, P.
The effects of air pollution on cultural heritage: The case study of Santa Maria delle Grazie al Naviglio Grande (Milan) European Physical Journal Plus, 133 (12), art. no. 556

(2018) Fermo, P., Goidanich, S., Comite, V., Toniolo, L., Gulotta, D.
Study and characterization of environmental deposition on marble and surrogate substrates at a monumental heritage site Geosciences (Switzerland), 8 (9), art. no. 349

(2018) La Russa, M.F., Comite, V., Aly, N., Barca, D., Fermo, P., Rovella, N., Antonelli, F., Tesser, E., Aquino, M., Ruffolo, S.A. *Black crusts on Venetian built heritage, investigation on the impact of pollution sources on their composition* European Physical Journal Plus, 133 (9), art. no. 370

(2018) Vecchi, R., Bernardoni, V., Valentini, S., Piazzalunga, A., Fermo, P., Valli, G.
Assessment of light extinction at a European polluted urban area during wintertime: Impact of PM₁ composition and sources Environmental Pollution, 233, pp. 679-689.

(2018) Amadori, M.L., Pallante, P., Fermo, P., Emami, M.A., Chaverdi, A.A., Callieri, P., Matin, E.; *Advances in Achaemenid brick manufacturing technology: Evidence from the monumental gate at Tol-e Ajori (Fars, Iran)* Applied Clay Science, 152, pp. 131-142.

(2017) Bernardoni, V., Elser, M., Valli, G., Valentini, S., Bigi, A., Fermo, P., Piazzalunga, A., Vecchi, R.
Size-segregated aerosol in a hot-spot pollution urban area: Chemical composition and three-way source apportionment Environmental Pollution, 231, pp. 601-611.

(2017) Daellenbach, K.R., Stefanelli, G., Bozzetti, C., Vlachou, A., Fermo, P., Gonzalez, R., Piazzalunga, A., Colombi, C., Canonaco, F., Hueglin, C., Kasper-Giebl, A., Jaffrezo, J.-L., Bianchi, F., Slowik, J.G., Baltensperger, U., El-Haddad, I., Prévôt, A.S.H.
Long-term chemical analysis and organic aerosol source apportionment at nine sites in central Europe: Source

identification and uncertainty assessment Atmospheric Chemistry and Physics, 17 (21), pp. 13265-13282.

(2017) La Russa, M.F., Fermo, P., Comite, V., Belfiore, C.M., Barca, D., Cerioni, A., De Santis, M., Barbagallo, L.F., Ricca, M., Ruffolo, S.A.

The Oceanus statue of the Fontana di Trevi (Rome): The analysis of black crust as a tool to investigate the urban air pollution and its impact on the stone degradation Science of the Total Environment, 593-594, pp. 297-309.

(2017) Marabini, L., Ozgen, S., Turacchi, S., Aminti, S., Arnaboldi, F., Lonati, G., Fermo, P., Corbella, L., Valli, G., Bernardoni, V., Dell'Acqua, M., Vecchi, R., Becagli, S., Caruso, D., Corrado, L.G., Marinovich, M. *Ultrafine particles (UFPs) from domestic wood stoves: genotoxicity in human lung carcinoma A549 cells* Mutation Research - Genetic Toxicology and Environmental Mutagenesis, 820, pp. 39-46.

(2017) Bozzetti, C., El Haddad, I., Salameh, D., Daellenbach, K.R., Fermo, P., Gonzalez, R., Minguillón, M.C., Iinuma, Y., Poulain, L., Elser, M., Müller, E., Slowik, J.G., Jaffrezo, J.-L., Baltensperger, U., Marchand, N., Prévôt, A.S.H. *Organic aerosol source apportionment by offline-AMS over a full year in Marseille* Atmospheric Chemistry and Physics, 17 (13), pp. 8247-8268.

(2017) Amadori, M.L., Del Vais, C., Fermo, P., Pallante, P.

Archaeometric researches on the provenance of Mediterranean Archaic Phoenician and Punic pottery Environmental Science and Pollution Research, 24 (16), pp. 13921-13949.

(2017) Corsini, E., Vecchi, R., Marabini, L., Fermo, P., Becagli, S., Bernardoni, V., Caruso, D., Corbella, L., Dell'Acqua, M., Galli, C.L., Lonati, G., Ozgen, S., Papale, A., Signorini, S., Tardivo, R., Valli, G., Marinovich, M. *The chemical composition of ultrafine particles and associated biological effects at an alpine town impacted by wood burning* Science of the Total Environment, 587-588, pp. 223-231.

(2017) Pino, F., Fermo, P., La Russa, M., Ruffolo, S., Comite, V., Baghdachi, J., Pecchioni, E., Fratini, F., Cappelletti, G.

Advanced mortar coatings for cultural heritage protection. Durability towards prolonged UV and outdoor exposure Environmental Science and Pollution Research, 24 (14), pp. 12608-12617.

(2017) Bigi, A., Bianchi, F., De Gennaro, G., Di Gilio, A., Fermo, P., Ghermandi, G., Prévôt, A.S.H., Urbani, M., Valli, G., Vecchi, R., Piazzalunga, A. *Hourly composition of gas and particle phase pollutants at a central urban background site in Milan, Italy* Atmospheric Research, 186, pp. 83-94.

(2017) Ozgen, S., Becagli, S., Bernardoni, V., Caserini, S., Caruso, D., Corbella, L., Dell'Acqua, M., Fermo, P., Gonzalez, R., Lonati, G., Signorini, S., Tardivo, R., Tosi, E., Valli, G., Vecchi, R., Marinovich, M. *Analysis of the chemical composition of ultrafine particles from two domestic solid biomass fired room heaters under simulated real-world use* Atmospheric Environment, 150, pp. 87-97.

(2017) Benetello, F., Squizzato, S., Hofer, A., Masiol, M., Khan, M.B., Piazzalunga, A., Fermo, P., Formenton, G.M., Rampazzo, G., Pavoni, B.

Estimation of local and external contributions of biomass burning to PM_{2.5} in an industrial zone included in a large urban settlement Environmental Science and Pollution Research, 24 (2), pp. 2100-2115.

(2017) Chiara Pietrogrande, M., Barbaro, E., Bove, M.C., Clauser, G., Colombi, C., Corbella, L., Cuccia, E., Dalla Torre, S., Decesari, S., Fermo, P., Gambaro, A., Gianelle, V., Ielpo, P., Larcher, R., Lazzeri, P., Massabò, D., Melchionna, G., Nardin, T., Paglione, M., Perrino, C., Prati, P., Visentin, M., Zanca, N., Zangrando, R.

Results of an interlaboratory comparison of analytical methods for quantification of anhydrosugars and biosugars in atmospheric aerosol Chemosphere, 184, pp. 269-277.

(2017) Corsini E, Ozgen S, Papale A, Galbiati V, Lonati G, Fermo P, Corbella L, Valli G, Bernardoni V, Dell'Acqua M, Becagli S, Caruso D, Vecchi R, Galli CL, Marinovich M. *Insights on wood combustion generated proinflammatory ultrafine particles (UFP)*. Toxicology Letters, 266, 74-84.

(2016) Daellenbach KR, Bozzetti C, Křepelová A, Canonaco F, Wolf R, Zotter P, Fermo P, Crippa M, Slowik JG, Sosedova Y, Zhang Y, Huang R, Poulain L, Szidat S, Baltensperger U, El Haddad I, Prévôt ASH. *Characterization and source apportionment of organic aerosol using offline aerosol mass spectrometry*. Atmospheric Measurement Techniques, 9, 23-39.

(2016) Cattaneo A, Fermo P, Urso P, Perrone MG, Piazzalunga A, Tarlassi J, Carrer P, Cavallo DM. *Particulate-bound polycyclic aromatic hydrocarbon sources and determinants in residential homes*. Environmental Pollution, 218, 16-25.

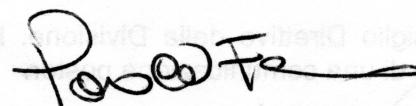
(2016) Ielpo P, Fermo P, Comite V, Mastroianni D, Viviano G, Salerno F, Tartari G. *Chemical characterization of biomass fuel particulate deposits and ashes in households of Mt. Everest region (NEPAL)*. Science of The Total Environment, 573, 751-759.

(2016) Amadori ML, Del Vais C, Fermo P, Pallante P. *Archaeometric researches on the provenance of Mediterranean Archaic Phoenician and Punic pottery*. Environmental Science and Pollution Research International, 1-29.

(2016) Fasani D, Fermo P, Barroso PJ, Martín J, Santos JL, Aparicio I, E. Alonso E. *Analytical Method for Biomonitoring of PAH Using Leaves of Bitter Orange Trees (Citrus aurantium): a Case Study in South Spain*. Water Air and Soil Pollution, 227, 360.

(2016) Pino F, Fermo P, la Russa M, Ruffolo S, Comite V, Baghdachi J, Pecchioni E, Fratini F, Cappelletti G. *Advanced mortar coatings for cultural heritage protection. Durability towards prolonged UV and outdoor exposure*. Environmental Science and Pollution Research International, 1-10.

(2016) Ozgen S, Becagli S, Bernardoni V, Caserini S, Caruso D, Corbella L, Dell'Acqua M, Fermo P, Gonzalez R, Lonati G, Signorini S, Tardivo R, Tosi E, Valli G, Vecchi R, Marinovich M. *Analysis of the chemical composition of ultrafine particles from two domestic solid biomass fired room heaters under simulated real-world use*. Atmospheric Environment, 150, 87-97.

A handwritten signature in black ink, appearing to read 'Paola Fermo', with a long horizontal flourish extending to the right.

Paola Fermo