

**Surname:** Bontempi

**Name:** Elza

**Organization and Position:** University of Brescia, Full Professor in Fundamental Chemistry for Technologies

**Date of birth:** 30 August 1971

**Education and training:** Elza Bontempi received her Environmental Engineering degree (full marks) at the University of Brescia in 1996. Her doctoral studies were mainly focused on thin films characterizations using advanced characterization techniques, such as X-Ray Reflectivity and Magnetic X-Ray Scattering (XRMS).

In 1999 she worked in Grenoble, at the "Laboratoire de Crystallographie" in the group of professor Raoux, director of the Soleil Synchrotron. During this period she learned and gained experience in Synchrotron radiation experiments, in order to study thin films magnetic materials. In 2001 she presented her Ph.D. thesis "X-Ray Reflectivity and Glancing Angle X-ray Diffraction for Materials Characterisation". She developed the theoretical aspects to analyze XRMS data and to simulate the pattern for any polarization state of the incident light and for any orientation of the magnetization vector in the sample plane. Her Ph.D. research produced 8 publications that have been cited more than 100 times. During her Ph.D. studies and postdoctoral work, she has carried out research in different synchrotron radiation sources e.g., ELETTRA (Trieste), ESRF (The European Synchrotron Radiation Facility - Grenoble), LURE (Orsay), and Daresbury laboratories, Warrington, Cheshire, UK.

In 2000 she obtained a permanent position at the University of Brescia, where she is now Full Professor in Fundamental Chemistry for Technologies.

**Professional experience:** Elza Bontempi research is focused on environmental chemistry, and the development of new sustainable technologies related to the raw materials preservation and substitution. She is responsible of eco-materials development in the DIMI Department at the University of Brescia.

She obtained several important researches results:

1) She developed a new technique for entrapment of heavy metals from municipal solid waste incinerator fly ash, by using different amorphous silica sources. The proposed technologies were patented, and one patent was transferred to a Slovakian small industry.

The results of this activities allowed her to achieve an European prize, about raw materials substitution, in 2016 (see Prize section).

2) She developed a new simplified method to evaluate the sustainability of raw material substitution, that allows to support small industries working in raw materials and public authorities. This because the proposed approach is more simplified in respect to LCA procedure. Scopus Citation Benchmarking shows that the related paper (n° 13 in the attached list of publication) falls in the 99th percentile for citations (it is in the top of all published research of the same age - <https://www.scopus.com/record/pubmetrics.uri?eid=2-s2.0-85024099428&origin=recordpage>).

This work was also recently highlighted by Science for Environment Policy, that is the news and information service published by Directorate-General Environment, European Commission. The news can be downloaded at:

[http://ec.europa.eu/environment/integration/research/newsalert/pdf/new\\_approach\\_evaluating\\_sustainability\\_substituting\\_raw\\_materials\\_510na3\\_en.pdf](http://ec.europa.eu/environment/integration/research/newsalert/pdf/new_approach_evaluating_sustainability_substituting_raw_materials_510na3_en.pdf)

3) She contributed to develop a new method for heavy metals detection in air particulate matter (PM) filters, based on Total Reflection X-Ray Fluorescence (TXRF) technique. The main advantage of this method, related to conventional ones, is that the filter can be directly analyzed, without digestion, making the analysis much more reliable, fast, economic and sustainable. This method was developed in a new analysis technology that allowed to found a University Spinoff: SMART SOLUTIONS. Elza Bontempi is a co-founder of the Spinoff.

4) She has very recently proposed a new chemistry approach "Azure chemistry", to go beyond Green Chemistry. The Azure chemistry goal is to restore or reconstruct the ecosystems by sustainable solutions in terms of energy, materials and emissions. Azure Chemistry concerns, for example, carbon dioxide sequestration, PM pollution reduction, waste minimization, and energy neutrality. It requires low-energy paths, manufacturing and technologies reducing the use of non-renewable resources, and in which wastes and by-products are employed. Overall, Azure Chemistry approach must minimize the global impact of the remediation processes (see the submitted publication "The first sustainable material designed for air particulate matter capture: An introduction to Azure Chemistry").

Elza Bontempi was responsible of more than 20 post-docs and 7 Ph.D students.

#### GRANTS:

#### INTERNATIONAL PROJECTS RESPONSIBILITY:

Elza Bontempi collaborated in the development of several international and national projects. From 2004 she started to be responsible of international projects. The international projects with high involvement of the Principal Investigator are reported in the following:

- 2004 Project leader of the project "X-ray reflectivity measurements for evaluation of thin films and multilayers" VAMAS (THE VERSAILLES PROJECT on ADVANCED MATERIALS and STANDARDS)
- 2006 Responsible for Chemistry for Technologies Laboratory for the PHIME (Public health impact of long-term, low-level mixed element exposure in susceptible population strata) project, sponsored by the EU [www.phime.org](http://www.phime.org).
- 2008 Responsible for Chemistry for Technologies Laboratory of the Galileo project with France for the development of instrument to study mechanical properties of thin films by means of X-Ray Diffraction techniques.
- 2008 Responsible of a project about new nanotechnologies development with India, founded from Italian Ministry of Research.
- 2010 Scientific Responsible of the European project "COSMOS" (Life+ 2008 call) concerning the development of new procedure for municipal solid waste incinerator fly ash inertization.

- 2010 Responsible for Chemistry for Technologies Laboratory of "Neurologic function in children exposed to ambient manganese" project, founded by National Institute of Health (USA).
- 2010 Responsible for Chemistry for Technologies Laboratory of "Metals and Children" project (n. 170174 SAL-68), with Université du Québec, Montreal, founded by Regione Lombardia.
- 2011 Responsible of a project of researchers exchange with India, regarding heavy metals monitoring, founded from Italian Ministry of Research (Prot. number CII10T43QQ).
- 2013 Scientific Responsible of the European project "COSMOS-RICE" (Life+ 2011 call) concerning the development of new procedure for municipal solid waste incinerator fly ash inertization by using rice husk ash.
- 2014 Responsible for Chemistry for Technologies Laboratory of the MED (Life+2013 call) project, "MED" Medical Equipment Discarded - A new Integrate system to reduce waste by medical equipment and medical WEEE
- 2014 Scientific Responsible of European project: EQUATOR - Employ of Waste instead of Quarry for sUBstitution of AnTimOny as fire Retardant additive - in the frame of "Raw Material Commitments"
- 2016 Representative of the University of Brescia of the COST-Action "Mining the European Anthroposphere" (MINEA) - Working Group (WG) A3 - "Resource potential of solid residues from waste incineration" (active)
- 2018 Responsible for University of Brescia of the European project Deasphor, Design of a product for SUBSTITUTION of phosphate rocks. - ERA-MIN Joint Call (active 100K€ for UNIBS)

#### NATIONAL PROJECTS RESPONSIBILITY:

- PRIN (2005) - Advanced synthesis and characterization of self-assembled and patterned magnetic systems (Italian Ministry of Research)
- FCB (2012) Reuse of rice husk ash (Fondazione Comunità Bresciana - Foundation)
- NINIVE (2013) A new nano-plaster made on ecological glass (Lombardy Region)
- FCB (2015) New bioplastics synthesis (Fondazione Comunità Bresciana - Foundation)
- RISANA (2015) New composited obtained by sustainable fillers and bioplastics (Italian Ministry of Environment)
- BASALTO (2016) New sustainable materials for air particulate matter capture (Lombardy Region) (active - 120K€ for UNIBS)
- SINFONIA (2016) Substitution of brominated flame-retardants with new sustainable fillers (University of Brescia) (active - 50K€ for UNIBS)

- *RENDERING (2018) New sustainable composited based on ash derived from municipal wastes and sludges incineration process (Italian Ministry of Environment) (active 220k€ for UNIBS)*

- *Responsible for INSTM of the RESTART (2019) project: Recovery and treatment of food wastes to produce membranes for micropollutants reduction and jellies for food*

#### **PRIZES:**

- *2012 International prize: “what are you doing for a better society?” from European Projects Association*

- *2015 Supervisor of the students work winning the competition at the European conference: The Air Quality and Emissions Show (Formally MCERTS)*

- *2016 International prize: “European Business Idea Competition on raw materials” from European Institute of Innovation & Technology (EIT) Raw Materials, for the new proposed eco-material from wastes.*

- *2018 Special mention on the national ITALIADECIDE prize for the development of a new material for air particulate matter trap.*

- *2018 Winner of Prize for “Tecnologie abilitanti e soluzione innovative per la città sostenibile” from Associazione Italiana per la Ricerca Industriale (AIRI).*

- *2018 Winner of the GAETANO MARZOTTO prize (22th November 2018) for the development of a new eco-material;*

- *2018 Winner of the ITWIIN (ITalian Women Innovators and Inventors Network) prize (assigned on 9th November 2018 <http://www.itwiin.org/>) for the development of a new eco-material;*

- *2019 Innovation Village Award, for the best project in the frame the Global Agenda for sustainable development (4 April 2019).*

#### **Total number of publications and h-index.**

*Elza Bontempi has 231 publications in SCOPUS. Her H index is 34*

#### **5 peer-reviewed selected publications**

*The selected publications are:*

*Bilo, F., Pandini, S., Sartore, L., Depero, L.E., Gargiulo, G., Bonassi, A., Federici, S., Bontempi, E.*

*A sustainable bioplastic obtained from rice straw  
(2018) Journal of Cleaner Production, 200, pp. 357-368.*

Quina, M.J., Bontempi, E., Bogush, A., Schlumberger, S., Weibel, G., Braga, R., Funari, V., Hyks, J., Rasmussen, E., Lederer, J.

Technologies for the management of MSW incineration ashes from gas cleaning: New perspectives on recovery of secondary raw materials and circular economy  
(2018) *Science of the Total Environment*, 635, pp. 526-542.

Zanoletti, A., Bilo, F., Depero, L.E., Zappa, D., Bontempi, E.

The first sustainable material designed for air particulate matter capture: An introduction to Azure Chemistry  
(2018) *Journal of Environmental Management*, 218, pp. 355-362.

Pasquali, M., Zanoletti, A., Benassi, L., Federici, S., Depero, L.E., Bontempi, E.

Stabilized biomass ash as a sustainable substitute for commercial P-fertilizers  
(2018) *Land Degradation and Development*, 29 (7), pp. 2199-2207.

Benassi, L., Dalipi, R., Consigli, V., Pasquali, M., Borgese, L., Depero, L.E., Clegg, F., Bingham, P.A., Bontempi, E.

Integrated management of ash from industrial and domestic combustion: a new sustainable approach for reducing greenhouse gas emissions from energy conversion  
(2017) *Environmental Science and Pollution Research*, 24 (17), pp. 14834-14846.