

UNIVERSITA' DEGLI STUDI e-CAMPUS  
FACOLTA' DI INGEGNERIA  
Corso di laurea in Ingegneria industriale  
Ingegneria informatica e dell'automazione

PROF. GIULIO SANTORI

NAME : Giulio SANTORI  
h-INDEX: 6 (as of 11/06/2012)

EDUCATION

-25/10/2005-22/01/2009: Università Politecnica delle Marche (UNIVPM). Dipartimento di Energetica. PhD degree in Energetics. The thesis "*Thermodynamic optimization of biodiesel production process*" reports a 3 year work aimed at the optimization of the industrial process for the production of biodiesel. The work was performed at the Dipartimento di Ingegneria Industriale e Scienze Matematiche (formerly Dipartimento di Energetica) of the Università Politecnica delle Marche and gave birth to a dedicated laboratory for the study of biodiesel production processes from a thermodynamic point of view. The project was carried out within the "Thermophysical Properties of Fluids" group led by Prof.F.Polonara, who is also the Ph.D. thesis advisor. The unusual thermodynamic orientation of the investigation on biodiesel was also supervised by Dr.R.Stryjek of the Polish Academy of Sciences (Warsaw).

-15/09/2005: Chartered engineer in the Ascoli Piceno province (Italy).

-15/06/2005: State Examination for entering the Chartered engineers list.

-1998-07/12/2004: UNIVPM. Eng. faculty. Master of Science degree in Mechanical Engineering. Thesis developed at CNR-ITAE (Institute of Energy Processing and Storage) in Messina. Thesis title: "*Adsorption refrigerator systems powered by solar energy: development of a dynamic simulation model design oriented*" within an international research project INTAS-NATO. He collaborated with researchers from Aachen University of technology and Bereskov Institute of Catalysis Novosibirsk.

AFFILIATIONS:

-Member since September 21, 2007 of AIPT (Italian association of thermophysical properties).

-Member in 2005 of ISES Italy, the Italian section of the International Solar Energy Society

-Member since 2005 of the chartered engineers of the Ascoli Piceno province

PROFESSIONAL ACKNOWLEDGEMENTS

-05/06/2009: Winner of the ROTARY ENFASI 2009 Fund

-Active reviewer for the Journal of Chromatography A (International Scientific Journal, ISI) since 2009, Talanta and Energy & Fuels (International Scientific Journals, ISI) since 2010, Applied Energy (International Scientific Journals, ISI) since 2012 and CRCPress/Taylor&Francis Group since 2012.

SCIENTIFIC RESEARCH

-*BIOFORME Project; 2010-present day*: Investigation on equilibrium of microalgal oil and vegetable oil transesterification with ethanol

-*EFESO Project; 12/2009-present day*: Chemical-thermal-fluid-dynamics simulation of a tubular anode supported solid oxide fuel cells stack (Acumentrics) and cathode recuperator (collaborators: Ariston Thermo Group; Acumentrics Corp.). Supervisor of 2 research fellows and 1 Ph.D. Student.

-*SIM Project; 09/2009-present day*: Design, development and testing of a solar adsorptive Ice Maker for vaccine storage (collab.: Univ. of Warwick-Prof. R.E.Critoph; CNR/ITAE-Ing. A.Freni). Supervisor of 2 undergraduate students.

-*CaRiJesi Project; 2008*: Study on the possible ways to optimize (consumption decreasing) the biodiesel production process. Supervisor of 2 Ph.D. Student.

-*AERCA Project; 2005-2008*: Thermodynamic optimization of biodiesel production process and testing of 2 tubular anode supported solid oxide fuel cells units (Acumentrics) powered respectively by hydrogen and natural gas.

## INDUSTRIAL RESEARCH

-Industrial partner: Indesit Company (Italy); 1/09/2010-31/12/2010

Principal Investigator for the development of a Dishwater with zeolite drying.

-Industrial partner: Acumentrics Corp. (USA)+AristonThermo Group (Italy)

Responsible of the research team for the experimental and CFD study of a solid oxide fuel cells mCHP unit for domestic applications within the EFESO research project funding

-Industrial partner: NovaOl S.r.l. (Italy)

Principal Investigator for the optimization (reduction of the energy consumption) of the NovaOl biodiesel production plants (plant 1+ plant 2 +Ravenna plant)

## PROFESSIONAL EXPERIENCES

-22/09/2011-present day: Founder member and Vice-President of GreenTech Srl (www.greentechsrl.com), academic spin-off of UNIVPM.

-2006 – present day: Author of:

- o 23 original papers published in international scientific journals (Journal of Chromatography A, Journal of Chemical and Engineering Data, Solar Energy, Energy Conversion and Management, Applied Thermal Engineering, Energy & Fuels, International Journal of Thermophysics, Journal of Thermal Analysis and Calorimetry, International Journal of Chemical Reactor Engineering, International Journal of Hydrogen Energy, Applied Energy, Renewable Energy, High Temperature-High Pressures). Research fields:, separation, adsorption, solar cooling, thermodynamics, refrigeration, fuel cells, biofuels (biodiesel and DME).
- o 1 open access book chapter
- o 2 original papers in national journals
- o 34 papers in international and national congress proceedings

-25/03/2010 – present day: Research Associate at UNIVPM, Dipartimento di Ingegneria Industriale e Scienze Matematiche (formerly Dipartimento di Energetica), Ancona, Italy.

-25/03/2010 – present day: Assistant Professor in applied physics at Università Telematica e-Campus Novedrate (CO, Italy) for the courses:

1) Applied Physics, Faculty of Engineering (Industrial; Electrical and Automation)

2) Thermal Systems & Air Conditioning, Faculty of Engineering (Industrial)

-01/02/2009-30/09/2009: Postdoctoral fellow at UNIVPM, Dipartimento di Energetica (Ancona, Italy). Project title: "*Study of a code for the technical-economic assessment of a micro-turbine cogeneration system*".

-22/01/2009: End of PhD course at UNIVPM, Dipartimento di Energetica (Ancona). Thesis title: "*Thermodynamic optimization of the biodiesel production process*".

-05/05/2008-31/12/2008: Contract with S.TRA.TE.G.I.E. Srl (academic spin-off). Subject: Development of a simulation code for an innovative micro-turbine triple-generation control system.

-19/01/2008-15/03/2008: Teaching assistant (6 hours/week) on the course "Refrigeration system design" at the Engineering Faculty, UNIVPM.

- Academic years 2007;2008: Teaching assistant (3 hours/week) on the course of Applied Physics at the Engineering Faculty, UNIVPM.

-Academic years 2006;2007;2008;2009;2010: Teaching assistant (6 hours/week) on the course "Refrigeration system design" at the Engineering Faculty, UNIVPM.

-25/10/2005: Awarded a place on the PhD course for studies supported by the Italian Ministry of the Environment and the Marche Regional Government (Italy) as part of the project "Ricerche energetico-ambientali per l'AERCA di Ancona Falconara e bassa valle dell'Esino". Research fields: Thermophysical properties of fluids and phase equilibria. Tutor: Prof. F. Polonara.

-30/05/2005-30/09/2005: ATR Group Srl (leading European company in the production of carbon fiber components), internship. Field: Standardization of production processes.

-12/12/2004-30/05/2005: "Studio tecnico SAG progetti" (Design of air conditioning systems) internship. Field: Air conditioning system design.

## MOST RELEVANT PUBLICATIONS IN INTERNATIONAL JOURNALS (ISI):

- Santori G, Brunetti E, Polonara F. (2011). Experimental Characterization Of An Anode-Supported Tubular SOFC Generator Fueled With Hydrogen, Including A Principal Component Analysis And A Multi-Linear Regression. International Journal of Hydrogen Energy, vol. 36; issue 14; p. 8435-8449.
- Di Nicola G, Moglie M, Pacetti M, Santori G. (2010). Bioenergy II: Modeling and Multiobjective Optimization of Different Biodiesel Production Processes. International Journal of Chemical Reactor Engineering Vol. 8:1.

This study focuses on the characteristics of the production process currently used to produce biodiesel. Comparing some of the reference solutions that have inspired numerous installations, an optimization analysis was conducted using ASPENPLUS. The optimization analysis was carried out using a multi-objective genetic algorithm optimization to define the configuration of the main parameters that guarantee the best trade-off between the maximization of the purity of some important compounds and the minimization of energy requirements. The results of this analysis were Pareto frontiers that define the best trade-off between the objectives.

- Arteconi A, Di Nicola G, Moglie M, Santori G, Stryjek R. (2009). PVT properties of an alternative biofuel: dimethyl ether. *Journal of Thermal Analysis and Calorimetry*, vol. 97; p. 631-636.
- Maggio G, Gordeeva LG, Freni A, Aristov YuI, Santori G, Polonara F, Restuccia G. (2009). Simulation of a solid sorption ice-maker based on the novel composite sorbent "lithium chloride in silica gel pores". *Applied Thermal Engineering*, vol. 29; p. 1714-1720.  
In this paper, a novel composite sorbent "lithium chloride in silica gel pores" is proposed for application in solar-powered adsorptive ice makers. A mathematical model was used to calculate the performance of an ice-maker using this material as adsorbent and methanol as adsorbate. The results of the model showed that a maximum solar coefficient of performance (COPs) of 0.33 and a maximum daily ice production (DIP) of 20 kg/m<sup>2</sup> can be obtained for an ice-maker equipped with a solar collector area of 1.5 m<sup>2</sup> and 36 kg of adsorbent material. This performance are noticeably higher than those obtained using commercial activated carbon, which is the adsorbent mostly often proposed till now.
- Di Nicola G, Pacetti M, Polonara F, Santori G, Stryjek R. (2008). Development and optimization of a method for analyzing biodiesel mixture with non-aqueous reversed phase liquid chromatography. *Journal of Chromatography A*, vol. 1190; p. 120-126.  
Biodiesel is commonly analyzed using gas chromatography/flame ionization detection, as specified by the standards. This paper proposes a binary gradient method for analyzing biodiesel mixtures using non-aqueous reverse phase HPLC with a UV detector. The new analytical method was developed using a 2<sup>5</sup> full factorial design method combined with the Yates algorithm and the steepest ascent optimization procedure.
- Freni A, Maggio G, Vasta S, Santori G, Polonara F, Restuccia G. (2008). Optimization of a solar powered adsorptive ice-maker by a mathematical method. *Solar Energy*, vol. 82; p. 965-976.
- Vasta S, Maggio G, Santori G, Freni A, Polonara F, Restuccia G. (2008). An adsorptive solar ice-maker dynamic simulation for north Mediterranean climate. *Energy Conversion and Management*, vol. 49; p. 3025-3035.

#### FUNDED PROJECTS

##### *-ROTARY ENFASI 2009 Fund:*

Scientific partners: CNR-ITAE (IT); University of Warwick (UK)

The manufacturing and the testing activity of a solar-powered adsorption ice-maker was performed for storing vaccines in remote areas of 3rd-World countries. The use of these machines does not require any human presence or electricity. The system is completely independent and meets the standards set by the World Health Organization. In most cases, the functionality of the cold chain is interrupted after they have been transported into the area where they are required because electrical energy is not available everywhere in many 3rd-World countries. To overcome this problem, this project proposes the use of solar energy for refrigeration with adsorption machines. The operation of these units is based on the use of activated carbons to capture gas molecules of methanol on their surface. The prototype is able to produce an amount of ice of 5-10 kg per day depending on the weather conditions. The operation of the prototype is based on a day/night intermittent cycle. Every 24 hours the system goes back to the initial conditions and is ready to perform a new cycle. The system consists of the following main components: a flat type solar collector, in which the multi-tubular adsorber is integrated, an air-cooled condenser and an evaporator placed inside an insulated box where cold is produced.

##### *-Biodiesel plant consumption reduction:*

Industrial partner: NovaOl s.r.l. (IT)

The optimization of a biodiesel production process is an important task to avoid energy inefficiencies and contain production costs. Two real biodiesel production plants using different algorithms were optimized. The multi-objective optimization worked on two contrasting objective functions identifying the configurations

which guarantee the minimization of energy consumption and the maximization of the quality of biodiesel and all by-products.

*-Development of an Adsorption Dishwater*

Industrial partner: INDESIT COMPANY Spa (IT)

Utilization of an open-cycle adsorption process for efficient dishwashers was studied showing that the implementation of an adsorption system allows to reduce the energy consumption compared with a conventional dishwasher. Practical feasibility of this technology has been demonstrated. The developed systems employ a desiccant cartridge that is regenerated during the heating up/washing stage of the dishwasher (desorption phase) and that releases dry and warm air during the subsequent drying stage (adsorption phase). Focus of this work was the evaluation the energy efficiency of a dishwasher employing less hydrophilic dessicants (silica gel, SAPO34). Secondly, we performed experimental tests on a prototype, to ascertain the design parameters having the strongest influence and which arrangement affords the best performance and energy saving.

*TUTORING AND MENTORING ACTIVITIES:*

G.Santori has tutored and mentored during 6 years of research activity 62 students for bachelor and master thesis, 1 Ph.D. students on biodiesel form microalgae and 2 fellowships in solid oxide fuel cells. Currently G.Santori is mentoring 2 Ph.D. students on solid oxide fuel cells and 1 Ph.D. student on biofuels.

*TEACHING ACTIVITY:*

*-25/03/2010–present day:* Assistant Professor at the Università degli Studi e-Campus, Novedrate (Italy) and Lecturer for the courses (for bachelor degree) of Applied Physics and Thermal Systems & Air Conditioning at the Engineering Faculty.

*-19/01/2008-15/03/2008:* Teaching assistant (6 hours/week) on the course "Refrigeration systems design" at the Engineering Faculty of UNIVPM for Master students in Mechanical Engineering. Official Lecturer: Prof.F.Polonara.

*-2007;2008:* Teaching assistant (3 hours/week) on the course of Applied Physics at the Faculty of Engineering, UNIVPM for students (bachelor degree) in Mechanical Engineering. Official Lecturer: Prof.F.Polonara.

*-2006;2007;2008;2009;2010:* Teaching assistant (6 hours/week) on the course "Refrigeration systems design" at the Engineering Faculty, UNIVPM for Master students in Mechanical Engineering. Official Lecturer: Prof.F.Polonara.