

Curriculum vitae et studiorum

Name and Surname: **Vanessa Rosciardi**

Date of birth **26/08/1989**

Nationality **Italian/Croatian**

Education:

Ph.D. in Chemical Sciences October 2018-April 2022

(Date of thesis defense: April 28th, 2022)

“Ugo Schiff” Chemistry Department, University of Florence- Italy.

Final grade: **Excellent.**

Thesis title: “Green” Poly(vinyl alcohol)/Starch based cryogels for the cleaning of works of art: Application, characterization, and investigation of the Amylose/Amylopectin structural role.

Supervisor: Prof. Piero Baglioni

Summary of the main research activities: Formulation and characterization of biocomposite hybrid gel networks obtained via the cryogelation of aqueous solutions of poly (vinyl alcohol) (PVA) and raw rice starches; investigation and control of liquid-liquid phase separation phenomena in the pre-gel polymeric solutions; investigation of the influence of variable PVA:starch ratios on the viscoelastic behavior of the gels, on their crystallinity and porosity, and on their meso- and nanostructural organization; fine-tuning of the rheological properties of the gels for their practical application (as cleaning tools on artistic surfaces and as wound dressing devices for biomedical purposes). Investigation of the structural role of amylose and amylopectin in PVA/starch gel networks via rheological, thermal, spectroscopic, and x-ray scattering experiments. Determination of the occurrence of PVA-amylose hybrid amorphous/crystalline tie points in PVA/starch networks.

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Firenze, 9/01/2024

MSc in Materials Science December 23rd, 2015 - April 12th, 2018

Chemistry Department, University of Turin - Italy.

Final grade: **110/110 cum laude**

Supervisor(s): Prof. Oscar Chiantore /Dr. Tommaso Poli

Research Experience:

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|-------------------|--|
| 2021-today | Postdoctoral Researcher at the Center for Colloids and Surface Science (CSGI University of Florence – Italy) within the GREENART project (EU grant agreement 101060941). Formulation and characterization of green colloidal systems with reduced environmental impact. Formulation and study of surfactant-free microemulsions and anisotropic water-in-water polymeric emulsions. Development of green protocols for the spontaneous synthesis of metallic nanoparticles in gellable/filmable polymeric solutions. |
| 2020-2021 | Junior Researcher at the Center for Colloids and Surface Science (CSGI – University of Florence – Italy) within the APACHE project (EU grant agreement 814496). Study of the adsorption mechanism of volatile organic compounds (VOC) in castor-oil-based matrixes doped with metal oxide microparticles. |

Technical skills and research interests:

During the last 4 years, I have been on a clear path towards establishing myself as an independent researcher in soft matter, with a strong background in liquid-liquid phase-separation phenomena, and the physicochemical aspects lying behind the stability and processability of colloidal systems. I have a marked multidisciplinary approach towards research, which is attested by my academic records. Starting from

an MS degree in material science and engineering I then moved on to a Ph.D. program in applied physical chemistry where I conducted research on phase-separating phenomena in polymeric solutions and developed novel biocomposite cryogels with reduced environmental impact. Here I gained strong technical and scientific skills, which are summarized in the following table:

<i>Technique/Instrument/Method</i>	<i>Skills</i>
Rheology	Rheological characterization of colloidal systems, with a particular focus on viscous polymeric solutions, and weak and strong gels. Experimental determination of G' and G'' in amplitude sweep and frequency sweep modes. Complete autonomy in managing the experimental set-up. Data analysis and interpretation of the results.
Small-angle x-ray scattering (SAXS)	Determination of characteristic dimensions of colloidal systems (e.g., correlation length, radius of gyration, fractal dimension), with a particular focus on nanoparticles, gel networks, and microemulsions. Complete autonomy in managing the experimental set-up. Data manipulation and analysis, use of fitting models, interpretation of the results.
Dynamic light scattering (DLS)	Determination of the hydrodynamic radius of solid nanoparticles, of micelles in classical microemulsions, and of pseudo-micellar aggregates in non-classical surfactant-free microemulsions. Complete autonomy in managing the experimental set-up. Data manipulation and analysis, use of fitting models, interpretation of the results.
Differential scanning calorimetry (DSC)	Determination of first and second-order phase transitions on pure polymers, polymeric blends, and xerogels. Quantification of polymer crystallinity, interpretation of variations of glass transition temperatures. Complete autonomy in managing the experimental set-up. Data manipulation and analysis, interpretation of the results.

Spectroscopy	Proficiency in multiple spectroscopic techniques (UV-visible spectroscopy, Fourier-transform infrared spectroscopy, and spectrofluorimetry). Complete autonomy in managing the experimental set-up. Data manipulation and analysis, interpretation of the results.
Confocal laser scanning microscopy (CLSM)	Proficiency in time-resolved and spatially resolved 3D imaging of fluorescently labeled gels and microemulsions. Complete autonomy in managing the experimental set-up. Application of mathematical methods for image analysis, and interpretation of the results.

Publications:

V. Rosciardi, D. Bandelli, G. Bassu, I. Casu, P. Baglioni, *Highly Biocidal PVA-Hydantoin/Starch Hybrid Gels: a "Trojan Horse" for bacillus subtilis*, Journal of Colloid and Interface Science (JCIS), **2023**, 613, 697-708. **IF=9.9**.

Significance: In this work, we present a simple and smart strategy to boost the efficacy of antimicrobial Poly (vinyl alcohol) (PVA) hydrogels. Our approach consists of the functionalization of the PVA backbone with a highly selective antibacterial molecule, coupled with the embedding in the cryogel network of an available bacterial food source to promote chemotactic bacterial migration towards the biocidal gel matrix and their consequent inactivation. To this end, we synthesized a novel hydantoin-functionalized PVA (H-PVA-hyd). The newly synthesized H-PVA-hyd polymer was introduced in the formulation of H-PVA-based cryogels. The activated H-PVA-hyd cryogels have been tested against bacteria with amylolytic activity (*B.subtilis*) and the outcomes were analyzed by direct observation via confocal laser scanning microscopy (CLSM). The cryogels containing starch proved to be the most effective (up to 90% bacterial killing), despite carrying a lower amount of hydantoin groups than their starch-free counterparts, suggesting that their improved efficacy relies on a "Trojan Horse" type of mechanism.

V. Rosciardi, P. Baglioni, *Role of amylose and amylopectin in PVA-starch hybrid cryogels networks formation from liquid-liquid phase separation*, Journal of Colloid and Interface Science (JCIS), 2023, 630b, 415-425. IF=9.9.

Significance: This work deals with the investigation of the structural roles of amylose and amylopectin in the formation of eco-sustainable biocomposite polymeric materials based on poly (vinyl alcohol) (PVA) and raw starches. The results reported in this work represent a simple and novel tool, able to predict the formation of high-quality biobased materials that can replace their fully synthetic counterparts with a significantly positive impact on our ecosystem. The knowledge produced within this output has a high academic and scientific impact since the use of bio-derived materials as sources for new eco-compatible plastic-like materials is an expanding field in colloid and polymer science.

V. Rosciardi, D. Chelazzi, P. Baglioni, *"Green" biocomposite Poly (vinyl alcohol)/starch cryogels as new advanced tools for the cleaning of artifacts*, Journal of Colloid and Interface Science (JCIS), 2022, 613, 697-708. IF=9.9.

Significance: This work deals with the application of colloid chemistry to the field of conservation of cultural heritage, hence proving my interdisciplinary engagement. This peer-reviewed article presents the formulation of novel eco-compatible biocomposite cryogels with tunable rheological behavior for the cleaning of painted artworks. Aside from the scientific impact of the results, this work represents the beginning of a new approach towards the formulation of colloidal systems for cultural heritage, putting the environmental sustainability of the employed materials in a priority position. Indeed, this work contributed to setting the basis for the EU GREENART project, granted to my research group. This 3-year project will in fact deal with the formulation of green colloidal systems for cultural heritage preservation.

V. Rosciardi, F. Andriulo, D. Bandelli, R. Giorgi, Scalable spontaneous one-pot silver nanoparticles synthesis in PVA-co-PVAm filmable solutions, Submitted Article.

Significance: We report the spontaneous formation of silver nanoparticles with tunable size in diluted solutions of a poly(vinylalcohol)-co-(vinylamine) copolymer. This process does not require any organic solvents, additional reducing agents, or external power supply. The preparation protocol that we present in this work can be easily scaled up for industrial purposes. Moreover, the polymeric solutions in which the silver nanoparticles are embedded can be easily converted into self-standing films

by drop-casting method. The films proved to be excellent supports for surface-enhanced Raman spectroscopy (SERS).

V. Rosciardi, G. Poggi, M. Pagliai, D. Bandelli, D. Chelazzi, P. Baglioni, Surfactant-free oil-in-water and water-in-oil water/2-butanol/citric acid microemulsions: a SAXS and molecular dynamics simulation study, Article ready for submission.

Significance: Surfactant-free microemulsions are an emerging class of colloids with a high potential to substitute classical microemulsions, reducing their environmental impact. In this work, we studied the evolution of the different nanostructural organization of complex fluids formed by water/2-butanol/citric acid and determined the formation of oil-in-water and water-in-oil nonclassical green microemulsions.

Conference contributions:

Oral - 37th Conference of the European Colloids and Interface Society (ECIS 2023), *“Hydrotrope or Surfactant? Citric acid structuring effect in water/2-butanol mixtures”*, 03-08 September 2023, Napoli – **Italy**.

Poster - 37th Conference of the European Colloids and Interface Society (ECIS 2023), *“Novel PVA-hydantoin and its stable embedding in biocidal cryogels exploiting phase-separation”*, 03-08 September 2023, Napoli – **Italy**.

Oral - 18th Zsigmondy Colloquium of the German Colloid Society, *“Novel PVA-hydantoin and its stable embedding in biocidal cryogels exploiting phase-separation”*, 04-06 April 2023, Berlin - **Germany**.

Oral - Next Generation Chemists (NGCHEM 2022), *“PVA-based hydrogels with active biocidal effect: from polymer functionalization to real-time observation of the gels efficacy against model bacteria through confocal laser microscopy”*, 04-05 November 2022, Cagliari - **Italy**.

Oral – 73rd Japanese Divisional Meeting of Colloid and Surface Chemistry, *“Phase separation behavior and structural role of amylose and amylopectin in PVA/starch hybrid networks”*, 20-22 September 2022, Hiroshima – **Japan**.

Oral – XLVIII National Congress of Physical Chemistry, *"Phase separation behavior and structural role of amylose and amylopectin in PVA/starch hybrid networks: a step back to gain broader perspectives"*, 4-7 Luglio 2022, Genova, - **Italy**.

Poster - XLVIII National Congress of Physical Chemistry, *"Starch/Poly(Vinyl Alcohol-Vinyl Hydantoin) hydrogels with active biocidal effect"*, 4-7 Luglio 2022, Genova – **Italy**.

Oral - Polymer Networks Group 2022, *"Composition/Structure/Properties relationships in PVA/Starch biocomposite networks and their application in Cultural Heritage"*, 12-16 June 2022, Roma – **Italy**.

Oral – Interfaces 2021, *"Novel Poly(vinyl alcohol)/Starch cryogels: Environmentally friendly tools for the cleaning of painted artworks"*, 20-24 September 2021, Cagliari - **Italy**.

Oral – XXVII National Congress of the Italian Chemical Society (SCI), *"Biocomposite Poly(vinyl alcohol)/starch cryogels: green tailorable tools for the cleaning of painted artworks"*, 13-22 September 2021, **online conference**.

Oral – 35th Conference of the European Colloids and Interface Society (ECIS 2021), *"Novel green Poly(vinyl alcohol)/starch cryogels for cleaning art: a focus and the amylose/amylopectin structural role"*, 4-9 September 2021, Athens – **Greece**.

Oral – American Chemical Society – Resilience of Chemistry (ACS Fall 2021), *"Designing green poly(vinyl alcohol)/starch cryogels: the amylose/amylopectin structural role"*, 21-25 August 2021, Atlanta, **USA** (hybrid event).

Poster – American Chemical Society – Macromolecular Chemistry (ACS Spring 2021), *"Biocomposite hydrogels based on poly(vinyl alcohol) and rice starch: green modern materials for the tailored cleaning of works of art"*, 4-29 April 2021, **online conference**.

Poster – Royal Society of Chemistry, Twitter conference 2021, *"Poly(vinyl alcohol) meets rice starch: green biocomposite hydrogels with a tunable viscoelastic response"*, 1-2 March 2021, **online conference**.

Editorial experience:

Reviewer for the *Journal of Applied Biology & Biotechnology*

Guest co-Editor for *Pharmaceutics*, Special Issue: *"Biodegradable*

Hydrogels with Potential Biomedical Applications as Drug Delivery Systems"

Conference and meetings organization:

Chair in the 18th Zsigmondy Colloquium of the German Colloid Society (2023)

Supervision/mentoring/teaching:

M.Sc. co-supervisor, University of Florence, Italy. (2022)

Supervised M.Sc. student laboratory internship and dissertation project in Physical Chemistry and Colloids.

B.Sc. co-supervisor, University of Florence, Italy (2021)

Supervised 2 B.Sc. students' laboratory internship and dissertation project in Chemical Sciences for Cultural Heritage.

Chemistry tutor, University of Florence, Italy (2020) Supervised and mentored 30 students through tutoring activities within the General and Inorganic Chemistry class.

Laboratory Assistant, University of Florence, Italy (2020 – today).

Led more than 100 students (in 4 laboratory courses) through undergraduate colloids and advanced molecular sciences modules to develop their experimental and analytical skills.

Outreach:

OpenLab scientist, University of Florence, Italy (2021 – today).

Organization and active participation in public outreach events (ScienzEstate) and interactive laboratories for kids and adults.

Author, Softbites blog (2023 – today).

Language skills and certifications:

Language	Level	Certificate
English	C2	IELTS (2021)
Italian	Mother tongue	-
Croatian	Mother tongue	-