PhotoLAT EU Workshop 2026

Extended programme and book of abstracts

From Light to Function
Latin America and Europe in Conversation

10–12 November 2026
INIFTA · La Plata · Argentina

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Organizing committee

Gabriela Bosio · Manuel Llansola Portolés · Juan José Romero

INIFTA (CONICET–UNLP, Argentina) and I2BC (CNRS–Université Paris-Saclay, France)

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Extended workshop programme

From Light to Function
Latin America and Europe in Conversation

10–12 November 2026 · INIFTA · La Plata, Argentina
Diagonal 113 y 64, S/N · Workshop language: English

Tuesday 10 November

Time	Session and contribution
09:00–09:30	Opening · Gabriela Bosio Welcome and workshop overview
09:30–10:30	Bruno Robert · Plenary lecture Photosynthesis and its regulations
10:30–11:00	Coffee break
11:00–11:45	Gabriela Lagorio · Invited lecture Light, Organisms and the Environment: From Biocommunication to Plant Function
11:45–12:00	Manuela Manrique Holguín · Short oral presentation O01 Heterouniones TiO2@PCN. ¿Realmente existen heterouniones tipo II o esquemas Z directos?
12:00–12:15	Gerardo Armijos-Capa · Short oral presentation O02 Light-Triggered Controlled Release from 6-Carboxypterin-Modified Poly(allylamine) and poly(sodium 4-styrenesulfonate) Microcapsules
12:15–12:30	Gastón Corti · Short oral presentation O03 Photocurable bioinks based on methacrylated silk fibroin, hyaluronic acid and methylcellulose blends for 3D bioprinting of cartilage scaffolds
12:30–14:00	Lunch
14:00–15:00	Ana Moore · Plenary lecture Multiproton Coupled Electron Transfer in Artificial Photosynthetic Systems
15:00–15:45	Ricardo J. Fernández-Terán · Invited lecture Ultrafast Multidimensional Spectroscopies Meet PCET: Thermodynamics, Real-Time Protonation/Oxidation States, and a Perspective on Vibrational Control
15:45–16:15	Discussion and coffee break
16:15 onwards	Poster session 1 · P01–P11 End time to be confirmed

Wednesday 11 November

Time	Session and contribution
09:00–09:45	Mónica González · Invited lecture Metal–Organic hybrids as Photocatalysts for Solar-Driven Reactions.
09:45–10:30	Daniel Mártire · Invited lecture Photoactivatable nanozymes: a manganese–porphyrin nanozyme for biomedical and environmental applications
10:30–11:00	Coffee break
11:00–11:45	Galo Soler Illia · Invited lecture Porosity as a Design Parameter: Engineering Light–Matter Interactions in Mesoporous Thin Films
11:45–12:15	Gastón Corthey · Invited lecture Ultrafast dynamics of charge carriers in TiO_2 thin films: effect of morphology and crystallinity
12:15–12:35	Daniel Cacciari · Invited lecture Wavelength-Dependent Photochemistry in MOF-Type Nanoparticles: From Ultrafast Dynamics to Photoredox Reactivity
12:35–12:55	Marcos Peralta · Invited lecture Stimuli-responsive nanocarriers for controlled drug delivery
12:55–14:00	Lunch
14:00–14:45	Franco Cabrerizo · Invited lecture The photochemistry of β-carbolines alkaloids: ongoing biological research and potential (bio)technological applications
14:45–15:30	Carolina Lorente · Invited lecture Type I Photosensitization and Antioxidant Protection of Biomolecules
15:30–16:30	Coffee break and poster session 2 · P12–P22
16:30–16:45	Gricelda Godoy Ortega · Short oral presentation O04 Photochemistry and Photosensitizing Activity of a Model of the (6–4) Photoproduct Chromophore Proposed placement within the original discussion block
16:45 onwards	Free discussion and collaboration time End time to be confirmed

Thursday 12 November

Time	Session and contribution
10:00–11:00	Silvia Braslavsky · Closing plenary lecture Connecting Photochemistry with Photobiology (and the people working on these subjects)
11:00–11:30	Coffee break
11:30–11:50	Manuel Llansola Portolés · Short framing lecture Selective Vibrational Tracking of Excited States in Photosynthetic Antennas
11:50–12:45	Round table · Latin America–Europe collaborations Ricardo J. Fernández-Terán, Manuel Llansola Portolés and Silvia Braslavsky, with workshop participants
12:45–14:30	Closing working lunch General discussion and final remarks led by Silvia Braslavsky and Manuel Llansola Portolés
14:30	End of workshop

Scientific contributions

14 plenary and invited lectures · 4 requested short oral presentations · 22 unique posters. Short oral slots are proposed as 12 minutes of presentation plus 3 minutes of questions. Lecture slots retain the durations in the published schedule, including discussion.

Organizing committee

Gabriela Bosio · Manuel Llansola Portolés · Juan José Romero

A joint initiative of INIFTA (CONICET–UNLP, Argentina) and I2BC (CNRS–Université Paris-Saclay, France).

Programme source: https://photolat-eu-2026.netlify.app/#program

Poster session 1

Tuesday 10 November · From 16:15

Code	Presenting author and title
P01	B. Caram An alternative green synthetic route for Fe-BDC MOF with enhanced catalytic activity towards heterogeneous photo-Fenton processes
P02	Mamani Lopez Rocio Anabel Degradación de contaminantes emergentes en agua utilizando fotocatalizadores nanoestructurados magneticos
P03	Víctor A. Castaño-Rodríguez Sunflower Seed Shell Derived Activated Carbons for Phenol Carbophotocatalytic Degradation: Comparison of Two H3PO4 Activation Levels
P04	Ada I. Montilla S. Immobilization of Polymeric Carbon Nitride (CN) and Fe-Modified CN onto Clays: Assessment of Photocatalytic Efficiency for Contaminant Degradation
P05	Emilia R. Serrano From Light to Function: Ligand-Tuned Rhenium(I)-Ferrocene Photosensitizers for the Degradation of Emerging Pollutants
P06	Valentin Lucena Sustainable Micellar Environments Enhances Selectivity in UV-Driven Photo-Fries Reactions of 4-Phenoxyphenol Esters

Poster session 1 continued

Tuesday 10 November · From 16:15

Code	Presenting author and title
P07	Ignacio Battagliese Photo-Fries rearrangement of some acyl and sulfonyl derivatives of a non-natural steroid in homogeneous and micro-heterogeneous media
P08	Tomás Byrne Negative Photochromism in Epoxy Vitrimers: Photothermally Assisted Isomerization and Self-Healing Properties for Rewritable Optical Materials
P09	María Alejandra Guerrero-V. Controlled Synthesis of Silver Nanocomposites in DMSO by Femtosecond Laser Ablation: Correlating Composition and Optical Response through a Dual Theoretical-Experimental Approach
P10	Fabricio Ragone Protonation-State Control of Excited-State Character and Photophysics in a Bithiophene-Functionalized Rhenium(I) Imidazophenanthroline Complex
P11	Micaela E. Grassano Solar-photopolymerized hydrogels as photosensitizing platforms for coliform inactivation in urban lake water

Poster session 2

Wednesday 11 November · 15:30–16:30

Code	Presenting author and title
P12	Heryerli Fernandez Natural Antioxidants and their role in the deactivation of Reactive Oxygen Species generated in photosensitized processes
P13	M. Laura Dántola Photoinduced damage of skin biomolecules caused by radiation emitted by nail polish drying lamps
P14	Carlos A. Ardila Padilla Decyl-riboflavin as a lipophilic photosensitizer for blue-light-induced lipid membrane damage
P15	Karla Paola García Beltrán Effect of the Peptide Bond and Tryptophan on Dityrosine Photogeneration and Photochemistry
P16	Mariana Paula Serrano Folic acid-functionalized polyelectrolyte multilayer microcapsules as photosensitizing platforms for targeted photodynamic therapy

Poster session 2 continued

Wednesday 11 November · 15:30–16:30

Code	Presenting author and title
P17	Delfina Rossetti Synthesis, characterization, and photodynamic evaluation of riboflavin-loaded lanthanide upconversion nanoparticles in HeLa cells
P18	Daniel A. Heredia Water-Dispersible BOPHY Nanocrystals for Photodynamic Inactivation
P19	Valentina Chiara Cajiao Checchin Photoactive Ag- and Ce-modified TiO2 nanotube surfaces for antibacterial potential application.
P20	María Noel Urrutia Photosensitizer and Silver Nanoparticle-Based Surface Modification Strategies for Biofilm Control
P21	Sebastian Steingruber Substituent and Solvent Effects on the Spectroscopy and Photochemical [6π] Electrocyclization of Diphenylamines to Carbazoles
P22	Mariel Scaramutti Combined oxidation/bioremediation treatment of waste resulting from petroleum storage

L01 · Plenary lecture

Photosynthesis and its regulations

Bruno Robert

[1]*Institute of Integrative Biology of the Cell Univ Paris Saclay, CEA, CNRS, Gif Sur Yvette, France*

Photosynthesis is a major process for our planet, and photosynthetic organisms are growing and fixing CO2 in most land and sea areas. It possesses an amazing quantum efficiency to convert the energy of the sun into chemical potential, and the last decades have seen the appearance of new structural and dynamical approaches, always more precise, always faster, with the goal to understand the mechanisms underlying this efficiency. Those have led to a quite complete picture of the photosynthesis, and I will make a brief summary of what is currently known about this process, and what we still eager to understand. Additionally, photosynthesis has this fascinating property to be able to occur nearly anywhere, from burning deserts to cold moutains, this regardless the harshness of the environment. This adaptability relies on multiscales responses, involving entire organisms as well as protein structures. In this talk, I will address some of the strategies used by plants to survive in light-changing environment, as well as newly discovered mechanisms occurring in particularly hostile desertic environments.

Bio: Bruno Robert, Head of Division at the Atomic Energy Commission, has been involved in research on photosynthesis for more than 40 years. His work mainly focused on the molecular bases of the different aspects of the photosynthetic process, and led to more than 250 publications in peer-reviewed journals, including the most prestigious ones.

Light, Organisms and the Environment: From Biocommunication to Plant Function

María Gabriela Lagorio

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Light is not only essential for life but also a source of information about living organisms and their interactions with the environment. In this presentation, I will explore how fluorescence and reflectance can provide non-invasive and non-destructive optical signals of biological processes, from potential roles in communication to responses associated with photosynthetic function.

Biological systems present important challenges, including high concentrations of light-absorbing compounds (chromophores), multiple scattering, and reabsorption of emitted radiation. These properties can strongly affect the propagation of light and alter the fluorescence signals detected from tissues, leaves, and whole organisms.

To address these limitations, we develop and apply physics-based models that provide a more accurate description of light-matter interactions in complex biological media. In this presentation, I will highlight several of our contributions, encompassing theoretical developments and applied research.

By bringing together physics, chemistry, and biology, we seek to understand how light can reveal biological function and interactions with the environment. Particular emphasis will be placed on chlorophyll fluorescence as a sensitive optical signal of photosynthetic activity and plant responses to environmental conditions, illustrating how plant biophotonics can connect fundamental photophysical processes with ecological and environmental applications.

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Bio: María Gabriela Lagorio holds a PhD in Chemical Sciences from the University of Buenos Aires, where she is a Professor and CONICET Principal Researcher.
Her research focuses on photochemistry and photobiology, particularly fluorescence and reflectance in living organisms.
She has extensive expertise in chlorophyll fluorescence and develops physical models of light interactions in complex biological materials.
She serves on the Editorial Board of the Journal of Photochemistry and Photobiology B: Biology and chairs the Argentine Society of Environmental Science and Technology.

Multiproton Coupled Electron Transfer in Artificial Photosynthetic Systems

Ana Moore

Daniel. A. Heredia,[a,c] Edwin. J. Gonzalez,[a] Sharon Hammes-Schiffer,[b] Graham R. Fleming,[d] James P. Allen,[a] Joann C. Williams,[a] Gary F. Moore,[a] Thomas A. Moore,[a] and Ana L. Moore[a]

[a] *School of Molecular Sciences, Arizona State University, US.* [b] *Department of Chemistry, Princeton University, US.* [c] *Instituto de Investigaciones en Tecnologías Energéticas y Materiales Avanzados, Universidad Nacional de Río Cuarto, Argentina.* [d] *Department of Chemistry, University of California Berkeley, Berkeley, US.*

Inspired by the proton-coupled electron transfer (PCET) process in photosystem II involving Tyr_z-His190, we designed and synthesized a benzimidazole-phenol (BIP) system to illustrate electrochemically or photochemically driven one-electron oxidation of the phenol, accompanied by proton transfer to the benzimidazole in a PCET process (E1PT, where E is electron; 1 is the number of protons involved; PT is proton translocated).[1] Aiming at long-range proton translocation, constructs consisting of a phenol, a Grotthuss-type hydrogen-bonded network based on polybenzimidazoles, and a terminal proton acceptor (TPA) were designed, resulting in the translocation of protons up to ∼16 Å by an E4PT process.[2]

We studied a photochemically initiated E1PT process with a BIP linked to a tripentafluoro-phenylporphyrin ($BIPPF_{15}$). Two-dimensional electronic-vibrational spectroscopy (2DEV) shows that PCET takes place on two time scales: 1) an ultrafast process from the unrelaxed S_1 state, and 2) a delayed process on the time scale of a few hundred ps arising from the relaxed S_1 state. The ultrafast process enables observation of the initial F-C state evolving to complete charge separation on the 120 fs time scale via dipole-moment development due to dihedral twisting between the BIP and the macrocycle.[3] With the BIP of $BIPPF_{15}$ substituted by a pyridine derivative TPA, the dynamics of a photoinduced E2PT process were explored. It was found that following porphyrin excitation, proton arrival to the TPA and electron arrival to the porphyrin are concerted within 24 fs.[4]

Recently, we designed systems in which, upon reduction, an anthraquinone bearing a hydrogen-bonded substituent at the terminus of a hydrogen-bonded network "pulled" the proton toward itself. We systematically extended the hydrogen-bonded network, and cyclic voltammetry revealed anodic shifts of the $Q/Q^{\bullet-}$ couple as the framework was lengthened, progressing from $E_{mid} \approx -1.10$ V to −0.83 V, −0.76 V, and −0.66 V, a cumulative +440 mV increase in E_{mid}. Visible (VIS) and infrared (IR) spectroelectrochemistry (SEC) data under negative polarization are consistent with the formation of a hydrogen-bonded semiquinone-radical anion. Nuclear-Electronic Orbital (NEO-DFT, which treats the hydrogen nuclei of the hydrogen-bonded framework quantum mechanically) shows that the proton donor-acceptor distance of the hydrogen bond proximal to quinone ($H^{\cdots}O$) decreases by up to 0.23Å upon one-electron reduction of the quinone. NEO-DFT convincingly shows that this effect propagates along the hydrogen-bonded network; the hydrogen bonds farther from the reduction center also contract. Encouragingly, it appears that "pulling" protons along the hydrogen-bonded network is a viable strategy to increase the E_{mid}, which can be attributed to the electrostatic effect of the semiquinone radical anion causing the proton(s) to move closer to it.[5]

In another focus, we have modeled PCET in protein environments. We have assembled constructs consisting of a four-helix bundle enclosing a Mn-porphyrin with a covalently attached BIP docked to a high-potential bacterial reaction center (BRC). Exciting the BRC reversibly oxidizes Mn(II)-Porphyrin to Mn(III)-Porphyrin.[6] Concomitant with the Mn oxidation in complexes containing porphyrins with benzimidazole, proton release was observed by optical measurements using the pH indicator cresol red. Quantum mechanics/molecular mechanics calculations reveal that Mn oxidation alters the electrostatic field at the benzimidazole site, shifting the pK_a to favor proton release. This hybrid system illustrates how electrostatics can couple electron transfer to proton transfer and model the ubiquitous PCET processes in bioenergetics.

Bio: Ana Moore is a member of the Arizona State University (ASU) School of Molecular Sciences.
She earned her undergraduate degree at the University of La Plata, Argentina; her M.Sc. from the University of Rio de Janeiro, Brazil; and her Ph.D. from Texas Tech University, US. She did her postdoctoral work at the University of Washington before starting her work at ASU. Alongside colleagues Devens Gust and Tom Moore, she led a team of students and postdoctoral associates, many from Argentina, to develop bio-inspired molecular systems for energy conversion and storage. Their work helped position ASU as a leader in both natural and artificial photosynthesis.

References

(1) Mora, S. J.; Odella, E.; Moore, G. F.; Gust, D.; Moore, T. A.; Moore, A. L., Acc. Chem. Res. 2018, 51, 445. DOI: 10.1021/acs.accounts.7b00491
(2) Odella, E.; Wadsworth, B. L.; Mora, S. J.; Goings, J. J.; Huynh, M. T.; Gust, D.; Moore, T. A.; Moore, G. F.; Hammes-Schiffer, S.; Moore, A. L., J. Am. Chem. Soc. 2019, 141 (36), 14057-14061. DOI: 10.1021/jacs.9b06978.
(3) Yoneda, Y.; Mora, S. J.; Shee, J.; Wadsworth, B. L.; Arsenault, E. A.; Hait, D.; Kodis, G.; Gust, D.; Moore, G. F.; Moore, A. L.; Head-Gordon, M.; Moore, T. A.; Fleming, G. R., J. Am. Chem. Soc. 2021, 143, 3104. DOI: 10.1021/jacs.0c10626
(4) Arsenault, E. A.; Guerra, W. D.; Shee, J.; Reyes Cruz, E. A.; Yoneda, Y.; Wadsworth, B. L.; Odella, E.; Urrutia, M. N.; Kodis, G.; Moore, G. F.; Head-Gordon, M.; Moore, A. L.; Moore, T. A.; Fleming, G. R., J. Phys. Chem. Lett. 2022, 13, 4479. DOI: 10.1021/acs.jpclett.2c00585
(5) Gonzalez Lopez, E. J.; Cui, K.; Yoo, J. M.; Heredia, D. A.; Hammes-Schiffer, S.; Moore, T. A.; Moore, A. L., J. Am. Chem. Soc. 2026, 148, 41650-41660. DOI: 10.1021/jacs.6c15431
(6) Williams, J. C.; Faillace, M. S.; Gonzalez, E. J.; Dominguez, R. E.; Knappenberger, K.; Heredia, D. A.; Moore, T. A.; Moore, A. L.; Allen, J. P., Photosynth. Res. 2024, 162 (2-3), 1-14. DOI: 10.1007/s11120-023-01051-9.

Ultrafast Multidimensional Spectroscopies Meet PCET: Thermodynamics, Real-Time Protonation/Oxidation States, and a Perspective on Vibrational Control

Ricardo J. Fernández-Terán

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Direct determination of bond dissociation free energies (BDFEs) remains challenging, despite their fundamental role in quantifying the thermodynamics of proton-coupled electron transfer (PCET) processes,[1] and hydricities.[2] Conventional methods rely on equilibrium measurements with reference compounds, thermodynamic cycles,[3,4] or derivation from gas-phase bond dissociation enthalpies (BDEs), which inherently neglect solvation effects. Furthermore, quantum-chemical predictions frequently deviate from experimental benchmarks.[1]

To address this gap, we introduce a spectroscopic method to estimate solution BD(F)Es using two-dimensional IR spectroscopy (2D-IR),[5] focussing on the Si–H stretching vibration in silane model compounds. After validating against known BDFEs, we expanded the existing library by determining BDEs in multiple solvents. Additionally, our approach allows for the direct identification and time-resolved characterisation of specific solute–solvent interactions without additional modifications.

Finally, we demonstrate the utility of 2D-IR spectroelectrochemistry to unambiguously determine the protonation and oxidation states of transition metal hydrides in real time,[6] concluding with a perspective on using multidimensional spectroscopies to disentangle complex spectra, and to actively steer PCET reactivity with light,[7] switching the role of the spectroscopist from observer to director.

Bio: Dr Ricardo J. Fernández-Terán, originally from Venezuela, leads an independent physical chemistry research group at the University of Geneva since 2024, supported by an SNSF Ambizione grant. His research specialises in ultrafast multidimensional spectroscopies and the IR control of PCET reactions, building upon his Ph.D. at the University of Zurich (with Prof. Peter Hamm), and postdoctoral work at the University of Sheffield (with Prof. Julia A. Weinstein) and in Geneva (with Prof. Eric Vauthey). Outside of chemistry, he is a classically trained pianist who has pursued music since childhood

References

[1] R. G. Agarwal, S. C. Coste, B. D. Groff, A. M. Heuer, H. Noh, G. A. Parada, C. F. Wise, E. M. Nichols, J. J. Warren, J. M. Mayer, Chem. Rev., 2022, 122, 1–49.
[2] L. Sévery, N. Emmanuel, M. Alexis, C. Thibault, Inorg. Chem., 2025, 64, 12927–12931.
[3] G. W. Margulieux, S. Kim, P. J. Chirik, Inorg. Chem., 2020, 59, 15394–15401.
[4] M. Lucarini, P. Pedrielli, G. F. Pedulli, S. Cabiddu, C. Fattuoni, J. Org. Chem., 1996, 61, 9259–9263.
[5] J. Kölbel, L. Sévery, R. J. Fernández-Terán, Angew. Chem. Int. Ed. 2026, in press (doi:10.1002/anie.4964422).
[6] R. J. Fernández-Terán, I. I. Ivalo, D. Chekulaev, J. A. Weinstein, J. Phys. Chem. Lett., 2026, 17, 3008–3012.
[7] R. J. Fernández-Terán, CHIMIA, 2025, 79, 744–748.

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Metal–Organic hybrids as Photocatalysts for Solar-Driven Reactions.

Mónica González

Monica C. Gonzalez

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Metal–organic nanohybrids are a class of materials composed of organic ligands coordinated to metal ions or metal clusters. In recent years, the use of metal – organic frameworks as photocatalysts has attracted considerable attention owing to their unique combination of properties: efficient light harvesting by tunable organic linkers and effective charge separation enabled by the intimate contact between the linkers and metal nodes.

The vast diversity of organic linkers and the rich coordination chemistry of metal ions have driven the development of these materials as promising platforms for solar-driven photocatalysis. Different strategies can be implemented to optimize their properties for specific photocatalytic applications, depending on the targeted reaction.

In this talk, I will present our experimental studies on the photocatalytic behavior of two metal-organic hybrids based on Zr and Hf clusters as secondary building units (SBUs), incorporating porphyrin and perylene ligands. These systems display distinct activities toward oxidation and reduction reactions under visible-light irradiation, reflecting the crucial role of the ligand in defining their catalytic performance. Our results highlight that metal–organic hybrids with related inorganic building units can follow markedly different photocatalytic pathways depending on the nature of the organic ligand, and that understanding these mechanistic differences is essential for the rational design of more efficient solar-driven catalysts for targeted reactions.

Bio: Mónica C. González is a CONICET researcher at INIFTA, Universidad Nacional de La Plata, where she leads the NANOFOT group. Her research focuses on photoactive nanomaterials and photocatalysis for environmental and energy applications. In 2025, she received the Eduardo H. Staricco Career Achievement Award from the Argentine Association for Physicochemical Research.

Photoactivatable nanozymes: a manganese–porphyrin nanozyme for biomedical and environmental applications

Daniel Mártire

Nanozymes are nanomaterials with intrinsic enzyme-like activity. Unlike natural enzymes, they are cheap and robust, they are easy to functionalize, and their activity can be tuned through size, composition and structure. Light adds spatiotemporal control: catalysis can be switched on where and when it is needed, without chemical activators.

After a brief overview of nanozymes and the main routes to photoactivation, we present a new oxidase-like nanozyme (NZ1). It is built by layer-by-layer assembly of poly(allylamine) and polystyrene sulfonate on ~360 nm silica cores. It carries the cationic porphyrin TMPyP as photosensitizer and Mn(II)EDTA as redox mediator. Zeta potential, TEM, DLS, SEM-EDX and XPS show stable, monodisperse particles with patchy porphyrin and manganese coverage (≈2.3×10^3 Mn atoms per particle).

NZ1 is inactive in the dark. Under 430 nm irradiation it oxidizes 3,3′,5,5′-tetramethylbenzidine (TMB) with dissolved O_2 at near-neutral pH, following Michaelis–Menten kinetics (K_m = 1.16 mM). Time-resolved singlet-oxygen phosphorescence, XPS and control experiments support the following mechanism. $^1O_2$ generated by TMPyP oxidizes Mn(II)EDTA to Mn(III)EDTA, the main species responsible for TMB oxidation, although direct oxidation of TMB by $^1O_2$ also contributes. Surprisingly, activity is lower under pure O_2 than in air, because excess oxygen binds Mn(III) and diverts it toward superoxide formation.

In HeLa cells, NZ1 localizes in the cytoplasm. It is non-toxic in the dark and causes light-dependent cell death, driven mainly by $^1O_2$. NZ1 is therefore a tunable platform that couples singlet-oxygen generation with manganese redox chemistry, with uses in photocatalysis, environmental remediation and photodynamic therapy.

Bio: Daniel Mártire earned his Ph.D. from the Universidad Nacional de La Plata (UNLP) in 1988. He then completed postdoctoral fellowships in Germany and the USA before joining INIFTA as a researcher in 1992.
He is currently a Professor at UNLP, where he has also taught several postgraduate courses. He has supervised 11 doctoral theses, co-supervised 2 more and 5 dissertations, and is supervising one doctoral thesis now.
He has also directed, and continues to direct, researchers and postdoctoral fellows.

Porosity as a Design Parameter: Engineering Light–Matter Interactions in Mesoporous Thin Films

Galo Soler Illia

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The integration of sol-gel synthesis, self-assembly, and orthogonal functionalization provides a versatile platform for designing mesoporous thin films (MTFs) with tunable structural and surface properties. MTFs can be readily integrated into optical, electrochemical, or microfluidic devices, and their highly controlled mesopore size permits engineering of optoelectronic responses tightly coupled to the chemical environment. Our group exploits this design principle across four interconnected fronts.

One-dimensional Bragg stacks assembled from alternating MTF layers act as vapor-responsive photonic crystals: capillary condensation within the ordered pore network shifts the photonic band gap reversibly across the visible spectrum. Functionalization and integration of molecules or nanospecies extend these platforms toward analyte-specific optical sensing (UV-vis and SERS).

Porosity also programs matter–phonon interactions: this same architectural concept supports coherent acoustic phonon resonances up to 90 GHz, opening the gate to a new class of vapor- and humidity-responsive nanophononic materials fabricated by wet chemistry.

The high refractive index contrast between dense and mesoporous layers ($\Delta n \approx 0.8$) can be exploited to reach the strong exciton–photon coupling regime: five-bilayer dip-coated mirrors integrated with the 2D perovskite $(PEA)_2PbI_4$ yield a Rabi splitting of 90 meV at room temperature, opening a low-cost route to solution-processed polaritonic devices.

Regarding energy applications, nanocrystalline titania MTFs on transparent conductive substrates serve as robust photoelectrocatalytic platforms for water splitting and solar fuel generation. Ultrafast transient absorption analysis reveals the critical role of surface defects in limiting performance, mitigated through co-catalysts (metalloporphyrins, CoPi, or Ni/Fe LDH) confined within the pore network.

Together, these results position MTFs as scalable, chemically programmable materials bridging photonic sensing, nanoacoustics, polaritonics, and solar energy conversion.

Bio: Galo Soler-Illia is a CONICET Superior Researcher and founding director of the Institute of Nanosystems at Universidad Nacional de San Martín. His research focuses on mesoporous materials, functional thin films, and hybrid nanosystems. His distinctions include the Platinum Konex Award in Nanotechnology and the Bernardo Houssay Award.

Recent references

A. Alvarez-Fernandez et al. Acc. Mater. Res. 2026, 7, 88–99.

E. Cardozo de Oliveira et al. Nano Letters 2026, 26, 1004-1010.

P. Vensaus et al. Nanotechnology. 2026, 37, 045401

M. Méndez-Galván et al. Mater. Adv. 2026, 7, 7832–7841

M. Zuarez-Chamba et al. ChemElectroChem 2026, 13, e70262

L08 · Invited lecture

Ultrafast dynamics of charge carriers in TiO_2 thin films: effect of morphology and crystallinity

Gastón Corthey

Michael Zuarez-Chamba[1], Gastón Grosman[1 2], Lucas N. Mendioroz[1], María Fernanda Cardinal[1], Galo J. A. A. Soler-Illia[1], Gastón Corthey[1]

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Abstract

Titanium dioxide (TiO_2) is widely used in photoactive applications such as solar fuel generation. However, how structural parameters affect the dynamics of photogenerated charge carriers is not yet fully understood. In this work, we study how morphology and crystallinity affect ultrafast charge-carrier dynamics in TiO_2 thin films. First, we compare mesoporous and dense films. Second, we vary the degree of crystallinity through thermal annealing between 300 and 550 °C and characterize the resulting films by X-ray diffraction and Raman spectroscopy. In both cases, we use broadband femtosecond transient absorption spectroscopy (325 nm / 3.82 eV pump, 480–900 nm probe) to follow free electrons (~850 nm) and surface-trapped holes (~525 nm). Together, these studies aim to provide structural criteria for designing materials with enhanced photoelectrocatalytic activity.

Bio: Gastón Corthey is an Associate Researcher at CONICET and leads the Ultrafast Dynamics Group at the Institute of Nanosystems, Universidad Nacional de San Martín (UNSAM), Argentina. He received his PhD in Chemistry from Universidad Nacional de La Plata and was an Alexander von Humboldt postdoctoral fellow at the Max Planck Institute for the Structure and Dynamics of Matter in Hamburg, Germany. His research focuses on ultrafast structural and electronic dynamics. He is also a co-founder of TECSCI, a company that develops open-source scientific instrumentation.

Wavelength-Dependent Photochemistry in MOF-Type Nanoparticles: From Ultrafast Dynamics to Photoredox Reactivity

Daniel Cacciari

Perylene-based metal–organic frameworks (MOFs) are promising platforms for visible-light photochemistry due to their strong absorption and tunable excited-state properties. Here, we investigate the wavelength-dependent photochemical behavior of ZIPER, a zirconium-based MOF incorporating perylene-derived linkers, to explore how selective photoexcitation influences its redox reactivity.

ZIPER nanoparticles were synthesized solvothermally and studied as aqueous colloidal suspensions under blue (420 nm) and green (520 nm) LED irradiation. Photochemical activity was evaluated through hydrogen peroxide (H_2O_2) photogeneration in the presence of triethylamine (TEA), methyl viologen (MV^{2+}) photoreduction under inert atmosphere, and degradation of diclofenac, caffeine, and cephalexin. Time-correlated single-photon counting (TCSPC) and femtosecond transient absorption spectroscopy (fsTA) were employed to investigate excited-state dynamics following selective photoexcitation. ZIPER exhibited a pronounced wavelength-dependent response. H_2O_2 production reached 420 µM after 1 h under green-light irradiation, compared with 50 µM under blue light. Conversely, MV^{2+} photoreduction was more efficient under blue-light excitation, suggesting differences in the redox pathways accessed at each wavelength. All three contaminants underwent degradation under both irradiation conditions, with higher efficiencies under green light.

These contrasting photochemical responses indicate that excitation wavelength modulates the balance between competing redox processes in ZIPER. Ongoing fsTA studies aim to elucidate the underlying excited-state dynamics and establish mechanistic connections between selective photoexcitation and photoredox reactivity. This work highlights wavelength-dependent excitation as a strategy for understanding and controlling the photochemical performance of MOF-type nanoparticles.

Bio: Dr. Daniel Cacciari is a CONICET researcher at INIFTA, Argentina, and a member of the NANOFOT group. He holds a Ph.D. in Chemical Sciences from the National University of Río Cuarto, specializing in organic photochemistry. His current research focuses on the photochemistry and photophysics of functional nanomaterials, with applications in energy conversion, photocatalysis, and biology.

Stimuli-responsive nanocarriers for controlled drug delivery

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Abstract

Stimuli-responsive nanocarriers have been widely studied for the treatment of different diseases and have attracted considerable attention in the biomedical field. In this presentation, polymer-gated magnetic mesoporous silica nanoparticles developed by our group will be presented as stimuli-responsive nanocarriers for controlled drug delivery. The synthesis and grafting of polymers onto magnetic mesoporous silica nanoparticles will be discussed, with particular emphasis on the relationship between polymer properties and nanocarrier performance. Drug loading capacity, release performance, cytotoxicity, and cellular uptake will also be presented and discussed. Finally, future challenges and potential opportunities for the application of these nanocarriers in controlled drug delivery will be addressed.

Keywords: Drug delivery, nanocarriers, mesoporous silica, thermoresponsive polymer

The photochemistry of β-carbolines alkaloids: ongoing biological research and potential (bio)technological applications

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Abstract

This presentation will focus on our ongoing research into the photochemistry of β-carboline alkaloids. While these compounds strongly interact with UV-visible light in living organisms, their actual biological roles remain largely uncertain and are a central target of our work. We will present fundamental photochemical research and propose hypotheses regarding their biosynthesis, biodistribution, and potential roles in UV stress defense and oxidative processes. However, much further research is needed to clarify these natural functions.

Despite these unresolved biological questions, the distinct photochemical properties of β-carbolines allow us to explore further (bio)technological applications. We will discuss how their light-responsive behavior is used to design targeted carriers for Photodynamic Therapy (PDT), to develop antimicrobial and antiviral agents, and other photo-triggered tools. Additionally, we will present our work using these photoactive compounds as additives in dye-sensitized solar cells and other solar-driven redox processes. By addressing open biological questions while testing practical applications, our work aims to connect fundamental photochemistry to address challenges in health and sustainable energy.

Type I Photosensitization and Antioxidant Protection of Biomolecules

Carolina Lorente

Carolina Lorente

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Photosensitized oxidation of biomolecules plays an important role in biological systems exposed to UV-visible radiation. These processes can proceed through different mechanisms, including electron or hydrogen transfer reactions (Type I) and singlet oxygen-mediated oxidation (Type II). Understanding the relative contributions of these pathways is essential for identifying effective photoprotective strategies.

This presentation will address the mechanisms of pterin-mediated photosensitized oxidation of biologically relevant molecules, including amino acids, nucleotides, and their corresponding macromolecules. Particular emphasis will be given to the predominance of Type I mechanisms and the involvement of radical intermediates in biomolecular damage.

The protective effects of natural antioxidants will also be discussed, focusing on their interactions with excited photosensitizers, biomolecule-derived radicals, and reactive oxygen species. Recent findings indicate that direct singlet oxygen quenching by several antioxidants is relatively inefficient, whereas alternative pathways, including excited-state quenching and radical repair, can contribute significantly to photoprotection.

Together, these findings highlight the importance of understanding the underlying reaction mechanisms to explain antioxidant activity and develop effective strategies against photosensitized biomolecular damage.

Connecting Photochemistry with Photobiology (and the people working on these subjects)

Silvia Braslavsky

Institution declared in registration: Max Planck Institute for Chemical Energy Conversion

Full author affiliations pending confirmation.

Abstract

The history of the group of chemical kinetics and photochemistry created in 1963 by Eduardo Lissi and Juan Grotewold in the School of Sciences of the University of Buenos Aires will be followed over the years until the present, pointing to the influence of the political events in Argentina and Chile, as well as to the Intersystem Crossings with other research groups. Over the years, and confronting severe political difficulties, the members of the original group and the various disciples, worked succesfully in different Countries in several areas such as material sciences, nanosciences, biological photoreceptors, photoinduced biological processes, photosensitization, photochemistry in micro-heterogeneous media and in water, photoremediation of soil, water and air, circular economy, strongly collaborating among them and with many other groups, showing great resilience and flexibility.

This lecture is an hommage to Eduardo Lissi and Juan Grotewold, and also a tribute to the photo-colleagues in Argentina and Chile who are not with us anymore: Miguel Rubinstein, Elsa Abuin, Josefina Awruch, Alberto Villa, Alejandra Grela, Eli Jares, Enrique San Román, Lelia Dicelio, Marta Litter, Mito Neumann, and close friends of the Latin-American photo-community who also left us: Dick Weiss, Miguel A. Miranda and André Braun.

Braslavsky & Previtali, Photochem. Photob. 101, 790-832 (2024), DOI: 10.1111/php.14044

Keywords: photochemistry, history, photobiology

Bio: Silvia E. Braslavsky studied Chemistry at and holds a PhD degree from the Univ. of Bs As. Since 1976 worked in the Max Planck Institute for Radiation Chemistry. In 1998 she was the first woman to be granted the Am. Soc. Photobiology Research Award. The biannual Prize for the best Master thesis in Photochemistry awarded by the German Society of Chemists (GDCh) bears her name.

Selective Vibrational Tracking of Excited States in Photosynthetic Antennas

Manuel Llansola Portolés

When a molecule absorbs light, it is promoted to an excited state, from which a range of different processes can follow: energy transfer, charge separation within or between molecules, internal conversion, etc... The more complex the molecule, or the environment it sits in, the harder it becomes to identify these processes with precision.

Photosynthetic energy harvesting is an extreme example. Photosynthetic antennas contain hundreds of pigments, typically chlorophylls and carotenoids, tightly packed together. Under optimal conditions, these systems transfer the energy of a single photon over several nanometres, through tens of individual transfer steps, and just as efficiently dissipate that energy harmlessly when too many photons arrive. Despite being one of the most studied biological systems, the overlapping signals of femtosecond transient absorption (fsTA) and two-dimensional electronic spectroscopy (2DES) make it impossible to follow these steps one at a time. Femtosecond stimulated Raman spectroscopy (FSRS) has been a valuable complement, since vibrational modes carry rich structural information, but routine probing in the near-infrared has not brought any selectivity.

We have combined our group's expertise in resonance Raman spectroscopy, which brings selectivity, with FSRS, using a tunable Raman pump whose resonance condition selects the state under observation. This approach lets us detect signals from, and determine the nature of, excited states that could not be described before. We have used it to characterise the nature and symmetry of several dark states in carotenoids, and are now extending it to photosynthetic complexes. In this talk, I will use photosynthetic complexes as the working example, but the technique and its underlying principles apply to any molecular system.

Romero, J. J. et al. The origin of carotenoid triplets in purple photosynthetic bacteria. arXiv preprint arXiv:2608.07390 (2026).

Bercy, R. et al. Reassessing Carotenoid Photophysics: Shedding Light on Dark States. J. Am. Chem. Soc. 148, 23976-23985, doi:10.1021/jacs.6c03864 (2026).

Heterouniones TiO2@PCN. ¿Realmente existen heterouniones tipo II o esquemas Z directos?

Manuela Manrique Holguín

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Abstract

En este trabajo se sintetizó un material compuesto TiO2@PCN mediante impregnación húmeda, utilizando urea como precursor de PCN a una proporción del 30 % (p/p) respecto al TiO2. El material se caracterizó mediante diversas técnicas y se evaluó su actividad fotocatalítica en reacciones de reducción (C6H5NO2RR, ORR y HER) y oxidación de fenol.

La caracterización fisicoquímica del material reveló la presencia de TiO2 principalmente en fase anatasa, mientras que también se encontró evidencia de la formación de PCN defectuoso (vacancias de nitrógeno o con ciclos de heptazina incompletos) interactuando de manera íntima con el óxido metálico. Este material compuesto reveló la generación de fotocorriente bajo irradiación de luz azul (λ = 420 nm) mientras que el gráfico de Nyquist mostró una mayor impedancia que la del TiO2 y del PCN prístinos. Los espectros CW-ESR bajo irradiación azul in situ evidenciaron la existencia de electrones atrapados en sitios Ti3+ y huecos en sitios Ti4+-O-.. Por otro lado, se detectó la presencia de oxígeno singlete bajo luz azul. Además, el análisis de ESR de captura de espín mostró la formación de radicales hidroxilo y anión superóxido. En cuanto a la actividad fotocatalítica reductiva bajo irradiación con luz azul, se alcanzó una formación de anilina de 7,2 mg L-1, 103 µM de H2O2 y la HER fue hasta tres veces superior a la del TiO2 al decorar fotocatalíticamente los materiales con nanopartículas metálicas de paladio. En cuanto a la oxidación de fenol bajo las mismas condiciones, esta fue de ~23%.

Keywords: Heterouniones, PCN, TiO2, luz visible

Light-Triggered Controlled Release from 6-Carboxypterin-Modified Poly(allylamine) and poly(sodium 4-styrenesulfonate) Microcapsules

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Abstract

Light-activated drug delivery systems offer exceptional spatiotemporal precision for controlled therapeutic release. Herein, we report the fabrication and characterization of photoresponsive polyelectrolyte multilayers (PEMs) assembled via the layer-by-layer (LbL) technique, utilizing 6-carboxypterin-functionalized poly(allylamine hydrochloride) (PAH-Cap) and poly(sodium 4-styrenesulfonate) (PSS). Multilayers were built on planar mica, platinum electrodes, and sacrificial $CaCO_3$ microparticles. Atomic force microscopy (AFM) revealed linear thickness growth up to five bilayers, above which structural aggregation increased surface roughness.

Upon UVA irradiation (λ = 365 nm), photochemical degradation of the pterin chromophore induced film thinning and increased permeability, which was corroborated by enhanced charge transfer in cyclic voltammetry. Hollow microcapsules, HM-(PAH-Cap/PSS)4, were obtained by $CaCO_3$ template dissolution with EDTA. Spectroscopic characterization confirmed the preservation of the photophysical properties of Cap within the assembled microcapsules. Light-triggered cargo release was evaluated using co-precipitated FITC-dextran (500 kDa) as a macromolecular model. Confocal laser scanning microscopy (CLSM) demonstrated efficient, time-dependent cargo release upon 5 min of UVA exposure. Crucially, the microcapsules maintained their structural integrity throughout the process, indicating that release is driven by light-induced permeability modulation rather than shell rupture. These findings highlight the potential of PAH-Cap-based LbL microcapsules as robust, smart nanostructured platforms for spatiotemporally controlled drug delivery.

Keywords: PAH-Cap, drug delivery, microcapsule, photoresponsive, polyelectrolyte

Photocurable bioinks based on methacrylated silk fibroin, hyaluronic acid and methylcellulose blends for 3D bioprinting of cartilage scaffolds

Gastón Corti

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Abstract

Osteoarthritis (OA) is a leading cause of disability worldwide, and current therapies fail to restore the architecture and mechanical function of articular cartilage. Three-dimensional (3D) bioprinting represents a promising strategy to fabricate biomimetic scaffolds; however, designing bioinks that simultaneously meet printability, cytocompatibility, and photocrosslinkability requirements remains challenging, since the photoinitiating system and the irradiation conditions govern both network formation and cell survival.

In this work, we develop a family of photocurable bioinks combining methacrylated silk fibroin (SFma) with hyaluronic acid/methylcellulose (HAMC) blends at varying compositions. Upon irradiation at 365 nm in the presence of lithium phenyl-2,4,6-trimethylbenzoylphosphinate (LAP), a water-soluble Norrish type I photoinitiator, the methacryloyl groups of SFma undergo free-radical chain-growth photopolymerization, yielding a covalent network whose crosslinking density can be tuned through the degree of methacrylation, photoinitiator concentration and light dose. As HA and MC are not methacrylated, they remain physically entrapped within the SFma network, forming a semi-interpenetrating polymer network. Methylcellulose (MC) provides thermoresponsive gelation at 37 °C and shear-thinning behavior for extrusion-based bioprinting, while hyaluronic acid (HA) contributes viscoelasticity, water retention, and bioactivity through CD44-mediated interactions with chondrocytes.

SFma was obtained by reaction with glycidyl methacrylate. Different SFma/HA/MC compositions were evaluated by oscillatory rheology to assess shear-thinning behavior and gelation kinetics at 37 °C, while photocrosslinking kinetics were followed by in situ photorheology as a function of LAP concentration, irradiance and exposure time.

Future studies will assess cell viability and the use of the scaffold as a platform for localized mRNA delivery to drive in situ chondrogenesis.

Keywords: photocrosslinking, LAP photoinitiator, methacrylated silk fibroin, 3D bioprinting, cartilage tissue engineering

Photochemistry and Photosensitizing Activity of a Model of the (6–4) Photoproduct Chromophore

Gricelda Godoy Ortega

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Abstract

UV radiation can cause several types of DNA damage, including (6–4) photoproducts formed by direct UV-B absorption by adjacent pyrimidines. The chromophore of these lesions, 5-methyl-2-pyrimidinone, absorbs in the UV-A region and may act as an endogenous photosensitizer, promoting further photochemical modifications.

This work investigated the photochemistry of 5-methyl-2-pyrimidinone 2′-deoxyribonucleoside (Pyo), a model of the (6–4) photoproduct chromophore, and its photosensitizing activity toward biologically relevant substrates: tryptophan (Trp), 2′-deoxyguanosine-5′-monophosphate (dGMP), and 2′-deoxythymidine-5′-monophosphate (dTMP). Steady-state photolysis at 300 nm was performed under argon-saturated, air-equilibrated, and oxygen-saturated conditions to evaluate the influence of oxygen availability on photodegradation, substrate consumption, and photoproduct formation. Photodegradation was monitored by HPLC, photoproducts were analyzed by LC-MS/MS, and laser flash photolysis (LFP) was used to characterize the Pyo triplet state and determine bimolecular quenching rate constants.

The Pyo triplet-state lifetime was 16 µs, and quenching rate constants for all three substrates were on the order of 10^9 M^{-1} s^{-1}. Pyo photodegradation rates decreased from 0.025 µM s^{-1} under argon to 0.0073 and 0.0052 µM s^{-1} under air and oxygen, respectively. Substrate consumption also decreased with increasing oxygen concentration. Multiple photoproducts were detected, including Pyo–substrate adducts under anaerobic conditions.

In summary, Pyo exhibits photosensitizing activity, and oxygen modulates its photodegradation and substrate consumption, with greater substrate consumption under anaerobic conditions, where photoadducts were also detected. These findings provide new insights into how (6–4) photoproducts may contribute to DNA damage not only as primary lesions but also as endogenous sensitizers capable of inducing further photochemical modifications.

Keywords: DNA photodamage, (6–4) photoproducts, photosensitization,

An alternative green synthetic route for Fe-BDC MOF with enhanced catalytic activity towards heterogeneous photo-Fenton processes

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Abstract

Iron-based metal-organic frameworks (Fe-MOFs) offer potential for heterogeneous photo-Fenton treatment at circumneutral pH. Here, Fe-BDC-CAT and Fe-BDC-BH were synthesized using precursors recovered from acidic and basic hydrolysis of post-consumer PET bottles and compared with Fe-BDC-SA, prepared from commercial terephthalic acid. Amido Black (AB, 1 mM) degradation was evaluated at initial pH 6.0 with H_2O_2 (10 mM) under polychromatic irradiation (¬ > 300 nm).

Dark controls showed negligible dye degradation, while near-complete decolorization (>99%) was achieved within 90 min. Total organic carbon (TOC) measurements also revealed partial mineralization. Leaked Fe(III) remained below 10% of the initial catalyst iron content, while filtration controls suggested an important heterogeneous contribution to degradation. Time-resolved UV-visible spectra were analyzed using multivariate curve resolution with alternating least squares (MCR-ALS). Three spectral contributions were resolved, corresponding to AB and two groups of transformation products. Their evolution was consistent with a common sequential degradation scheme across all catalysts. TOC removal accompanied the accumulation of the later product contribution.

Reusability was assessed over four consecutive reaction cycles through initial degradation rates and peroxide utilization efficiencies. The kinetic profiles recovered across successive cycles remained consistent with the same overall sequence of contributions. Fe-BDC-SA and Fe-BDC-CAT exhibited higher initial rates during the first cycle, but their performance declined upon reuse. Fe-BDC-BH maintained nearly constant initial rates and showed larger retention of peroxide utilization efficiency, particularly at higher peroxide conversions. These results highlight the importance of evaluating both initial catalytic activity and overall performance retention when comparing PET-derived catalysts for photo-Fenton treatment.

Keywords: Heterogeneous photo-Fenton, Fe-BDC MOFs, PET recycling, degradation kinetics, MCR-ALS

Degradación de contaminantes emergentes en agua utilizando fotocatalizadores nanoestructurados magneticos

Mamani Lopez Rocio Anabel

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Abstract

El ZnO y el TiO_2 son semiconductores de bajo costo y elevada actividad fotocatalítica. Las nanocintas de TiO_2 pueden emplearse como soporte para nanopartículas de ZnO, formando heteroestructuras con potencial aplicación en la eliminación de contaminantes. Además, la incorporación de óxidos de hierro magnéticos facilita la recuperación y reutilización del material tras el tratamiento. Contaminantes emergentes seleccionados: carbamazepina (CBZ), diclofenaco (DIC) e ibuprofeno (IBU), debido a su persistencia, escasa biodegradabilidad y relevancia ambiental a nivel local.

Objetivo:Desarrollar y caracterizar materiales fotocatalíticos basados en nanocintas de TiO_2 modificadas con ZnO y óxidos de hierro magnéticos, y evaluar su eficiencia en la degradación fotocatalítica de fármacos emergentes en agua.

Resultados: Se sintetizaron cinco materiales mediante diferentes tratamientos de modificación y calcinación. Su caracterización se realizó mediante SEM-EDS, TEM, DRX, espectroscopía Raman, VSM y DRS. Los ensayos fotocatalíticos se llevaron a cabo en un reactor Rayonet-100 con ocho lámparas UV-A utilizando una carga de catalizador de 0,5 g/L. La evolución de la concentración del contaminante fue por HPLC. Entre los materiales estudiados, el NBM (nanocintas de TiO_2 modificadas con óxidos de hierro magnéticos) demostró el mejor desempeño fotocatalítico, alcanzando degradaciones del 42% para CBZ, 84% para DIC y 77% para IBU.

Keywords: fotocatalizadores, nanoestructuras, magnéticos, contaminantes emergente, agua

Sunflower Seed Shell Derived Activated Carbons for Phenol Carbophotocatalytic Degradation: Comparison of Two H3PO4 Activation Levels

Víctor A. Castaño-Rodríguez

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Abstract

Activated carbons derived from lignocellulosic biomass are promising materials for contaminant removal. This study investigates the influence of H_3PO_4 activation on the physicochemical properties and carbophotocatalytic performance of sunflower seed shell-derived activated carbons prepared at biomass-to-acid ratios of 1:1 (AC-1:1) and 1:4 (AC-1:4). Textural, surface chemical, electronic, and optical properties were characterized, and phenol adsorption, phenolcarbophotodegradation, and H_2O_2 photogeneration and decomposition were evaluated.

AC-1:4 exhibited a higher synthesis yield (28.9% versus 5.8%) and surface acidity (213.4 versus 165.5 mV meq g^{-1}), whereas AC-1:1 showed a higher specific surface area (694 versus 277 m^2 g^{-1}). The Tauc plots of diffuse reflectance spectroscopy (DRS) data exhibit similar apparent optical band gaps for AC-1:1 and AC-1:4 (3.63 and 3.57 eV, respectively), suggesting semiconductor-like behavior. Electron paramagnetic resonance (EPR) measurements revealed dark-state g-factors of 1.9999 for AC-1:1 and 2.0006 for AC-1:4, which shifted to 2.0024 and 2.0022, respectively, under irradiation, indicating electron trapping in carbon-centered persistent free radicals (C-PFRs).

Phenol adsorption was comparable for AC-1:1 (59.6%) and AC-1:4 (61.4%), while degradation after 5 h reached 97.6% and 94.9%, respectively. AC-1:4 exhibited a higher H_2O_2 generation rate (31.15 versus 4.15 µM h^{-1}), potentially through O_2 reduction involving superoxide intermediates. Conversely, AC-1:1 showed faster H_2O_2 decomposition (6.41 versus 2.65 × 10^{-2} h^{-1}). H_2O_2 decomposition at C-PFR sites may generate hydroxyl radicals (•OH), promoting phenol degradation.

Overall, the activation level influenced H_2O_2 production and phenol degradation performance, demonstrating that H_3PO_4 activation can tailor the functional properties of biomass-derived carbons for carbophotocatalytic applications.

Keywords: Biomass derived activated carbon, Carbophotocatalysis, Phenol degradation, Hydrogen peroxide photogeneration, Reactive oxygen species.

Immobilization of Polymeric Carbon Nitride (CN) and Fe-Modified CN onto Clays: Assessment of Photocatalytic Efficiency for Contaminant Degradation

Ada I. Montilla S.

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Abstract

Polymeric carbon nitrides (CN) are promising photocatalysts for aqueous contaminant degradation; however, pristine CN exhibits operational limitations regarding solid-liquid separation. Immobilizing CN onto clay mineral supports, such as montmorillonite (Mt) and bentonite (Bt), addresses these drawbacks by enhancing material stability and facilitating catalyst recovery following water treatment. In this study, Mt- and Bt-supported CN and Fe-modified CN (Fe-CN) photocatalysts were synthesized via calcination to establish the relationship between their structural/optical characteristics and photocatalytic performance. Physicochemical characterizations confirmed the successful integration of the active phases within the clay matrices. Photocatalytic evaluations were performed using methyl orange (MO) and carbamazepine (CBZ) as target pollutants under various light irradiation sources. Kinetic monitoring via UV-Vis spectroscopy and high-performance liquid chromatography (HPLC) revealed distinct degradation profiles for MO and CBZ under identical experimental conditions, stemming from their inherent structural and chemical differences. In conclusion, Fe-modification and clay immobilization successfully optimize the optical and catalytic properties of CN-based materials, offering a sustainable, cost-effective, and efficient approach for removing diverse organic pollutants from contaminated water systems.

Keywords: Polymeric carbon nitride, Clay immobilization, Fe-modification, Photocatalysis, Contaminant degradation

From Light to Function: Ligand-Tuned Rhenium(I)-Ferrocene Photosensitizers for the Degradation of Emerging Pollutants

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Abstract

Emerging pollutants such as ibuprofen (IBU) and diclofenac (DCF) are among the most frequently detected contaminants in surface waters, and they absorb little sunlight. Effluents also carry other pollutants, such as the azo dye amaranth red (AR), that react with light differently, calling for broad-spectrum photosensitizers.

We hypothesized that combining a ligand-tunable molecular Re(I) photosensitizer with magnetic iron oxide nanoparticles (FeOx) would allow contaminant degradation at low material loading and recovery of the photocatalyst. We prepared nanohybrids of FeOx, with or without a humic-substance coating, and fac-[$FcCO_2$–$Re(CO)_3$(phen)], and tested them on IBU, DCF and AR (different pollutant families).

Preliminary TEM/EDX shows rhenium co-localized with iron in nanoparticle aggregates, consistent with complex incorporation. Under 360 nm irradiation, hybrids at only 5 ppm, 100 times less material than the nanoparticles alone, produced spectral changes consistent with degradation of all three pollutants, and H_2O_2 increased photoproduct formation. For IBU, the band near 220 nm decreased while a band grew at 260 nm, attributable to acetophenone-type oxidation products, mainly 4-isobutylacetophenone; in 60 min the hybrid formed as much photoproduct as 150 min of direct photolysis. For DCF and AR, the characteristic bands at ~270 nm and ~520 nm decreased, respectively.

The hybrids degraded pharmaceuticals and a dye at low loading, showing potential as broad-spectrum photosensitizers. The hybrids are magnetically recoverable, a route to reusable photosensitizers for water remediation.

Keywords: Photosensitizers, Rhenium(I) complexes, Magnetic nanohybrids, Emerging pollutants, Water remediation

Sustainable Micellar Environments Enhances Selectivity in UV-Driven Photo-Fries Reactions of 4-Phenoxyphenol Esters

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Abstract

Controlling product selectivity in photochemical reactions involving radical pairs remains a significant challenge. This study investigates the Photo-Fries rearrangement of 4-phenoxyphenol esters within sustainable micellar environments using SDS, CTAC, and Brij-P35 surfactants, comparing these outcomes to homogeneous cyclohexane solutions. Direct irradiation in micellar media (at wavelengths of 254 and 310 nm) induces a remarkable selectivity, favoring the formation of the ortho-regioisomer with yields reaching up to 96%. The hydrophobic core of the micelles functions as a highly efficient microreactor; it inhibits the diffusion of photogenerated acyl and phenoxyphenoxyl radicals out of the cage, drastically promoting their confined coupling. UV-visible and 2D NMR (DCS, NOESY, and DOSY) spectroscopies were employed to determine the binding constants (Kb) and the location of the esters within the spherical micelles. Furthermore, the diffusion coefficients (D) and hydrodynamic radius (rs) were measured. Laser flash photolysis was utilized to observe the transient species formed during the reaction mechanism and to determine their kinetic constants. Ultimately, this microheterogeneous environment exerts crucial control over the photochemical pathway, demonstrating that the micelle-confined Photo-Fries reaction serves as a valuable, highly selective key step for the subsequent preparation of biologically relevant compounds.

Keywords: Photo-Fries rearrangement, micellar media, laser flash photolysis

Photo-Fries rearrangement of some acyl and sulfonyl derivatives of a non-natural steroid in homogeneous and micro-heterogeneous media

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Abstract

The Photo-Fries rearrangement of esters and sulfonates derived from natural aromatic steroids with potential pharmacological relevance has previously been successfully investigated. Continuing our research program, we studied the photoreactions of new esters and sulfonates derived from non-natural aromatic steroids. Starting from cholesterol, the required aromatic steroid precursor was obtained through a four-step synthetic sequence.

The photochemical reactions of various acyl- and sulfonyl-substituted steroids were first investigated on an analytical scale in homogeneous systems, using cyclohexane, acetonitrile, and methanol as solvents. Reaction rates, selectivity, and quantum yields were evaluated to investigate the photochemical behavior of these substrates in different solvent environments.

The reactions were also studied in three microheterogeneous systems consisting of aqueous solutions of SDS, CTAC, and Brij-P35, allowing us to assess the influence of the microenvironment on the photochemical reactions. Substrate–micelle interactions were investigated by NMR spectroscopy doing DOSY and NOESY experiments. The binding constants of every complex substrate-micelle were determined performing spectrophotometric titrations.

Finally, preparative-scale reactions were performed mostly in cyclohexane to determine chemical yields and fully characterize the isolated photoproducts by NMR spectroscopy. The ortho-regioisomers were obtained in yields ranging from 20% to 99%, although photosolvolysis and decomposition products were also observed in some cases.

Keywords: Photo-Fries reaction, cholesterol derivatives, photochemistry, micelles

Negative Photochromism in Epoxy Vitrimers: Photothermally Assisted Isomerization and Self-Healing Properties for Rewritable Optical Materials

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Abstract

Background: Covalent adaptable networks (CANs), such as vitrimers, are dynamic crosslinked polymers with reprocessable and self-healing properties. However, embedding photochromic dyes like spiropyrans (SPs) into rigid polymers often restricts their isomerization due to low free volume matrices.

Objective: This work aims to develop a self-healable epoxy-acid vitrimer that stabilizes the merocyanine (MC) form of SP to achieve negative photochromism.

Methods and Results: A 1,3,3-trimethylindolinobenzospiropyran dye was incorporated into an epoxy-carboxylic acid reactive blend. During polymerization, the polar environment induced a thermal transformation of SP into a stable, pink, and fluorescent MC form. Upon irradiation with a green laser (532 nm), the material exhibited rapid negative photochromism, converting the MC form back to a colorless state. This discoloration is assisted by local photothermal heating that softens the matrix when temperatures locally exceed the glass transition temperature (Tg). The colorless state can be erased (recovering the pink MC form) via prolonged UV irradiation. Furthermore, the dynamic nature of the vitrimer allowed the self-healing of surface scratches at 100 °C.

Conclusions: The combination of negative photochromism and a specific vitrimer matrix enables the creation of robust, self-healing smart materials suitable for rewritable optical devices.

Keywords: Epoxy, Vitrimer, Spiropiran, Negative Photochromism

Controlled Synthesis of Silver Nanocomposites in DMSO by Femtosecond Laser Ablation: Correlating Composition and Optical Response through a Dual Theoretical-Experimental Approach

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Abstract

The controlled synthesis of semiconductor and carbon-based silver nanocomposites remains challenging due to the limited ability to tailor their composition and optical properties in a single step. In this work, silver nanocomposites were synthesized by Femtosecond Laser Ablation in Solution (FLASiS) using pulse energies of 100 µJ and 500 µJ in neat water, various DMSO:water mixtures, and neat DMSO. Theoretical extinction spectra were modelled using Mie theory for Ag@Graphite, Ag2S, and Ag2S@Graphite nanoparticles. In water, the characteristic Surface Plasmon Resonance (SPR) band of silver nanoparticles was observed, while in DMSO:water mixtures the SPR was red-shifted due to a thin graphite layer. In neat DMSO, the plasmonic band was quenched and an absorption peak associated with Ag2S formation appeared. Optical Extinction Spectroscopy (OES) fitting revealed that the solvent governs the nanoparticle species: Ag@Ag2O in water, Ag@Graphite in DMSO:water mixtures, and Ag2S in neat DMSO. TEM analysis confirmed that Ag2S nanoparticles crystallize in the monoclinic α-Ag2S phase (acanthite). A hybrid OES-TEM approach was implemented to overcome the size-insensitivity of the Ag2S optical response, enabling reliable sizing and compositional analysis, supported by low RMSE values (0.012–0.26). The results demonstrate that FLASiS in DMSO enables the controlled, single-step fabrication of Ag2S and Ag@Graphite nanocomposites with tunable composition, relevant for sensing, photocatalysis, photodetection, and optoelectronic applications.

Keywords: Femtosecond laser ablation, silver nanocomposites, surface plasmon resonance, optical extinction spectroscopy, DMSO:water mixtures

Protonation-State Control of Excited-State Character and Photophysics in a Bithiophene-Functionalized Rhenium(I) Imidazophenanthroline Complex

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Abstract

Background: Rhenium(I) tricarbonyl diimine complexes are widely employed as luminescent probes because their photophysical properties can be tuned through ligand design. Strongly electron-donating substituents and the protonation state of the imidazole N–H group provide effective handles for controlling the nature of the emissive state.

Objective: To investigate the complex fac-[Re(CO)$_3$(btip)Cl], where btip is a bithiophene-substituted imidazophenanthroline, and its free ligand, in order to understand how deprotonation modifies the character of the excited states and the deactivation pathways.

Methods: Steady-state and time-resolved absorption and emission spectroscopy in several solvents was combined with electronic structure calculations. Ground-state geometries of the protonated and deprotonated forms were optimized using density functional theory (DFT), including relativistic effects for rhenium and an implicit description of the solvent. Absorption spectra were computed by time-dependent DFT (TD-DFT), and the character of the electronic transitions was assigned through a fragment-based analysis of electron density differences.

Results: The bithiophene donor electronically decouples the metal center from the organic chromophore. The intense absorption bands are dominated by intraligand and intraligand charge-transfer transitions, with only a minor metal contribution. The neutral species exhibits broad, unstructured dual emission with short lifetimes, characteristic of fluorescence. Deprotonation red-shifts both absorption and emission and gives rise to an additional, lower-energy emissive component, which is attributed to the destabilization of the donor-centered occupied orbital.

Conclusions: A strongly donating, conjugated substituent can effectively suppress the heavy-atom effect of Re(I), so that the photophysics is governed by ligand-centered singlet states and the protonation state becomes the main factor controlling emission properties. These findings are relevant for the design of pH- and analyte-responsive luminescent sensors.

Keywords: Rhenium(I) complex, imidazophenanthroline, protonation state, intraligand charge transfer, excited-state photophysics

Solar-photopolymerized hydrogels as photosensitizing platforms for coliform inactivation in urban lake water

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Abstract

The development of photoactive polymeric materials using mild and sustainable synthetic conditions offers interesting opportunities for environmental applications. In this context, hydrogels (HGs) can provide a versatile platform for immobilizing photosensitizers (PSs), combining their photochemical activity with the advantages of an insoluble and easily recoverable polymeric matrix.

In this work, photoactive HGs were obtained in aqueous medium by Type II photoinitiated polymerization using direct solar irradiation as the energy source. Mercurochrome (MCr) was employed as PS, while triethanolamine (TEOA) and polyamidoamine (PAMAM) dendrimers of different generations were evaluated as co-initiators. The polymeric network was formed from acrylamide and N-vinylpyrrolidone, using N,N′-methylenebisacrylamide as cross-linker. This approach allowed the formation of MCr-containing HGs under ambient conditions without the need for conventional thermal initiation or artificial irradiation sources.

Beyond their role in the synthesis process, the incorporated PS provides the resulting materials with the ability to act as photosensitizing platforms. Upon irradiation, MCr can generate reactive oxygen species (ROS), enabling the use of these HGs for photodynamic inactivation (PDI) while avoiding the direct addition of a soluble PS to the medium.

As a proof of concept under environmentally relevant conditions, the HGs were evaluated against coliform bacteria in water samples collected from Villa Dálcar Lake, an urban recreational lake located in Río Cuarto, Argentina. Solar irradiation in the presence of the HGs produced a marked reduction in coliform levels, whereas negligible inactivation was observed under dark conditions. These findings highlight the dual role of light in this strategy, first enabling the synthesis of the photoactive polymeric matrix and subsequently driving its antimicrobial activity, and support the potential of these materials as reusable photosensitizing platforms for water treatment.

Keywords: PAMAM, PHOTODYNAMIC INACTIVATION, HYDROGELS

Natural Antioxidants and their role in the deactivation of Reactive Oxygen Species generated in photosensitized processes

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Abstract

Natural antioxidants are known for their ability to prevent or reverse cellular oxidation caused by oxidative stress and environmental factors, including solar radiation. Their protective effects are associated with the scavenging of free radicals and the deactivation of reactive oxygen species (ROS), major contributors to biological oxidation. However, most ROS quenching rate constants have been determined using indirect methods that do not account for alternative pathways that reduce ROS formation, particularly singlet oxygen (1O2) and hydrogen peroxide. Singlet oxygen is commonly generated through photosensitized reactions, in which a photosensitizer absorbs electromagnetic radiation and transfers energy from its excited triplet state to ground-state molecular oxygen.

In this sense, the objective of this research was to evaluate the deactivation of singlet oxygen and hydrogen peroxide obtained through TMPyP photosensitized processes, in the presence of antioxidant compounds such as vanillin and nordihydroguaiaretic acid.

The results obtained demonstrate that the antioxidants evaluated are deficient in deactivating the reactive H_2O_2 species. Furthermore, the deactivation constants for $^1O_2$ obtained are in the range of 10^7–10^8 M^{-1} s^{-1}, consistent with values reported in the literature for these compounds. Additionally, the deactivation constants for triplet excited states were determined to be diffusion constants of 10^9 M^{-1} s^{-1}. Finally, the results show that although the antioxidant compounds proved to be good deactivators of $^1O_2$, the results suggest that the protection provided in photosensitized processes is primarily due to the deactivation of the triplet excited state of the photosensitizer with higher deactivation constants.

Keywords: Singlet oxygen, antioxidant, photosensitizer, ROS

Photoinduced damage of skin biomolecules caused by radiation emitted by nail polish drying lamps

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Abstract

UVA radiation and visible light can induce indirect damage to DNA, proteins, and lipids through photosensitized reactions. Pterins are naturally occurring heterocyclic compounds widely distributed in living organisms, including human skin, where they participate in critical biological processes and can act as photosensitizers. Given the increasing use of nail polish drying lamps and the limited information available regarding their potential health effects, this study investigated whether radiation emitted by these devices during a conventional gel manicure induces the photodegradation of pterins and whether the resulting photoproducts can damage skin biomolecules.

Experiments were performed using pterin concentrations comparable to those found in human skin, under physiologically relevant pH conditions (4.5–5.8) and with irradiation times representative of a typical manicure session.

The results showed that, although the radiation dose was insufficient to induce erythema, it promoted the photodegradation of skin pterin derivatives, generating photoproducts capable of acting as photosensitizers. These photoproducts induced tyrosinase inactivation, potentially affecting melanin biosynthesis, and promoted lipid peroxidation and membrane permeabilization.

In conclusion, nail polish drying lamps can trigger photosensitized processes that damage skin enzymes and lipids at exposure doses below the erythema threshold. These findings highlight the need for further research into the potential health implications of repeated exposure to these devices.

Keywords: photosensitized reactions, lipids peroxidation, enzyme inactivation

Decyl-riboflavin as a lipophilic photosensitizer for blue-light-induced lipid membrane damage

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Abstract

Photodynamic therapy (PDT) relies on the controlled generation of reactive species to selectively destroy target cells, and its efficacy depends largely on photosensitizer (PS) localization within lipid membranes, where proximity to polyunsaturated lipids maximizes oxidative damage. Riboflavin (Rf, vitamin B2) is a biocompatible PS that absorbs in the blue range; however, its hydrophilicity limits its interaction with membranes. Here, we present the photochemical and biological characterization of 3-decyl-riboflavin (decyl-Rf), a lipophilic derivative designed to direct oxidative damage to the lipid bilayer under blue LED irradiation. Decyl-Rf generates singlet oxygen (Type II mechanism) and simultaneously operates via a Type I mechanism, resulting in extensive lipid peroxidation and membrane disruption in biomimetic systems. These effects were largely absent for hydrophilic Rf. Studies of its interaction with serum albumin revealed the formation of ground-state complexes, which markedly reduced cellular uptake under serum-containing conditions. Using confocal fluorescence microscopy, we evaluated the subcellular localization of decyl-Rf in HeLa cells, observing efficient internalization and preferential accumulation in lipid-rich compartments. This membrane localization correlated directly with significant phototoxicity upon blue-light irradiation, assessed by dose-response assays measuring cell viability. Overall, these results position decyl-Rf as a potent membrane-targeted PS whose ability to induce lipid peroxidation suggests a possible contribution to regulated cell death pathways. Furthermore, they provide a mechanistic basis for the development of lipophilic flavin derivatives as next-generation agents for blue-light PDT in oncological and antimicrobial applications

Keywords: Photosensitizer, oxidative damage, lipid peroxidation

Effect of the Peptide Bond and Tryptophan on Dityrosine Photogeneration and Photochemistry

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Abstract

The oxidation of tyrosine (Tyr), either as a free amino acid or within proteins, generates several products, including 3,3′-dityrosine (Tyr_2), which is formed through an oxidative covalent bond between two Tyr residues. Tyr_2 formation can alter protein structure and function while introducing a new chromophore with distinct photophysical properties. However, despite the biomedical importance of Tyr2, the information regarding its photosensitized generation and photochemical properties remains limited due to the drawbacks inherent with its synthesis.

This study aimed to investigate the photosensitized formation and photochemical stability of Tyr_2 in the absence and presence of tryptophan (Trp), using pterin (Ptr) as an endogenous Type I photosensitizer. Free Tyr and Tyr incorporated into specially designed peptides were used as target molecules.

Incorporation of Tyr into a peptide chain does not affect dimerization efficiency but provides some protection against degradation. Furthermore, the presence of an adjacent Trp residue within a peptide sequence, promoted the photoinduced dimerization of Tyr, likely through to electron-transfer. Additionally, the presence of free Trp, as well as, Trp within the same peptide chain enhanced the efficiency of the photosensitized degradation of free and peptide dityrosine respectively.

The results demonstrate that the peptide environment and the presence of Trp differentially influence Tyr_2 formation and photochemical stability. While neighboring Trp residues can promote Tyr dimerization, Trp also enhances Tyr_2 photodegradation.

Keywords: Dityrosine, Tryptophan, Peptide bond, Electron transfer reaction, Photosensitization

Folic acid-functionalized polyelectrolyte multilayer microcapsules as photosensitizing platforms for targeted photodynamic therapy

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Abstract

Cancer therapies remain limited by the low specificity of active agent delivery. Hollow microcapsules based on polyelectrolyte multilayers (PEMs), built by layer-by-layer (LbL) self-assembly, are promising platforms for controlled release of photosensitizers. The amino groups of poly(allylamine hydrochloride) (PAH) allow its functionalization with folic acid (FA), promoting interaction with cells overexpressing folate receptors, such as cancer cells. Here we report the synthesis, fabrication and characterization of PEMs based on FA-functionalized PAH (PAH–FA, ~1% substitution degree) assembled with sodium polystyrene sulfonate (PSS) on mica substrates and $CaCO_3$ microparticles [1,2].

Atomic force microscopy showed linear growth of thickness and roughness on mica, indicating controlled, homogeneous PAH–FA/PSS assembly [3]. Cyclic voltammetry revealed that ionic permeability is preserved after UVA irradiation (365 nm), suggesting structural stability under photoactive conditions. However, irradiation induces photochemical degradation of FA, reflected in decreased thickness, increased roughness and release of photoactive species into the medium.

Hollow microcapsules, HM-$(PAH–FA/PSS)_4$, were obtained by LbL assembly on $CaCO_3$ templates followed by EDTA-mediated core removal, and subsequently functionalized with polyethylene glycol (PEG), improving stability and dispersion. Under UVA irradiation, these capsules displayed photosensitizing activity, evidenced by guanosine oxidation.

PAH–FA-based microcapsules are thus proposed as multifunctional systems that combine folate-receptor targeting with in situ generation of photosensitizing species, making them promising platforms for photodynamic therapy.

References

1. Armijos-Capa, G., et al. ACS Applied Polymer Materials 7 (2025) 12569–12580.
2. Thomas, A. H., et al. Journal of Photochemistry and Photobiology A: Chemistry 135 (2000) 147–154.
3. Strawski, M., Granicka, L. H., Szklarczyk, M. Electrochimica Acta 226 (2017) 121–131.

Keywords: polyelectrolyte microcapsules, layer-by-layer self-assembly, photosensitizers

Synthesis, characterization, and photodynamic evaluation of riboflavin-loaded lanthanide upconversion nanoparticles in HeLa cells

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Abstract

To address the need for developing NIR-activatable PDT platforms—thereby avoiding direct excitation with UV-visible light, which has limited tissue penetration—we utilized lanthanide-doped upconversion nanoparticles (UCNPs) as an active core. These were coated with a thin layer of silica, followed by a mesoporous silica layer designed to load riboflavin (an endogenous photosensitizer capable of generating reactive oxygen species under UV-blue irradiation). The thin SiO2 layer provides colloidal stability, surface protection, and a controllable chemical interface. The mesoporous layer (mSiO2) offers a high surface area and accessible pores to house the photosensitizer, while maintaining the oxygen diffusion necessary for the generation of reactive oxygen species (ROS). Following the synthesis and characterization of the UCNPs, we evaluated their photodynamic activity *in vitro* using HeLa cells, anticipating low toxicity in the dark and a significant reduction in cell viability upon NIR irradiation.

Keywords: UCNP, RIBOFLAVIN, ROS

Water-Dispersible BOPHY Nanocrystals for Photodynamic Inactivation

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Abstract

Most photosensitizers used in photodynamic inactivation (PDI) exhibit poor aqueous solubility and limited bioavailability, which can compromise their efficacy in vivo. To address these limitations, we formulated the diiodo-BOPHY photosensitizer BP-2I as drug nanocrystals by wet milling. This organic-solvent-free approach affords a high drug loading and enables aqueous dispersion of the photosensitizer. The resulting BP-2I nanocrystals (NC-BP-2I) were thoroughly characterized. SEM, TEM, and DLS analyses confirmed their uniform morphology, monodisperse size distribution, and average size of approximately 120 nm. X-ray diffraction further verified their crystalline structure. NMR and FTIR analyses confirmed the chemical integrity of the BOPHY core, while DSC and TGA analyses characterized the thermal behavior of the nanocrystals. Spectroscopic measurements revealed that NC-BP-2I remained optically active in water, with changes in the absorption and fluorescence profiles relative to molecularly dissolved BP-2I in acetonitrile. Singlet oxygen generation demonstrated that the nanocrystal formulation retained photodynamic activity. In addition, the nanosuspensions exhibited remarkable long-term stability under multiple storage conditions, showing no detectable changes in size, dispersity, or spectroscopic and photodynamic properties even after more than one year. In PDI treatments against methicillin-resistant Staphylococcus aureus, NC-BP-2I achieved complete photokilling at a concentration of 2.5 μg/mL after irradiation. Importantly, cytotoxicity assays confirmed that the nanocrystals were non-toxic to healthy mammalian cells, supporting their biocompatibility and suitability for biomedical applications. Together, these results highlight the potential of NC-BP-2I as a water-dispersible photosensitizer formulation for antimicrobial photodynamic applications.

Keywords: Nanocrystals, Photodynamic Inactivation, MRSA, BOPHY

Photoactive Ag- and Ce-modified TiO2 nanotube surfaces for antibacterial potential application.

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Abstract

A photochemical investigation of TiO_2 nanotubes (NT-Ti) electrochemically modified with Ag (Ag-NT-Ti) and Ce (Ce-NT-Ti) under UV-A and visible light irradiation is presented in this work, with the aim of applying these materials to the photodynamic inactivation of bacteria (PDI).

The characterization of the materials includes surface topography analysed by atomic force microscopy (AFM); internal and external nanotube diameters determined by scanning electron microscopy (SEM); surface chemical composition was evaluated by X-ray photoelectron spectroscopy (XPS), while structural and optical properties were investigated by Raman and Diffuse Reflectance Spectroscopy (DRS). Their photochemical behaviour was studied through photoelectrochemical and photocatalytic assays, and the antibacterial PDI activity during the early stages of adhesion, using Staphylococcus aureus ATCC 25923 as a model microorganism.

The characterization techniques concluded that the surfaces of the modified NT-Ti differed in terms of their morphology, optical properties, and chemical composition. The incorporation of a mixed cerium oxide on the surface enhanced the photoelectrochemical response of Ce-NT-Ti when exposed to visible light. In contrast, Ag micro-patches deposited on the nanotubes (Ag-NT-Ti) improved the antibacterial PDI activity against S. aureus across both light irradiation sources.

Keywords: Nanostructured TiO_2; Photocatalysis; Photoelectrochemistry; Photodynamic inactivation

Photosensitizer and Silver Nanoparticle-Based Surface Modification Strategies for Biofilm Control

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Abstract

Surface-immobilized photosensitizers (PSs) offer advantages for photodynamic inactivation (PDI), including reusability, ease of removal, and enhanced photostability. Pterins can photoinduce biomolecule oxidation under UV-A irradiation and photoinactivate pathogenic bacteria in planktonic cultures and biofilms. Silver nanoparticles (AgNPs) are widely investigated for antimicrobial surface development in response to bacterial resistance. This work aimed to develop, characterize, and evaluate surfaces modified with pterin (Ptr) derivatives and AgNPs, combining light-induced bacterial killing by immobilized PSs with the potential medium- and long-term antimicrobial effects of AgNPs. Glass was selected as a low-cost substrate.

A molecular layer of 11-bromoundecyltrichlorosilane (BUTS) was formed by immersing glass substrates in a 15 mM solution of BUTS in n-hexane for 24 h at room temperature. Subsequently, terminal bromine atom was replaced with Ptr through an SN2 reaction using K2CO3 in N,N-dimethylacetamide at 70°C for 24 h. AgNPs were adsorbed by immersing the substrates in an AgNP dispersion for 24 h at room temperature in the dark.

X-ray photoelectron spectroscopy (XPS) confirmed surface functionalization through characteristic Br signals, their decrease after Ptr coupling, and the appearance of an N signal. Ag-containing samples exhibited the characteristic Ag 3d doublet. The surfaces were also characterized by atomic force microscopy (AFM) and contact angle measurements.

Under UV-A irradiation, surfaces containing both PSs and AgNPs reduced viable Staphylococcus aureus ATCC 25923 cells by 85 ± 13% compared with irradiated glass, highlighting their potential for biofilm control.

Keywords: Self-assembled monolayers (SAMs), Photodynamic inactivation (PDI), Antimicrobial coatings.

P21 · Poster presentation

Substituent and Solvent Effects on the Spectroscopy and Photochemical [6π] Electrocyclization of Diphenylamines to Carbazoles

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Abstract

A comprehensive study on the spectroscopic behavior and photoinduced reactivity of a series of para substituted diphenylamines was carried out to elucidate how electronic and solvent effects govern their photochemical [6π] electrocyclization. The target diphenylamines, bearing a range of electron donating and electron withdrawing substituents, were synthesized in excellent yields through the Hartwig–Buchwald C–N cross coupling reaction and fully characterized by melting point and NMR spectroscopy. Their UV–visible absorption profiles were systematically examined in solvents of different polarity, including cyclohexane, acetonitrile, and methanol. The lower energy absorption band exhibited a clear bathochromic shift with increasing solvent polarity, consistent with a π–π* electronic transition. Hammett analysis revealed a bell shaped substituent dependence: electron donating groups induced a slight hypsochromic shift relative to unsubstituted diphenylamine, whereas electron withdrawing substituents produced a pronounced bathochromic displacement.

Upon direct irradiation at 254 nm, all diphenylamines underwent a photochemical [6π] electrocyclization, affording the corresponding substituted N–H carbazoles in modest to good yields, reaching up to 61% in polar media. The substituent effect on the photoreaction, evaluated through Hammett correlations, showed negative ρ values, indicating that electron donating groups markedly accelerate the electrocyclization, while electron withdrawing substituents inhibit it. The magnitude of the ρ slopes demonstrates that substituents exert a significant influence on the triplet state pathway involved in the photoreaction, with solvent polarity further modulating these effects. These findings highlight the combined utility of C–N cross coupling and photochemical [6π] electrocyclization for accessing structurally diverse carbazoles, reinforcing their relevance as privileged heterocycles.

Keywords: p-Substituted diphenylamines, Carbazoles, Photoinduced [6pi]-electrocyclization, Synthesis

P22 · Poster presentation

Combined oxidation/bioremediation treatment of waste resulting from petroleum storage

Mariel Scaramutti

Abstract

Oily wastes (OW) are primarily generated in crude oil storage tank bottoms. In Argentina, there are numerous refineries and storage terminals. In the La Plata region, 60,000 tons of OW are generated annually. Due to their composition, these wastes are highly toxic, recalcitrant, and biorefractory. Consequently, there is a need to develop complementary strategies that reduce the pollutant load and can be integrated into existing processes. The objective is to evaluate chemical oxidation methods—using potassium permanganate (PM) and sodium persulfate (PS)—applied to tank bottom (TB) waste, with the aim of subsequently combining them with bioremediation to reduce the total petroleum hydrocarbons (TPH) present in the TB waste.