Laboratory of Technology of Organic Functional Materials

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RESEARCH PROFILE:

- chemistry of radicals and antioxidants,
- thermal analysis,
- carbonylation processes catalysed by palladium compounds.
- nitroxide-stabilized metallic nanoparticles for biomedical applications
- bimetallic nanostructures as catalysts and active supports for organocatalysts
- preparation of smart polymeric materials using Controlled Radical Polymerization
- egzohedral functionalization of fullerenes using cycloaddition reactions
- synthesis of metal nanoparticles (Au, FexOy) with unique catalytic properties.

CURRENT RESEARCH ACTIVITIES:

Studies on the rate of initiation of lipid peroxidation. A knowledge about the initiation rate has a capital importance during the studies of mechanism and kinetics of autoxidation and autoxidation inhibited by antioxidants. The studies are performed in emulsions and suspensions of liposomes.

Antioxidant activity of polyphenols in homo- and heterogeneous systems. The aim of this thematic line of our research is to determine the impact of acid-base equilibria on the antioxidant activity of phenols, to obtain the structure-activity relationship for mono- and polyphenolic antioxidants.

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Studies on the antioxidant activity of catecholamines. Neurodegenerative diseases, such as amyotrophic lateral sclerosis, Alzheimer's disease, and Parkinson's disease, are characterized by a progressive degeneration and death of neurons associated with the overproduction of the Reactive Oxygen Species (the oxidative stress). Our goal is to get insights into protecting activity of catecholamine neurotransmitters in lipid systems exposed to Reactive Oxygen Species.

Application of thermal analysis techniques for studies of lipid oxidation. In our research we compare the standard analytical techniques (like Rancimat) with the results obtained by using thermal analysis (Differential Scanning Calorimetry, DSC).

Studies on carbonylation processes catalysed by palladium compounds. Our studies are aimed at developing new, environmentally safe, selective and active catalysts for carbonylation of aromatic nitrocompounds and amines as alternative, waste- and fosgene-free method of production of aromatic isocyanates, carbamates, and ureas.

SELECTED PUBLICATIONS:

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2. A. Konopko, J. Kusio, G. Litwinienko, Antioxidant Activity of Metal Nanoparticles Coated with Tocopherol-Like Residues — The Importance of Studies in Homo- and Heterogeneous Systems, Antioxidants. 9 (2020) 5, doi:10.3390/antiox9010005
3. A. Lewińska, J. Adamczyk-Grochala, D. Błoniarz, J. Olszówka, M. Kulpa-Greszta, G. Litwinienko, A. Tomaszewska, M. Wnuk, R. Pązik, AMPK-mediated senolytic and senostatic activity of quercetin surface functionalized Fe_3O_4 nanoparticles during oxidant-induced senescence in human fibroblasts, Redox Biology. 28 (2020) 101337.
4. K. Jodko-Piórecka, J. Cędrowski, G. Litwinienko, Physico-chemical principles of antioxidant action, including solvent and matrix dependence and interfacial phenomena. Chapter 12 in monography Measurement of Antioxidant Activity & Capacity: Recent Trends and Applications, Edited by R. Apak, E. Capanoglu, and F. Shahidi, ISBN: 978-1-119-13537-1, John Wiley & Sons Ltd. 2018.
5. A. Krogul-Sobczak, P. Kasperska, G. Litwinienko, N-heterocyclic monodentate ligands as stabilizing agents for catalytically active Pd-nanoparticles, Catalysis Communications. 104 (2018) 86-90.
6. R. Czochara, G. Litwinienko, H.-G. Korth, K.U. Ingold, Another Wieland Mechanism Confirmed. Hydrogen Formation from Hydrogen Peroxide Formaldehyde, and Sodium Hydroxide. Angewandte Chemie Int. Ed. 57 (2018) 9146-9149.
7. E. Megiel, Surface modification using TEMPO and its derivatives, Advances in Colloid and Interface Science. 250 (2017) 158-184.
8. J. Cędrowski, G. Litwinienko, A. Baschieri, R. Amorati, Hydroperoxyl Radical (HOO•): Vitamin E Regeneration and H-Bond Effects on Hydrogen Atom Transfer, Chemistry -A European Journal. 22 (2016) 16441–16445.
9. P. Piotrowski, P. Pawłowska, R. Bilewicz, A. Kaim, Selective and reversible self-assembly of C60 fullerene on a 9,10-bis(S-acetylthiomethyl) anthracene modified gold surface, RSC Advances. 6 (2016) 53101-53106.
10. M. Goździewska, G. Cichowicz, K. Markowska, K. Zawada, E. Megiel, Nitroxide-coated silver nanoparticles: synthesis, surface physicochemistry and antibacterial activity, RSC Advances. 5 (2015) 58403-58415.