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VABILO NA PREDAVANJE
V OKVIRU DOKTORSKEGA ŠTUDIJA
KEMIJSKE ZNANOSTI / INVITATION TO THE
LECTURE WITHIN DOCTORAL PROGRAMME IN
CHEMICAL SCIENCES

Prof. Werner Kunz

Regensburg University, Institute of Physical and Theoretical Chemistry, Regensburg, Germany

z naslovom / title:

The chemistry of liquids and solutions and its contribution to sustainability

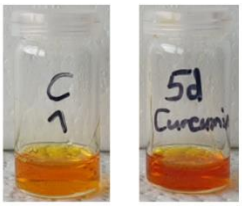
v sredo, 24. 1. 2024 ob 15. uri /
on Wednesday, 24. 1. 2024 at 15.00
v predavalnici 1 v 1. nadstropju Fakultete za kemijo in kemijsko tehnologijo, Večna pot 113 **/ in lecture room 1,** 1st floor at the Faculty of Chemistry and Chemical Technology, Večna pot 113

Vljudno vabljeni! / Kindly invited!

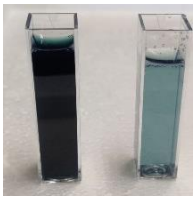
Abstract:

Today, there is an increasing quest for more sustainable solvents for many applications, be it in formulations of cosmetics, food, cleaning agents or pharmaceutics, etc., or in industrial processes, like plant extraction or large-scale production of chemicals, for which still (eco-)toxic solvents such as DMF and NMP are used.
In the present contribution, I will discuss some alternative liquids that are currently still neglected or not yet widely used, but that have a significant potential for future applications. For example, gamma-valerolactone (GVL) shows very promising properties such as a very high solubility power, e.g., for several polymers, together with a very low ecotoxicity, excellent biodegradability, and a complete miscibility with water [1]. Besides other promising solvents, I will also shortly discuss the potential of fashionable Ionic Liquids and Deep Eutectic Solvents (DES).
Clearly, water would be the most sustainable solvent. To use it, often oils or other hydrophobic molecules must be made soluble with the help of appropriate adjuvants. These can be classical surfactants or hydrotropes. We recently found different ways to use natural (and "drinkable") substances as additives. In some cases, they can even stabilise the obtained solutions, e.g., against oxidation in addition to increasing solubility, and have other beneficial effects. [2,3] Even the solubilisation of proteins in water is often a challenge, and I will also discuss this issue. [4]
Often the question is, if in water defined interfaces, as they occur in the case of surfactant solutions, are necessary to solubilise reactants and to stabilise catalysts or if a week structuring in so-called surfactant-free microemulsions is sufficient or if even a simple unstructured medium is enough. I will show examples for all three cases [5,6,7].

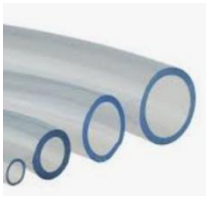
Curcumin in water



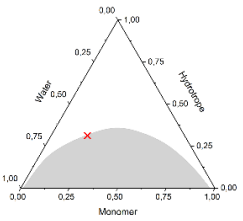
Indigo in water



GVL dissolves PVC



Microemulsion Polymerisation without Surfactants



References
[1] F. Kerkel, M. Markiewicz, S. Stolte, E. Müller, W. Kunz, The Green Platform Molecule Gamma-Valerolactone – Ecotoxicity, Biodegradability, Solvent Properties, and Potential Applications, *Green Chemistry 23* (2021) 2962.
[2] P. Degot, V. Huber, D. Touraud, W. Kunz, Curcumin Extracts from Curcuma Longa – Improvement of Concentration, Purity, and Stability in Food-Approved and Water-Soluble Surfactant-Free Microemulsions, *Food Chemistry 339* (2021) 128140.
[3] N. Ulmann K. Häckl, D. Touraud, W. Kunz, Investigation of the salting-in/-out, hydrotropic and surface-active behavior of plant-based hormone and phenolic acid salts, *The Journal of Colloid and Interface Science 641* (2023) 631-642.
[4] J. Mehringer, J. A. Navarro, D. Touraud, S. Schneuwly, W. Kunz Phosphorylated resveratrol as a protein aggregation suppressor in-vitro and in-vivo, *RSC Chemical Biology 3* (2022) 250-260.
[5] M. Giedyk, R. Narobe, S. Weiss, D. Touraud, W. Kunz, B. König, Photocatalytic activation of alkyl chlorides by assembly-promoted single electron transfer in microheterogenous solutions, *Nature Catalysis 3* (January 2020), 40-47.
[6] J. Blahnik, S. Krickl, K. Schmid, E. Müller, J. Lupton, W. Kunz, Microemulsion and microsuspension polymerization of methyl methacrylate in surfactant-free microemulsions (SFME), *The Journal of Colloid and Interface Science 648* (2023) 755-78867.
[7] E. Hofmann, L. Schmauser, J. Neugebauer, D. Touraud, F. Gallou, W. Kunz, Sustainable cascade reaction combining transition metal-1 biocatalysis and hydrophobic substrates in surfactant-free 2 aqueous solutions, *Chemical Engineering Journal*, 472 (2023) 144599.