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Water soluble porphyrin derivatives: Physicochemical study

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Statement of the Problem: Porphyrin derivatives are group of compounds with ability to form molecular complexes with metals, charged or uncharged organic molecules, supramolecular aggregates (J-, H-aggregates) and exhibit reversible protonation. A large number of such porphyrins were used for enantiomeric detection, selective detection of anions, water trace detection in organic solvents, naked-eye discrimination of methanol from ethanol, as sensors of toxic metal ions using nanostructured cage materials, etc. But a huge drawback for those systems was that all these valuable properties were achieved only in organic solvents ($CHCl_3$, DMSO and THF). In order to come closer to biological application, novel water soluble porphyrins with PNIPAM chains were synthesized.

Methodology & Theoretical Orientation: In order to provide qualified physicochemical analysis of these systems high-resolution NMR spectroscopy, small angle X-ray scattering and differential scanning calorimetry were used.

Findings: Obtained porphyrins exhibit reversible phase separation (LCST) and their phase separation temperature (T_p) depends on sample concentration and on the length of PNIPAM. Size and form of the nanoparticles before and after the phase separation were determined.

Conclusion & Significance: Physicochemical analysis for newly synthesized porphyrin derivatives was conducted. These systems can be potentially used in heterogeneous catalysis, drug delivery or as photosensitizers in photodynamic therapy, as well as for cloud point separation of acids/anions/chiral molecules and temperature sensing.

Biography

Nadiia Velychkivska has received her BSc and MSc from Lviv Polytechnic National University in the field of chemical technology of fuel and carbon materials in 2012. In 2013, she joined the Department of NMR Spectroscopy at the Institute of Macromolecular Chemistry, Prague. As a UNESCO/IUPAC student, she worked with temperature-sensitive polymers. She had been a PhD student since 2014 and her overall scientific interest lies in the investigation of temperature-sensitive macromolecular and supra-molecular systems. She had participated in NIMS Internship program, where she investigated supra-molecular water soluble porphyrin systems.

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