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*VABILO NA PREDAVANJE  
V OKVIRU DOKTORSKEGA ŠTUDIJA  
KEMIJSKE ZNANOSTI*

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z naslovom:

**Functional polymeric nanomaterials**

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za kemijo in kemijsko tehnologijo, Večna pot 113

*Vljudno vabljeni!*

## Abstract:

Water soluble polymers, both amphiphiles and polyelectrolytes will be discussed. A central concept is the responsiveness of polymers. Responsive polymers are such they discontinuously change their solubilities, chain conformations and sizes upon continuously changing conditions. These phenomena will be illustrated through some examples. It will be seen that various stimuli may trigger the sudden change in polymers.

Of responsive polymers, those reacting to temperature are the most widely studied. Polymers dissolved in water / aqueous medium may phase separate either upon cooling or during heating. With the help of a simple phase diagram, concepts such as lower critical solution temperature, LCST, and upper critical solution temperature, UCST, will be introduced. Examples of polymeric nanosystems with either LCST or UCST type behavior will be given.

**The first example** is a group of polylactide-polyoxazoline block copolymers. In these, the other block is insoluble in water whereas the other is soluble and thermoresponsive with known LCST. When transferred from an organic solvent to water the polymers build up polymeric micelles. In certain cases, the chemically different blocks are miscible and thus, the nano objects are not sensitive to temperature.

**Secondly**, it will be shown that polycations may be turned insoluble in water with a highly hydrophobic counterion. With an optimally selected counterion the polymers show UCST in saline water. The interactions between the blocks in polycation-PEG, as well as the interactions with the counter ions are complicated and allow the modulation of thermal behaviour of the polymers.

**Finally**, nanogels based on poly(N-vinylcaprolactam) will be discussed. The nanogels have been synthesized through emulsion polymerization or via polymerization induced self-assembly (PISA). The thermoresponsive gel particles have been functionalized with gold nanoparticles and sugars.

## References:

- Poly(2-isopropyl-2-oxazoline)-b-poly(lactide) (PiPOx-b-PLA) Nanoparticles in Water: Interblock van der Waals Attraction Opposes Amphiphilic Phase Separation; Pooch, Fabian; Sliepen, Marjolein; Knudsen, Kenneth D.; Nystrom, Bo; Tenhu, Heikki; Winnik, Françoise M. *Macromolecules* (2019), 52(3), 1317-1326
- Molecular Mass Affects the Phase Separation of Aqueous PEG-Polycation Block Copolymer; Baddam, Vikram; Missonen, Reetta; Hietala, Sami; Tenhu, Heikki. *Macromolecules* (2019), 52(17), 6514-6522
- The emulsion polymerization induced self-assembly of a thermoresponsive polymer poly(N-vinylcaprolactam); Siirila, Joonas; Hakkinen, Satu; Tenhu, Heikki. *Polymer Chemistry* (2019), 10(6), 766-775