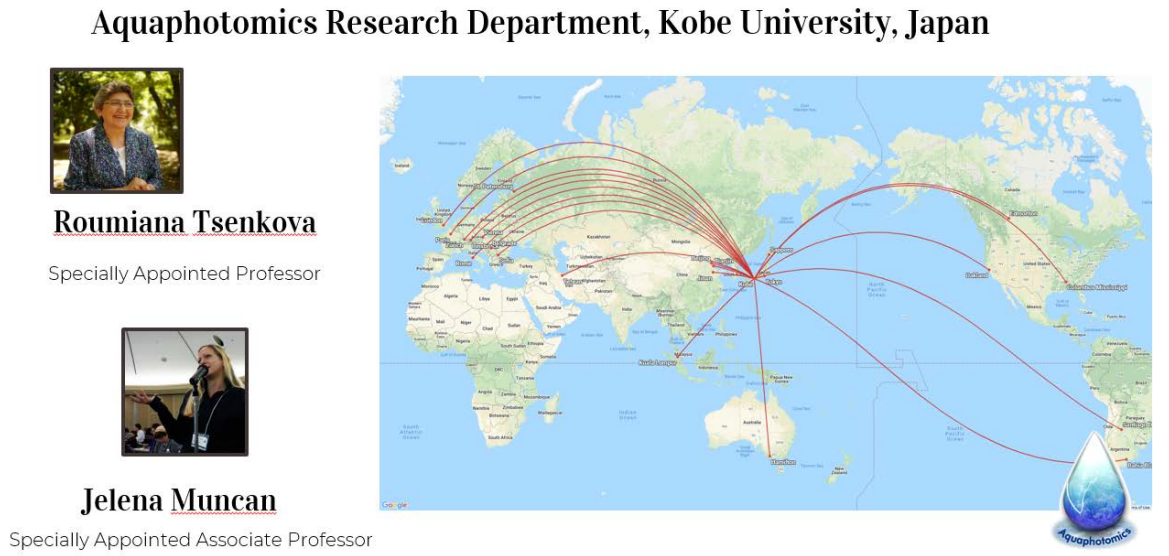
Speaker: Assoc. Prof. Jelena Muncan, Aquaphotomics Research Department, Graduate School of Agricultural Science, Kobe University, Japan

Jelena Muncan is currently working on development of aquaphotomics as a science and a technological platform for a multitude of measurement applications in various fields. She is working at the Aquaphotomics Research Department, Graduate School of Agricultural Science, Kobe University, Japan headed by the aquaphotomics founder – Prof. Roumiana Tsenkova, Dr.Eng., Dr.Agri.

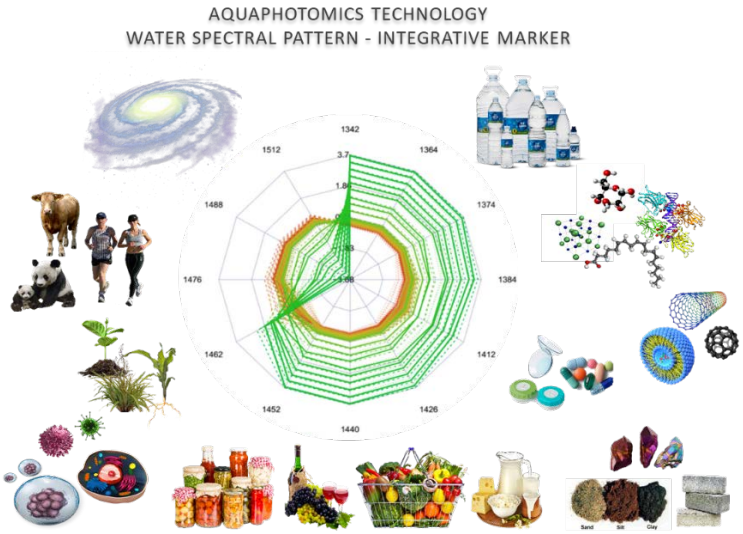
She received her Ph.D. degree in Biomedical Engineering at the Faculty of Mechanical Engineering, University of Belgrade in 2014, where she also started her research and teaching career (2008), later being promoted to an assistant (2014) and an assistant professor (2017). She spent two years as a postdoctoral research fellow of Japanese Society for Promotion of Science, in Biomeasurement Technology Laboratory, Kobe University until 2019, when she decided aquaphotomics is to become her main field of work. Upon establishment of the first in the world Aquaphotomics Research Department, she was employed as a specially appointed assistant professor, and in 2022 she was promoted to a specially appointed associate professor.

Her research is directed at reaching better understanding of structure of water in aqueous and biological systems and their resulting properties and functionality, thus providing a common platform for development of novel non-destructive, non-invasive measurement and monitoring technologies, advancing towards the development of bio-photomodulation strategies. She is actively contributing to the development of aquaphotomics as a science, which has spread over the years to now more than 15 laboratories in the world.



Presentation topic: Aquaphotomics as an Innovative Science and Technological Platform

As a new science, aquaphotomics defined its goal as a “Complete understanding of life”. To do this, aquaphotomics utilizes the light of all energies in the electromagnetic spectrum, and studies aqueous and biological systems as a whole, un-separated from their environment, not reduced to their components. This possibility exists because of the interaction of light and water – a network of intra- and inter-connected water molecules. The hydrogen bonds in this network, being extremely sensitive, enable water matrix to act as a sensor that detects changes within the system as they are inflicted by internal or external events. The measurable signal is produced in the interaction with light and read-out in the form of spectra. When the used light is in the near infrared spectral range, this sensor becomes non-invasive, non-destructive tool for observation and monitoring of the whole systems. While this does not sound particularly novel, the difference to traditional way of near infrared measurements is radical with the profound implications.



While traditionally, the events of importance for functionality of biological systems relied on measurements of single, weak biomarkers, such as proteins, sugars or other biomolecules, aquaphotomics measures the absorbance of different water molecular species which together comprise water spectral pattern – a strong, integrative marker because it is a result of synergy of all biomolecular changes underlying specific functionality of the system (i.e. disease, ovulation, infection, temperature stress, etc.). Different phenomena can be described and connected to respective absorbance patterns depicting different water species, absorbing at different frequencies. This way a new biomeasurement principle is established and used for description and biomonitoring of the living systems, in an easy, rapid, real-time and non-destructive manner. The examples of applications are numerous and growing, the application fields ranging from lowest level of biological organization such as biomolecules, cells, microorganisms, to tissues and fluids of plants, animals, humans. The number of scientific publications rises each year exponentially and new fields of applications are constantly being discovered.