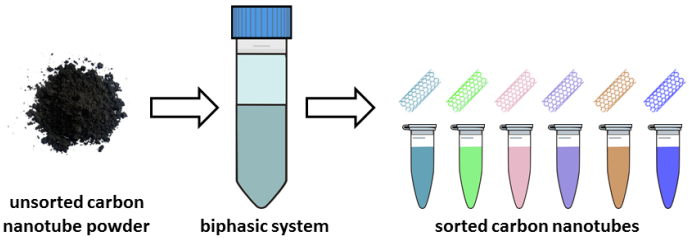
Synthesis of new biphasic systems for isolation of monochiral carbon nanotubes

It was 1896 when a Dutch scientist called Martinus Beijerinck mixed agar and starch in water and the results astounded him. In front of his eyes, there was a test tube with two chemical compounds (well soluble in water), which somehow formed two separate phases in a similar way as oil "floats" on water. Further research revealed that this scientific curiosity has very practical implications. Based on this concept, scientists from all over the world have developed various biphasic systems for purification of enzymes, antibodies and other biomolecules. Recently, to our surprise, it has become evident that this method can also be useful for gaining control over the structure of nanomaterials.



Carbon nanotubes (hollow cylindrical structures with diameters 10 000x smaller than a human hair) have shown very promising electrical, mechanical and optical properties. Unfortunately, they are synthesized as a black powder, which contains tens of types of them. Because of their very small size, separation of individual types has been found very challenging. The proposed project is focused on the development of methods able to eliminate this problem. For this purpose, we will design and synthesize polysaccharides and ionic liquids, which we will then use for construction of new tailored biphasic systems. Thanks to them, we will be able to isolate carbon nanotubes with unparalleled precision.

Moreover, as shown above, carbon nanotube dispersions are very colorful. Besides the obvious aesthetic values, the vivid colors demonstrate their rich optical properties. It is envisioned that appropriate level of control of carbon nanotube structure should open the route toward their implementation in a spectrum of photonic applications such as high-resolution imaging (*ex vivo* and *in vivo*), safe information processing or sensitive detection systems. Most of the technologies, which surround us nowadays, are based on the transport of electrons, which approach their limitations. It is expected that photonic technologies will succeed them on many fronts. Fundamental research planned in this project will not only have high scientific value, but it will also accelerate the development on this front for the benefit of the society. What is important, knowledge and know-how generated throughout the life of this project will extend beyond the realm of nanocarbon and make an impact on a number of important processes, which involve purification (e.g. drug development).