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Nanoplastics – protein interaction: A scattering study of transition from soft and hard corona

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There is growing concern about plastic waste in the environment, and its impact on biological organisms. While bulk plastics are thought to be non-toxic, when the plastics break down to a sub-micron length scale (i.e. nanoplastics), they obtain extra mobility inside living things, and may cause various adverse effects [1,2]. This, coupled with a lack of knowledge surrounding the dangers from different types of plastics, prevents well-designed responses to the problem. Hypothetically, the potential adverse effects are caused by protein denaturation, oxidative stress and/or cellular membrane damage. However, the inherent complexity of biological systems makes it challenging to gain a mechanistic understanding. Adding complexity to this problem, the potential adverse effects are highly dependent on the nature of nanoparticles (NPs) – the contributing factors could include elemental composition, chemistry of the plastic surface, and/or size of the plastic particle [3,2,4].

When in biological systems, nanoplastics are surrounded by various types of proteins5. The structure of proteins surrounding nanoplastics are important parameters to understand the interaction of nanoplastic/protein composite. We carried out light scattering and small angle neutron scattering (SANS) experiments to explore the structure of the protein corona on monodisperse polystyrene spheres using a model protein human serum albumin (HSA). The geometry of the PS/HSA complex was investigated with a contrast matching method. The transition from a “soft” to a “hard” interaction between the nanoparticle and the protein was observed when pH is lowered from 7.4, and the implications of this on nanoplastic toxicity is discussed.

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Topic

Soft Matter

Primary author(s) : Mr KIHARA, Shinji (School of Chemical Sciences, The University of Auckland, Auckland 1010, New Zealand); Dr KOEPER, Ingo (Flinders University); Dr SEAL, Chris (School of Chemical Sciences, The University of Auckland, Auckland 1010, New Zealand); Mr MCGILLIVRAY, Duncan (School of Chemical Sciences, The University of Auckland, Auckland 1010, New Zealand); MATA, Jitendra (ANSTO)

Presenter(s) : Mr KIHARA, Shinji (School of Chemical Sciences, The University of Auckland, Auckland 1010, New Zealand)

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