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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.

References

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Topic

Soft Matter

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