|  |
| --- |
| **The effect of surface properties of nanoparticles on their uptake by hepatic macrophage cells and hepatocytes.** |
| Ilay Sema Unal, Marie-Christine Jones |
| School of Pharmacy, Institute of Clinical Sciences, College of Medical and Dental Sciences, University of Birmingham, Birmingham, United Kingdom |
| **Background:** The surface properties of nanoparticles can significantly impact their uptake by mononuclear phagocytes and thus, their biodistribution. Kupffer cells (KC), the resident hepatic macrophages have been observed to capture nanoparticles with positive charge and/or hydrophobic surface. In this project, we investigated the surface hydrophobicity of albumin and polystyrene nanoparticles to assess its impact on their uptake by macrophages and hepatocytes. |
| **Methods:** Bovine serum albumin (BSA) NPs were prepared using a modified desolvation method. Commercial 200 nm Polystyrene (PS) NPs were used as control hydrophobic nanoparticles. The size, polydispersity index (PdI), and surface charge of the NPs were measured using dynamic light scattering (DLS). The hydrophobic interaction chromatography (HIC) index was calculated to assess the hydrophobicity of the NPs.LD50 of the NPs was determined in vitro using cell counting kit (WST-8 solution). Uptake of the nanoparticles was studied by flow cytometry in human liver hepatocellular carcinoma cells (HEP-G2) and macrophage-differentiated human leukaemia cells (dTHP-1).  |
| **Results:** BSA NPs had sizes between 150- 200 nm and PdI <0.10 while PS NPs have a mean hydrodynamic diameter and PdI of 223.967±2.816 nm and 0.024±0.005, respectively. Both NPs were anionic with zeta potentials ca. -23±6 and -41±2 mV for BSA NPs and PS NPs, respectively. HIC index showed that BSA NPs (0.160+0.022) were significantly less hydrophobic than PS NPs (0.436+0.036) (N=3, P<0.01, Unpaired t test).The LD50 of BSA NPs and PS NPs were ca. 6 mg/ml, and 2 mg/mL respectively when tested on HEP-G2 cells. BSA NPs were not toxic to dTHP-1 macrophages over the range of concentrations tested (0-8 mg/mL). In contrast, PS NPs had a LD50 ca. 8 mg/mL in these cells.PS NPs were taken-up ̴1.35 times more than BSA NPs by HEP-G2 cells, and ̴ 3.15 times more by dTHP-1 cells. Also, dTHP-1 cells captured more NPs than HEP-G2 cells: nearly 2.15 times more of BSA NPs, and 4.8 times more of PS NPs (N=3, P<0.05, Two-way ANOVA, with Tukey post-test). |
| **Conclusions:** Surface hydrophobicity of the nanoparticles seems to affect the cellular uptake as expected which the impact being stronger in dTHP-1 compared to HEP-G2 cells. |