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Nanoparticle-neural stem cells for targeted ovarian cancer chemotherapy

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One of the drugs used to treat ovarian cancer is cisplatin. However, cisplatin kills normal surrounding tissue in addition to cancer cells. To improve tumor targeting efficiency, our lab uses neural stem cells (NSCs), which migrate to ovarian tumors. To prevent the drug cisplatin from killing both the NSCs, we synthesize silica nanoparticles (SiNPs). The SiNPs encapsulate cisplatin, and then the SiNPs are loaded into NSCs. The big picture here is to maximize efficiency of tumor targeting using NSCs and minimize toxicity to these NSCs using SiNPs. When tested *in vivo*, the SiNPs leaked cisplatin before reaching the tumor. The goal of this project is to optimize the stability of SiNPs without cisplatin for efficient drug loading. To do this, the concentration of tetraethyl orthosilicate (TEOS), one of the main components of SiNPs, was varied. We hypothesized that the more TEOS added, the more stable the particles will be. The reasoning is that more TEOS means more silicon in the chemical structure of SiNPs, and thus a tightly-packed SiNPs results in a stable particle. Six batches of SiNPs were synthesized: 200, 400, 800, 1000, 1400 and 1800 µL TEOS. In order for the particles to effectively carry the drug without leakage, they must be stable in both cell media and PBS. Lastly, the SiNPs were characterized using the transmission electron microscope (TEM). Our results align with our hypothesis: the more TEOS added the more stable the SiNPs. In the TEM images, white spots were observed in the SiNPs for the 200-800 µL TEOS batches. The white spots were pores. However, the 1000-1800 µL TEOS batches had no pores. This means that those SiNPs are stable in both cell media and PBS. Thus, we concluded that the ultimate factor that determines the stability of our microemulsion-synthesized SiNPs (100 nm) in PBS and cell media is the concentration of TEOS.

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