**Hybrid-nanoparticles for controlled drug delivery and release to improve drug efficacy in Pancreatic Cancer.**

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**Background:**

Stimuli-responsive drug delivery systems are becoming of increasing interest. These can be particularly useful in diseases such as cancers. Pancreatic cancer is notoriously difficult to diagnose and treat, with poor patient prognosis and survival rates, it is often labelled incurable. First-line chemotherapy has very little effect, and faces challenges such as harsh side effects and chemo-resistance.

Hybrid iron-oxide-nanoparticle (HNP) formulations offer a promising platform for controlled delivery and triggered release of chemotherapeutics. With our system additionally designed to combat resistance caused by the tumour environment; we aim to exploit the multifunctional properties of this formulation to increase drug efficacy and improve therapeutic outcomes.

**Methods:**

Silver coated HNPs were synthesised by established methods of co-precipitation and chemical reduction then characterised using zeta potential measurements, TEM, ICP-OES and SQUID analysis. The HNPs were suspended in agar (to mimic tissue) and irradiated with a 1040 nm femtosecond laser to evaluate the particles ability to act as “nano-heaters”. Anti-cancer drugs were attached to the HNP surface and quantified using spectroscopic methods. Antimicrobial activity was assessed by exposing bacterial cell cultures to the silver HNPs. Pancreatic cancer cell lines were also used to evaluate the biocompatibility of the formulation evaluated using Trypan Blue Exclusion assay.

**Results:**

Characterisation showed successful synthesis of spherical, 50-100 nm, magnetic, hybrid-nanoparticles. Laser irradiation of the particles achieved a 40°C temperature increase over 60 s for 5 ug/mL HNP in agar, confirming their potential for use in thermally triggered release. Drug and polymer have been successfully attached to HNP surface. The particles exhibited antimicrobial activity, whilst showing minimal cytotoxicity in pancreatic cancer cells.

**Conclusions:** The data so far shows that silver-iron oxide hybrid nanoparticles have the potential to act as drug carriers and release upon thermal activation. Further *in vitro* work is ongoing, primarily investigating cellular response and cell trafficking.