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# Thermoresponsive Magnetic Hydrogels for Targeted Doxorubicin Delivery and Magnetic Hyperthermia in Cancer Therapy

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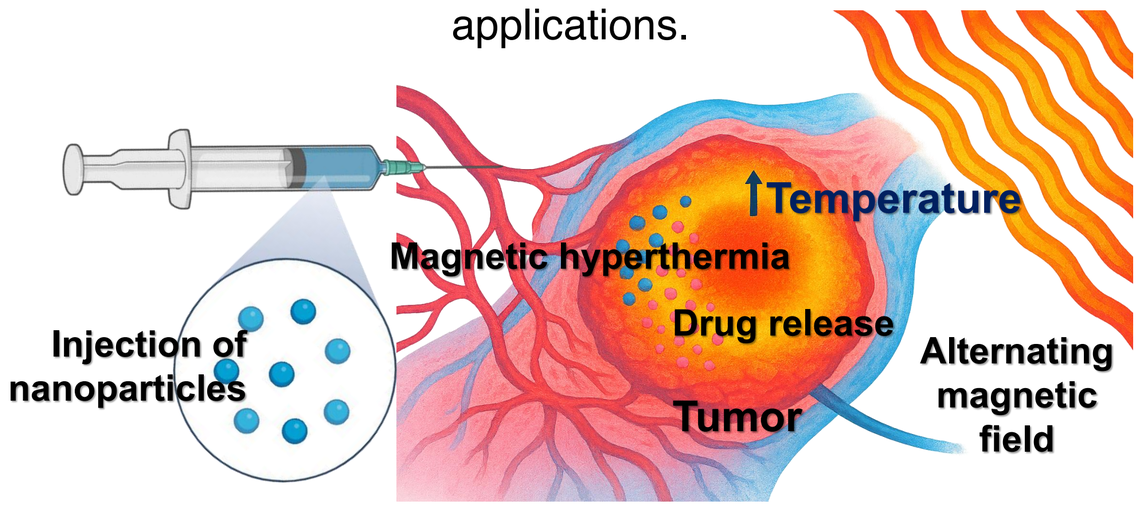
## INTRODUCTION & AIM

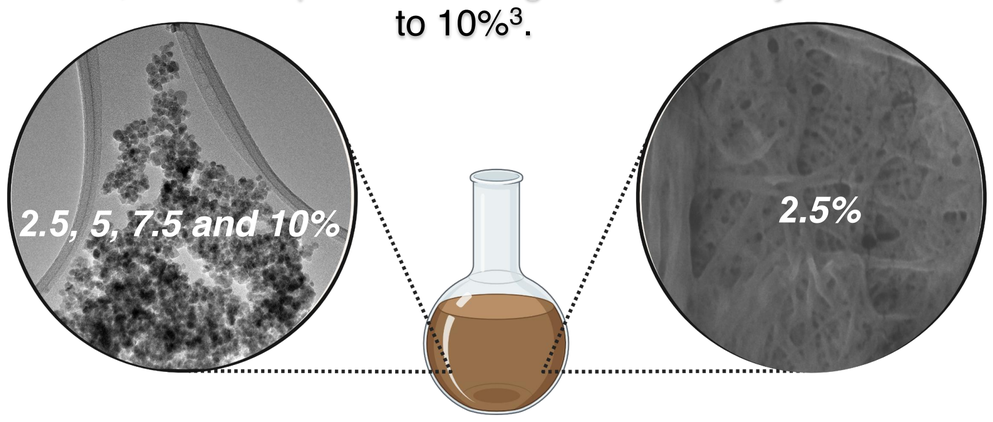
The development of multifunctional nanomaterials capable of simultaneously delivering drugs and inducing localized hyperthermia represents a promising strategy in advanced cancer therapies[1,2]. Here, thermoresponsive magnetic hydrogels *(GMag)* based on PNIPAM and PEG-coated $Fe_3O_4$ nanoparticles, reinforced with TEMPO-oxidized cellulose nanofibers were developed[3]. These nanoplatforms allow synergistic drug delivery and magnetic hyperthermia applications.




## METHOD

• $Fe_3O_4$ nanoparticles were previously synthesized via reverse co-precipitation[4] with simultaneous surface functionalization achieved through in-situ PEG-8000 coating (Fig. 1).

• Hybrid PNIPAM hydrogels reinforced with 2.5% TEMPO-oxidized cellulose nanofibers were synthesized through free radical polymerization, with nanoparticle loadings sistematically varied from 2.5 to 10%[3].




*NIPAM, 7.5% N-N'-MBA, APS, $H_2O$*
*60°C, stirring, 4h*

• Structural characterization: XRD, FTIR, TGA, SEM, DSC.
• Functional evaluation: Drug loading, release kinetics, magnetic heating under AMF, and cytotoxicity (MTT assay).

## CONCLUSION

*GMag* hydrogels synthesized integrate thermoresponsive drug release and magnetic hyperthermia for cancer therapy. They are stable, biocompatible, and capable of localized, on-demand DOX delivery, representing a promising dual-action nanoplatform for advanced cancer treatment.

## FUTURE WORK / REFERENCES

*Incorporate a pH-responsive comonomer[6,7].*
*Prepare GMags via RAFT polymerization[4].*

## RESULTS & DISCUSSION

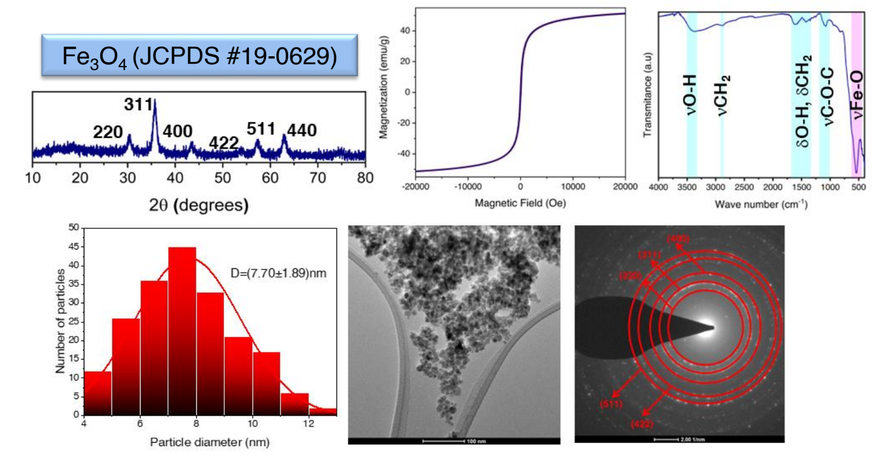



***Fig. 2*** *Structural, Morphological, and Chemical Characterization of $Fe_3O_4$-PEG8000.*

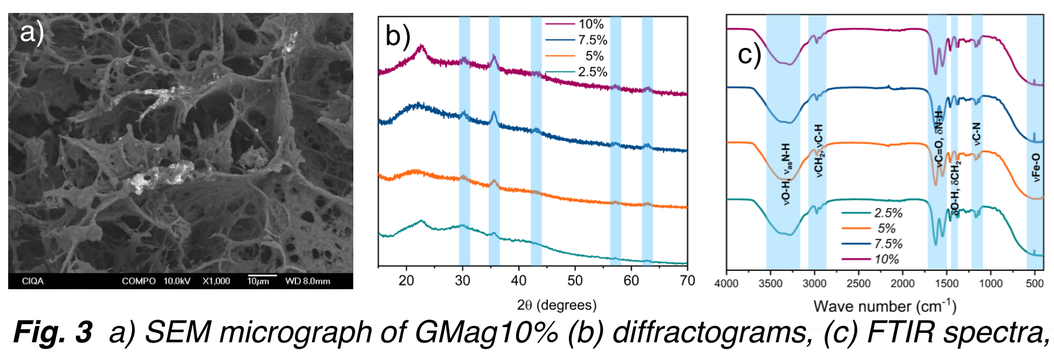
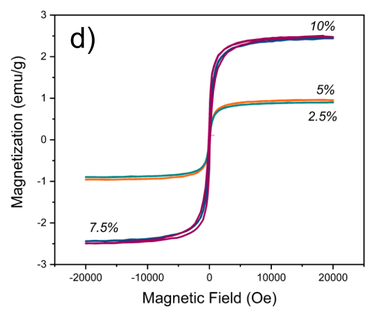


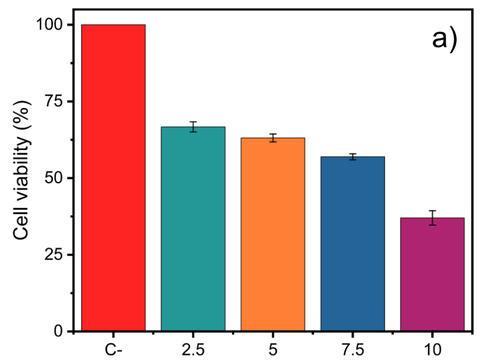

***Fig. 3*** *a) SEM micrograph of GMag10% (b) diffractograms, (c) FTIR spectra, (d) VSM curves and (e) LCSTs of GMags.*




| e) | LCST (°C) UV-Vis | LCST (°C) DSC |
|---|---|---|
| 2.5% | 35 | 35 |
| 5% | 35 | 35 |
| 7.5% | 36 | 36 |
| 10% | 36 | 36 |

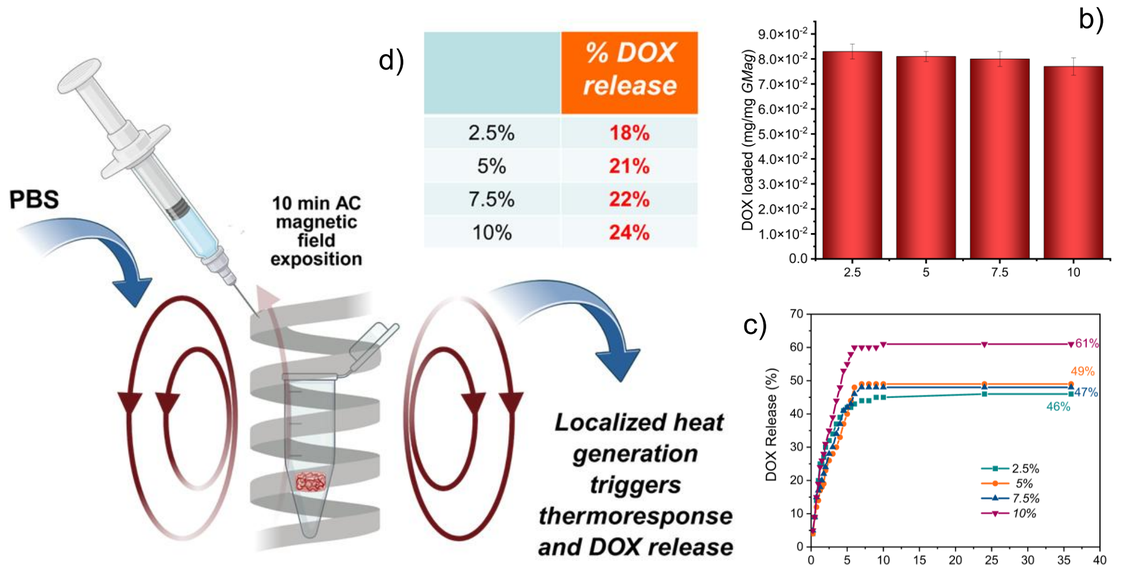
• Superparamagnetic behaviour confirmed[5]

• *GMags* exhibited LCST around 36 °C




•*GMags* are an effective DOX delivery platform[6].
• High DOX loading efficiency (up to $8.3\times10^{-2}$ mg DOX/mg *GMag*).
•Sustained DOX release at 37°C.

***Fig. 4*** *a) MTT assays of DOX-loaded GMag (b) DOX loading; DOX release (c) under AMF, (d) in vitro of GMags.*




| | % DOX release |
|---|---|
| 2.5% | 18% |
| 5% | 21% |
| 7.5% | 22% |
| 10% | 24% |

•AC magnetic field triggered an 18% burst release[7,8].
• Heating response reached ~42.8 °C under AMF[9].

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