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Advanced Multifunctional Guar Gum Hydrogel IPN: Tailored Porosity and Enhanced Gastroretentive Drug Delivery Performance

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INTRODUCTION & AIM

Gastroretentive drug delivery systems (GRDDS) have emerged as a promising strategy to enhance the pharmacokinetic profile and therapeutic performance of orally administered drugs such as amoxicillin (AMOX).

In the present work, innovative GRDDS were formulated through the synthesis of **super-porous guar gum-based interpenetrating polymer networks (GG-based IPN)** [1].

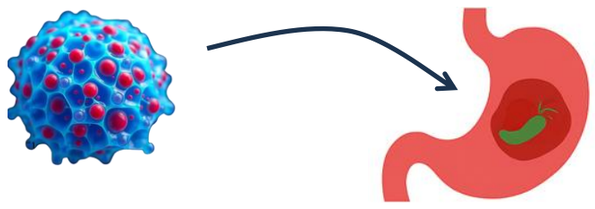


Figure 1. GRDDS with AMOX for Helicobacter pylori treatment.

METHOD

IPN were developed via simultaneous **Diels–Alder (DA)** crosslinking utilizing **di- and tri-functional furfuryl monomers and a dimaleimide monomer** [2], within a **GG solution**. This **one-pot procedure** incorporated **porogenic agents** and **AMOX** (Figure 2).

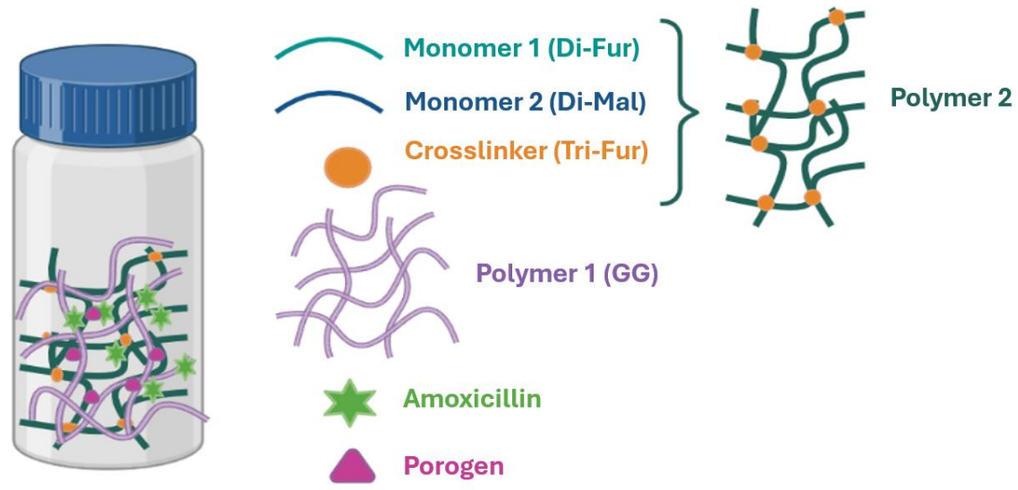
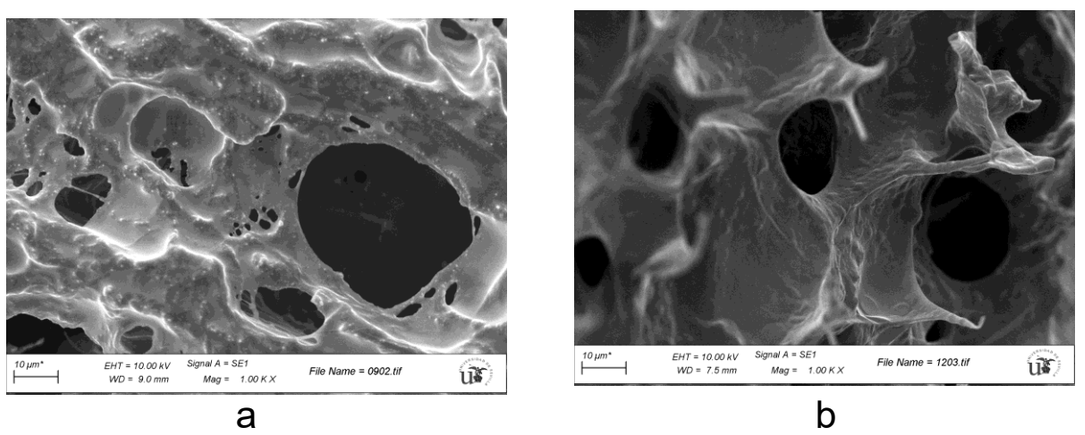


Figure 2. Preparation of GG-based IPN

RESULTS & DISCUSSION

The incorporation of **porogens** was effective in generating **porous structures** (Figure 3), increasing the **swelling index** and enhancing both the **storage modulus and the complex viscosity** of the hydrogels. The resulting hydrogels exhibited **mucoadhesive and floating properties**, making them suitable for prolonged gastric retention. **PEG-based IPN** offered improved **AMOX delivery performance** (Figure 4).



a b

Figure 3. SEM images: a. IPN with 50% PEG; b: IPN with 50% sucrose.

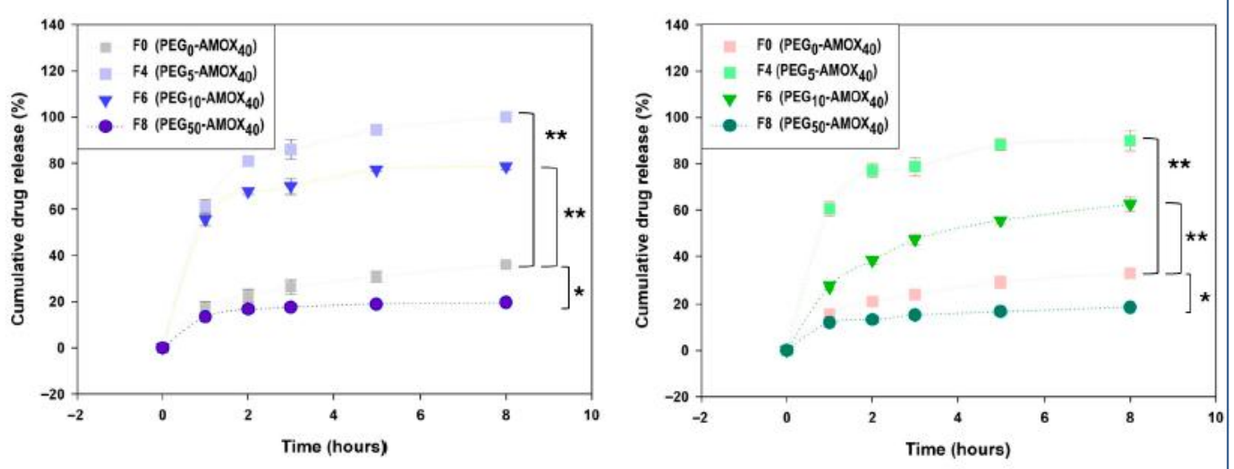


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Figure 4. Kinetic comparison of AMOX release from IPN hydrogels with PEG and 40% AMOX: effect of PEG content and pH (a: pH 1.2; b: pH 5.0).

CONCLUSION / FUTURE WORK

In contrast to non-crosslinked control samples, all IPN achieved **uniform and mechanically resilient hydrogels**. Rheological and swelling studies demonstrated that both the nature and concentration of the **porogenic agents** significantly **influenced the structural and functional properties of the hydrogels.**

These results underscore the promise of **one-pot IPN biocompatible preparation**, coupled **with porogen** modulation, as a viable strategy for the development of **GRDDS enabling sustained drug release**.

REFERENCES

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2. Galbis, E.; de Paz, M. V; McGuinness, K.L.; Angulo, M.; Valencia, C.; Galbis, J.A. *Polym Chem* **2014**, *5*, 5391–5402, doi:10.1039/C4PY00580E.

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