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Formulation and *in vitro* evaluation of thermosensitive hydrogel as a intravaginal drug delivery system

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Introduction

Cervical cancer remains a leading cause of mortality among women worldwide (1). To enhance therapeutic outcomes and minimize adverse effects, localized drug-delivery systems are being explored, including thermosensitive hydrogels for vaginal administration (2,3). The present study aims to develop a thermosensitive hydrogel and assess its physicochemical properties, as well as the cytotoxic effects of ibuprofen and cisplatin, both individually and in combination, on HeLa cells.

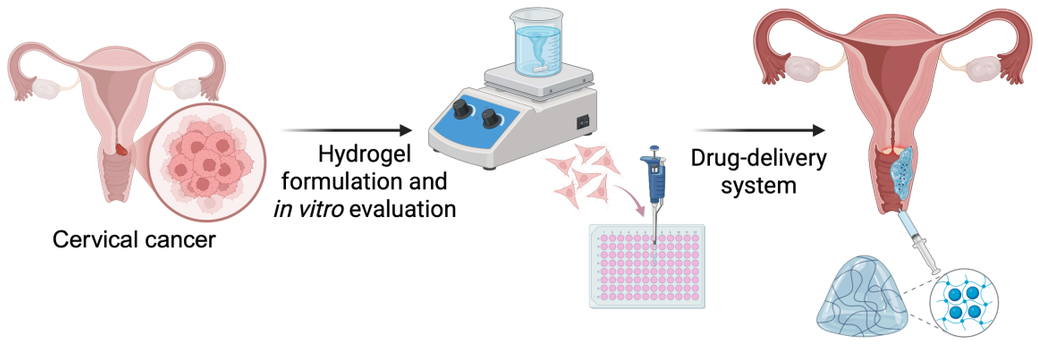

Fig. 1. Schematic representation of thermosensitive hydrogel delivery and combined ibuprofen–cisplatin effects on HeLa cells.

Results and discussion

A thermosensitive hydrogel was successfully formulated using a three-component mixture design and characterized by increased viscosity at 37 °C and a swelling profile with rapid initial absorption (Fig. 2, Table 1). MTT cytotoxicity assays showed that the combined treatment with ibuprofen and cisplatin reduced HeLa cell viability more than either drug alone (Fig. 3). These findings support the feasibility of the system for localized therapy, although *in vivo* studies are required to confirm biocompatibility, sustained release, and antitumor efficacy.

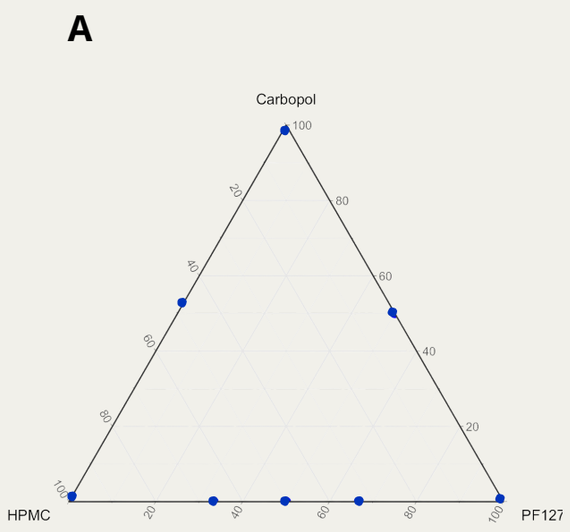

Fig. 2. A. Design of formulations based on Poloxamer 407 (PF127), Hydroxypropyl Methylcellulose (HPMC), and Carbopol 940. B. Swelling index determined by the gravimetric method.

Methodology

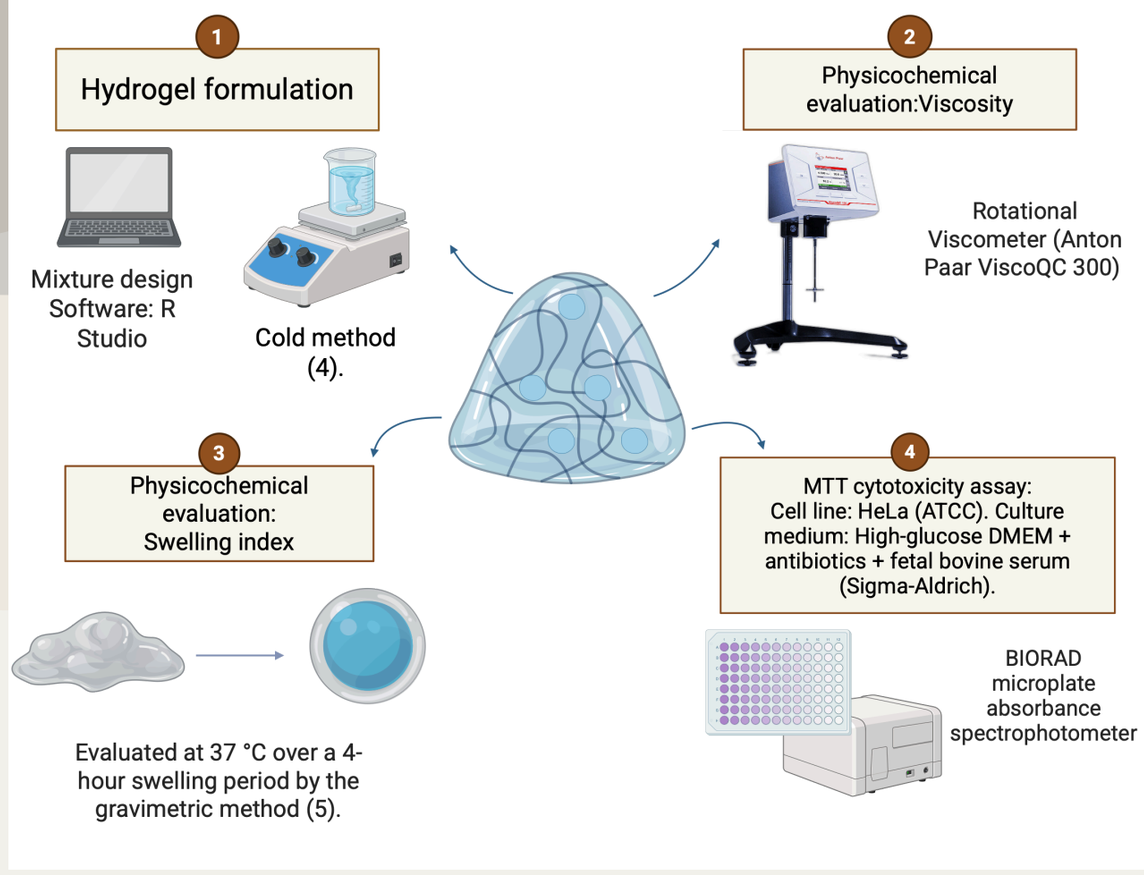

Table 1. Dynamic viscosity of hydrogel formulations (mean ± SD, n = 5). One-way ANOVA followed by Tukey's test ($p < 0.05$)

F	Viscosity (mPa.s)	Method	Temperature	Sterilization
F1	80,950 ± 22,783[b]	Extrusion	25°C	No
F1	2,622,000 ± 176,136[a]	Rest	37°C	No
F1+IBU	2,398,600 ± 146,548[a]	Rest	37°C	No
F1+IBU	2,554,000± 247,854[a]	Rest	37°C	Yes

[a,b] *Different superscript letters indicate statistically significant differences.*

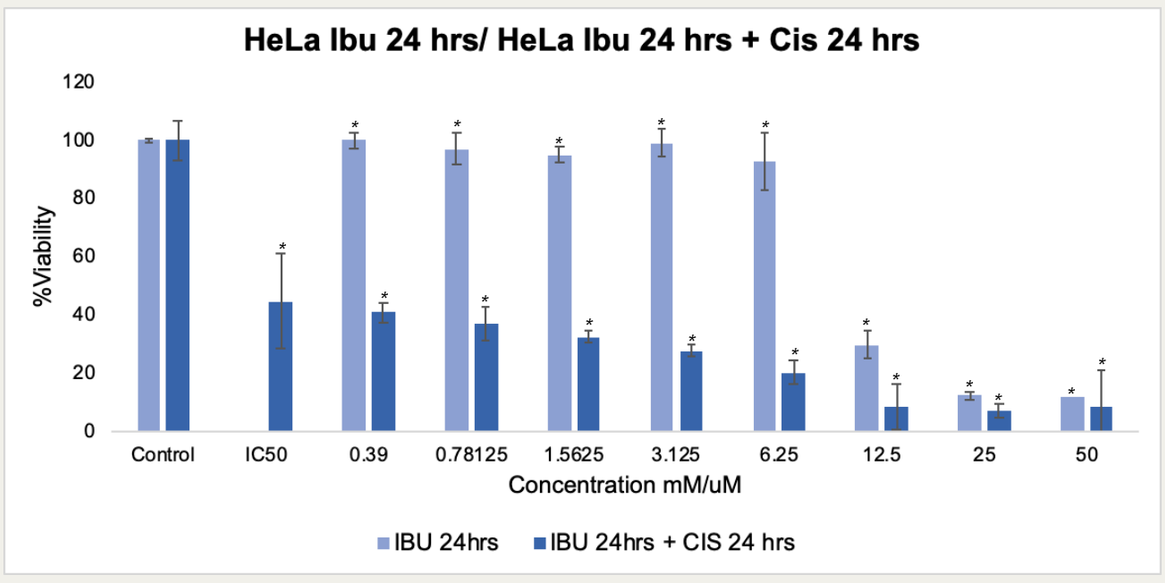

Fig. 3. MTT assay in HeLa cells. Cell viability after treatment with ibuprofen (24 h) vs. ibuprofen 24 h + cisplatin 24 h. *All treatment × concentration groups were significantly different from each other according to Tukey's post hoc test ($p < 0.05$)

Conclusion

A sterile, thermosensitive hydrogel formulation was successfully obtained and characterized in terms of swelling index and viscosity. The combination of ibuprofen and cisplatin reduced cell viability more effectively than either compound alone, suggesting an additive effect, although further studies are required to confirm this.

References

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