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# CALCIUM ALGINATE-NANOGRAPHENE OXIDE HYBRID HYDROGEL FOR IMPROVED BIOMEDICAL APPLICATIONS

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## INTRODUCTION

In recent years, due to its high surface-volume ratio and the presence of both hydrophilic and hydrophobic portions in its structure, graphene oxide sparkled considerable interest for its biomedical applications [1].

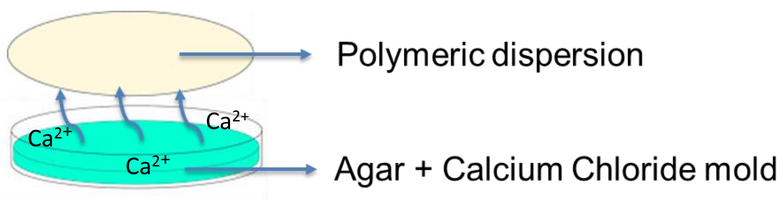
Alginate has been widely used in biomedicine, mostly due to its biocompatibility [2]. Here, the capacity of alginate to form physical hydrogels in the presence of divalent ions (e.g. calcium ions), through ionotropic gelation [3], has been exploited to achieve a flexible and mechanically stable hydrogel film. Such system has been loaded (before and after gelation) with Curcumin, as natural bioactive compound, in order to evaluate its ability to synergize the biological activity of the loaded therapeutic.

## SYNTHESIS APPROACH

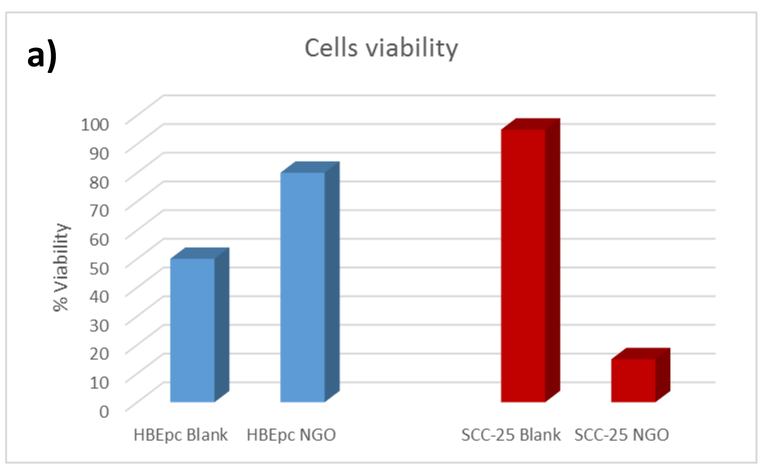
**Graphene oxide nanosheets** (**NGO**), without any previous modification, has been blended into sodium **alginate solution** (**SA**) with a straightforward approach, resulting in a homogeneous dispersion;

Polymeric dispersion has been crosslinked through slow diffusion of calcium ions from an agar matrix;

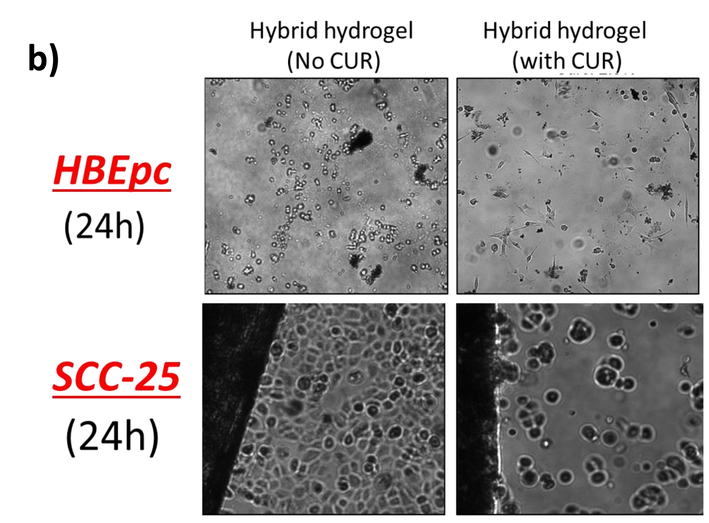
Such system has been loaded (before and after crosslinking) with curcumin (CUR), as natural bioactive compound.




## BIOLOGICAL TESTS



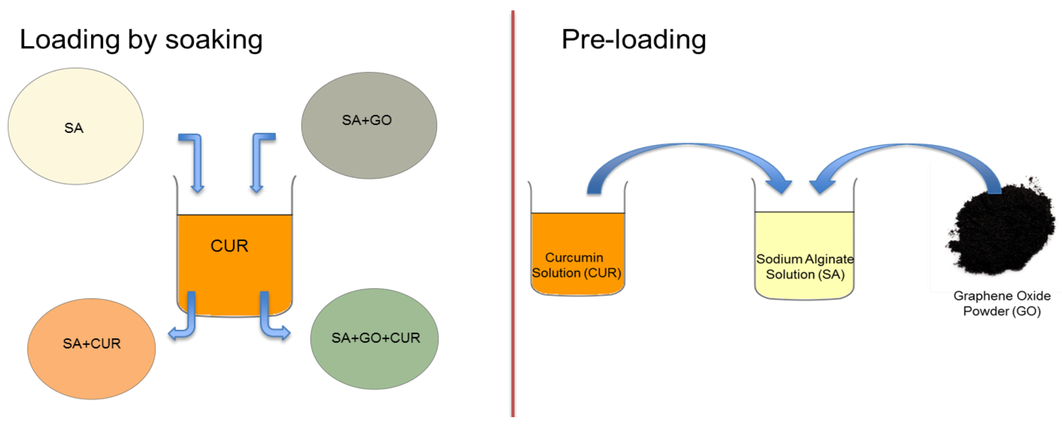

*In vitro* analysis on cell cultures have been performed: in the first 24 hours, blank hydrogel reduced healthy Primary Human Bronchial Epithelial Cells (*HBEpC*) viability by 45%, while it resulted almost non-toxic towards Squamous Cell Carcinoma (SCC-25); instead, hybrid hydrogel resulted to be less toxic towards *HBEpC* and extremely effective in reducing *SCC* viability (80%).



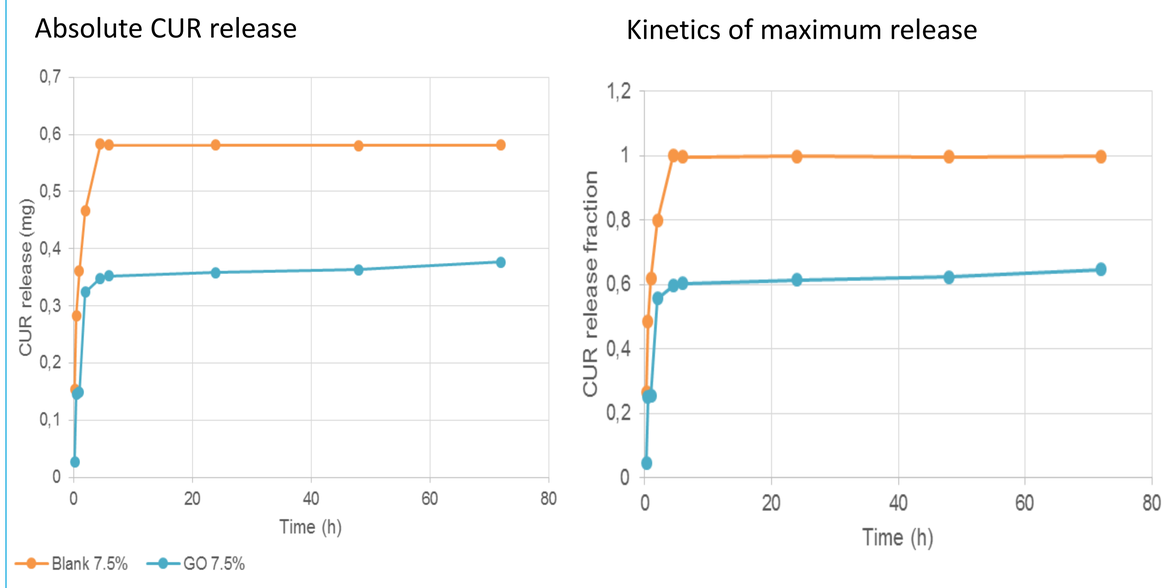

## LOADING PROCEDURE

Curcumin has been loaded into the hybrid hydrogel with two different methods:

- Loading by soaking: dried hybrid hydrogel film has been soaked into CUR solution;
- Pre-loading: CUR solution has been mixed directly into the SA+NGO polymeric dispersion.




## RELEASE TESTS




The presence of NGO inside the hydrogel film resulted in a controlled release of CUR over time. Burst release of bioactive compound has been achieved with blank hydrogel (0.6 mg in 6 hours), while hybrid hydrogel released 60% of the available CUR in the same amount of time.

## CONCLUSION

Preliminary *in vitro* analyses showed promising results: compared to blank hydrogel synthesized in the absence of NGO, hybrid hydrogel was found to show selective toxicity towards Squamous Cell Carcinoma (*SCC*), with reduced toxicity towards healthy Primary Human Bronchial Epithelial Cells (*HBEpC*). This effect was ascribed to the ability of synthesized hybrid material to control the curcumin release over time: after 6 h, release amount (%) of 60 and 100 were reached for hybrid and blank hydrogel, respectively.

## CONTACT PERSON

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## REFERENCES

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