

## Periodic precipitations for the controlled releases of drugs

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### Introduction

The term drug delivery refers to therapeutic systems designed to release the active ingredient in the quantities and at the times necessary to optimize its therapeutic action, increasing the drug's efficacy and decreasing side and toxic effects. The main objective of the project was to apply rhythmic precipitation to the design of a pulsating drug delivery system (single or nanoparticle encapsulated).



### Experimental procedure

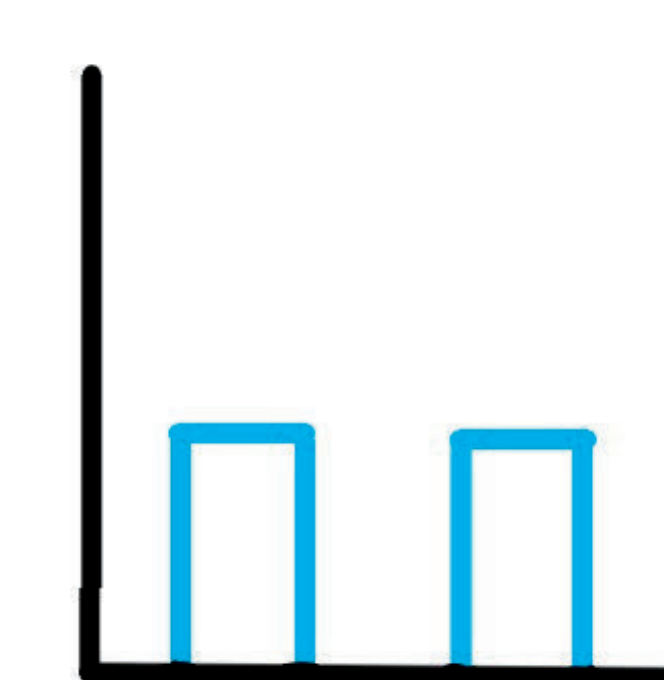
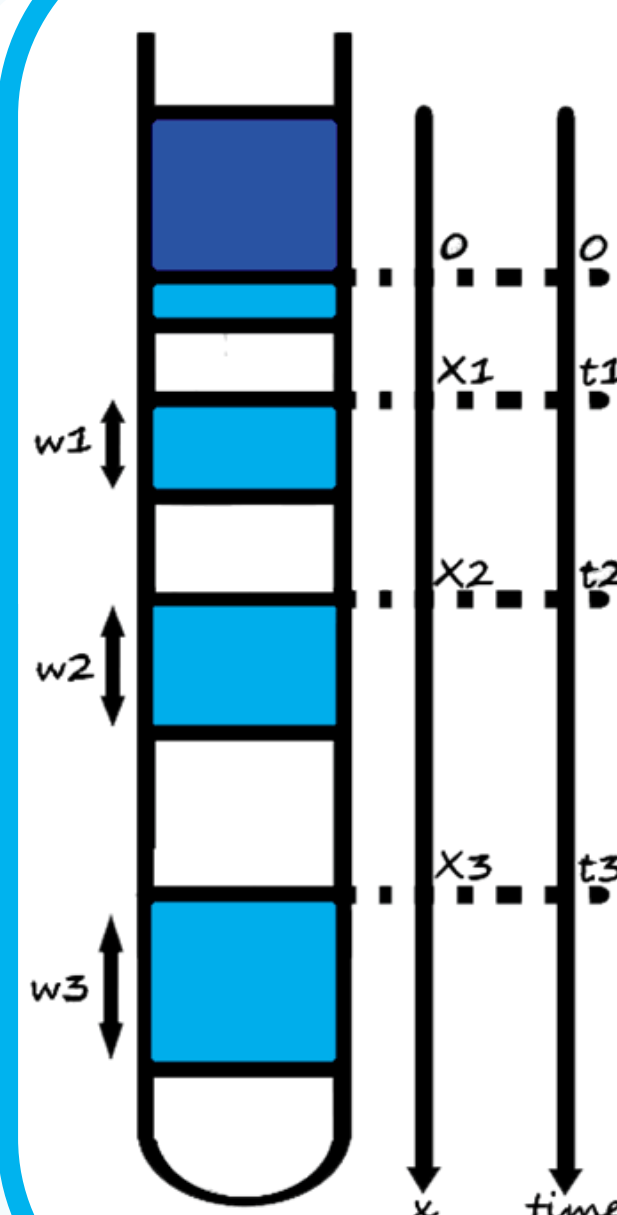
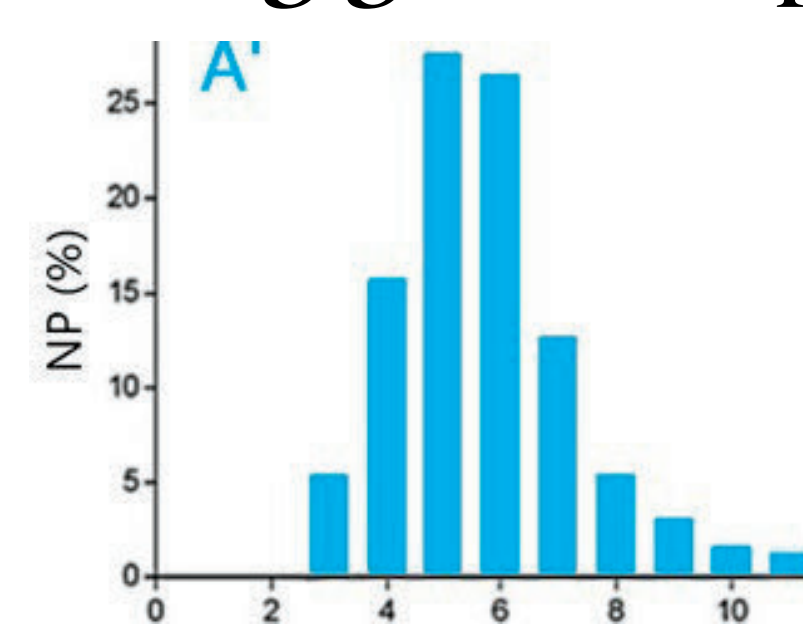
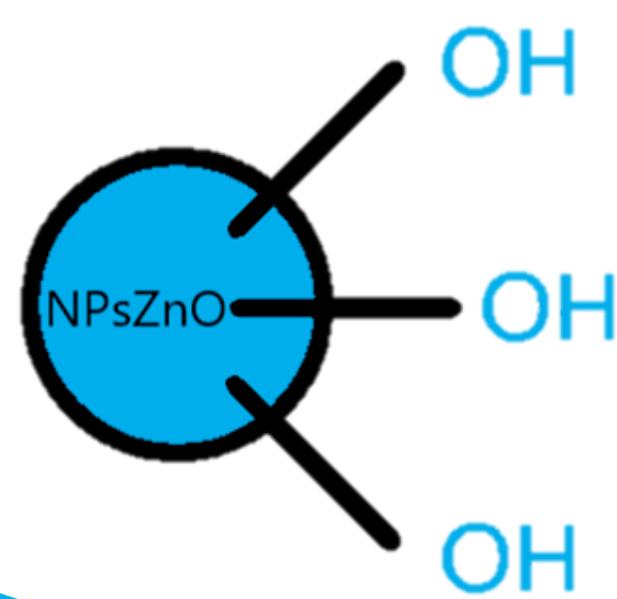
#### First step:

The periodic precipitation was carried out with the calcium hydrogen phosphate system ( $\text{CaHPO}_4$ ) in agar gels with concentrations from 1% to 8%.  $\text{CaCl}_2$  was used as external electrolyte  $\text{Na}_2\text{HPO}_4$  it was used as an internal electrolyte.



#### Second step:

Drug delivery (NPs-ZnO-Ibuprofen) nanoparticles with a size of 5-60 nm. Starting from a 0.3 M solution of zinc acetate dihydrate, ZnO nanoparticles were synthesized (either by the coprecipitation method using APTS or by a green method using green tea polyphenols)



Concentrations:  
5% w gelatine  
 $\text{Ca}^{2+}$  0,05M.  
 $\text{HPO}_4^{2-}$  0,5M.

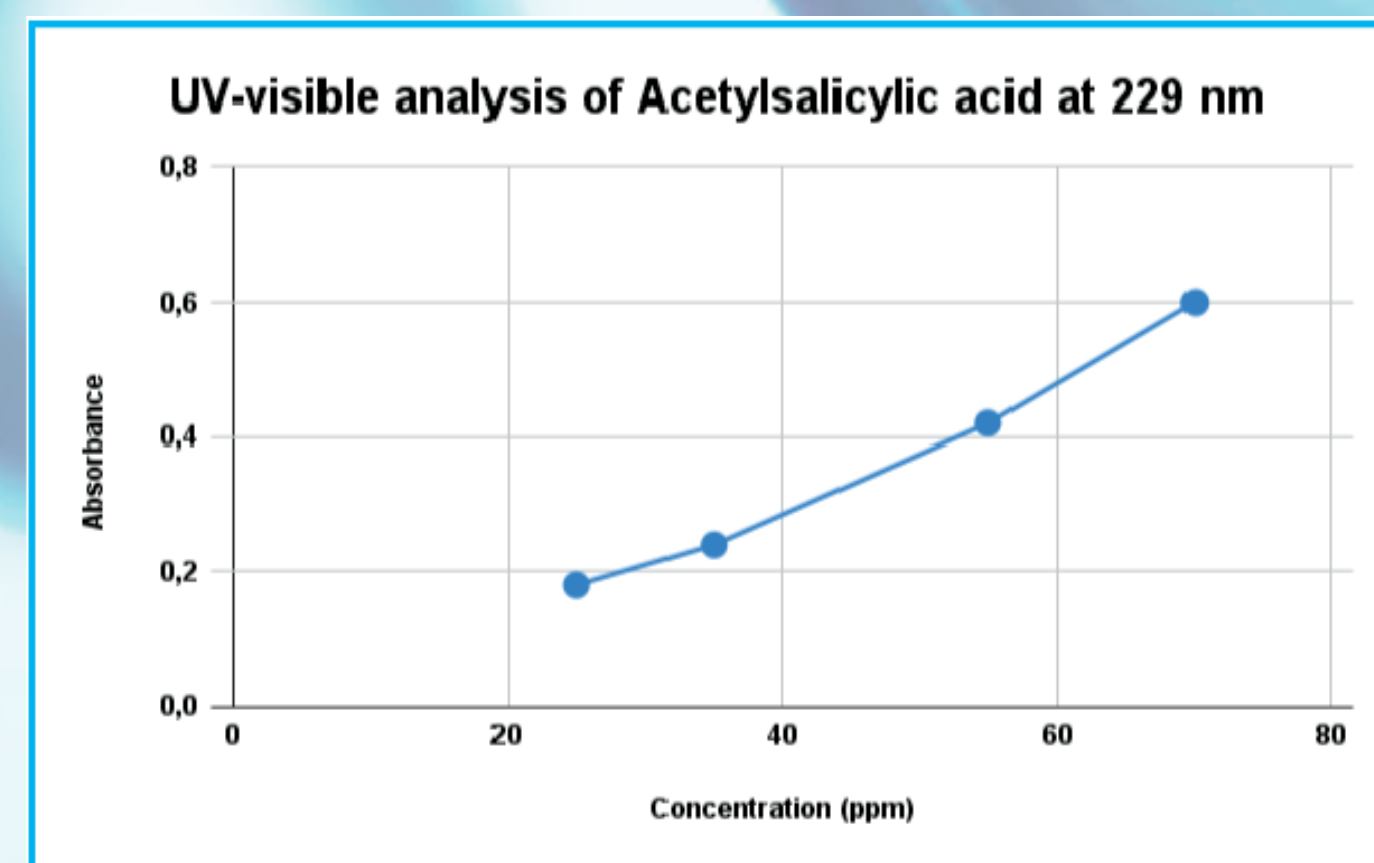
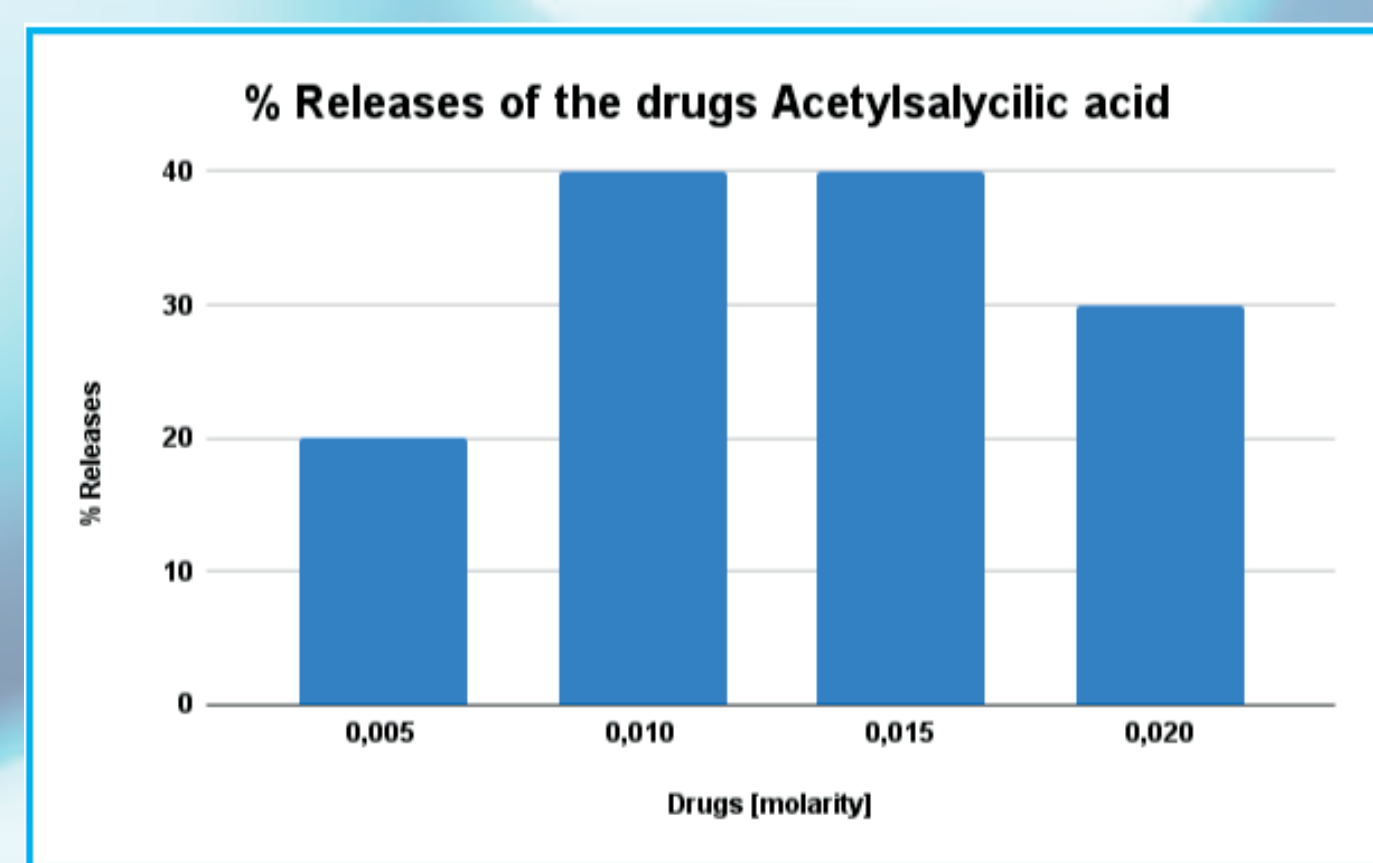
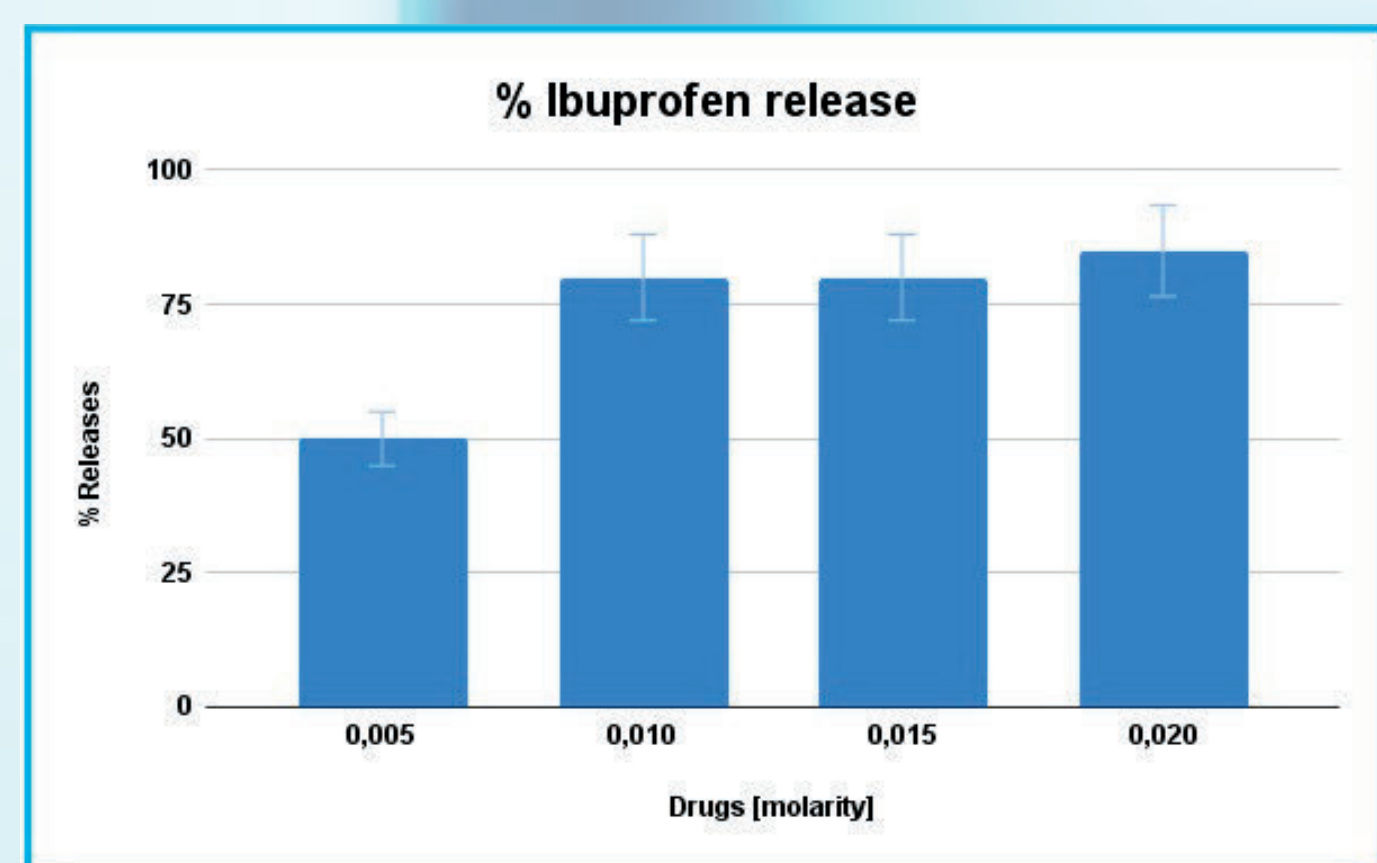
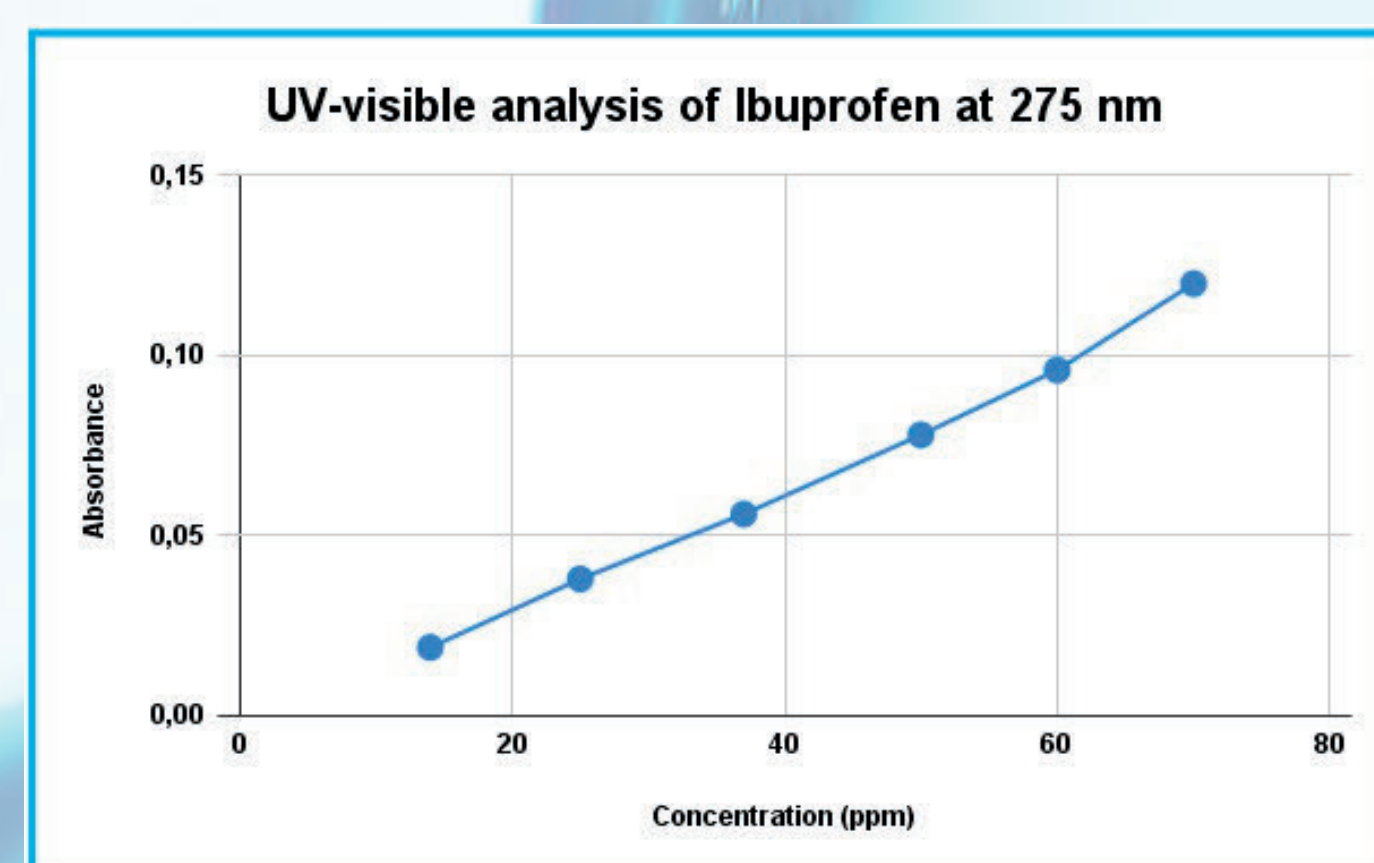
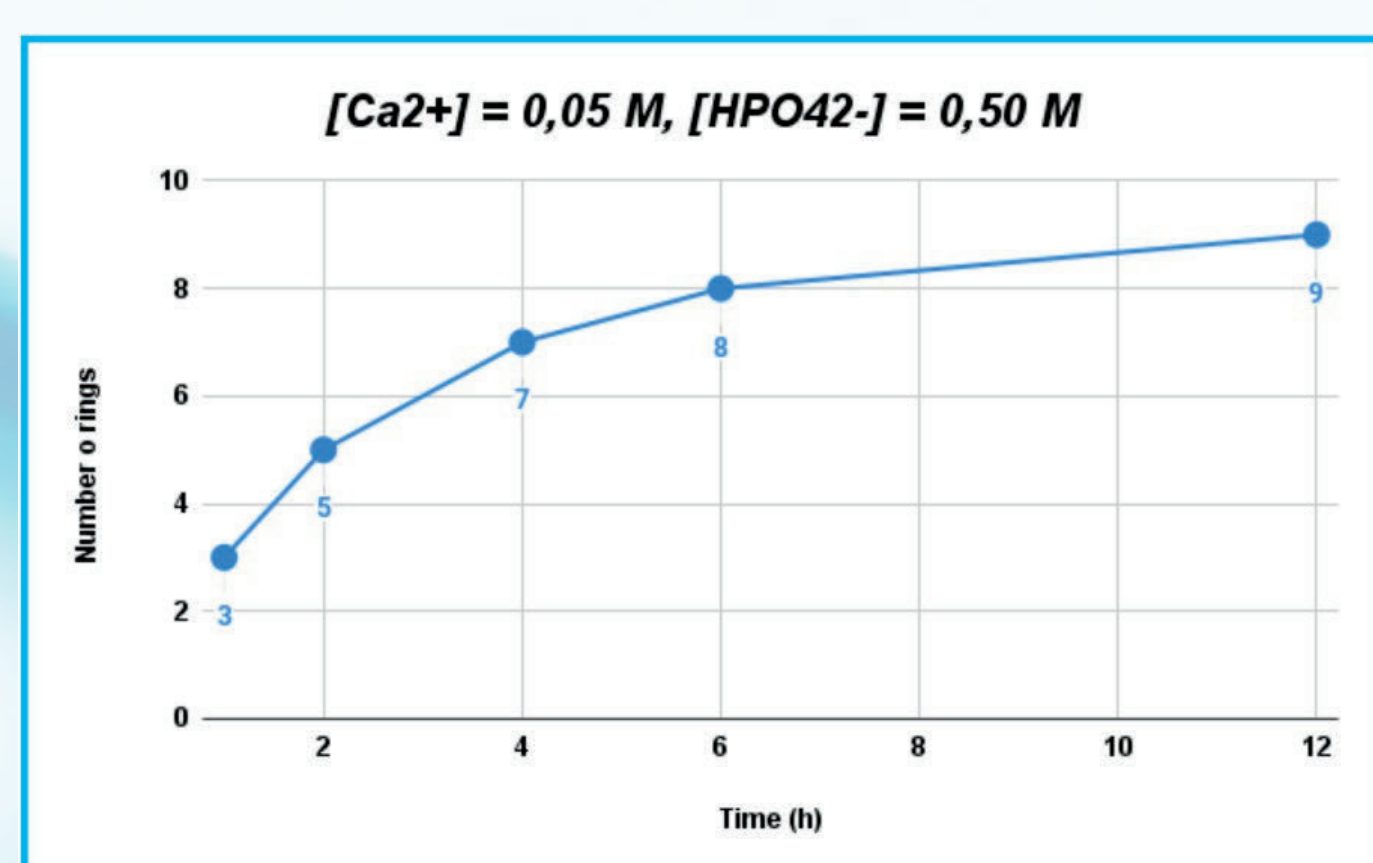
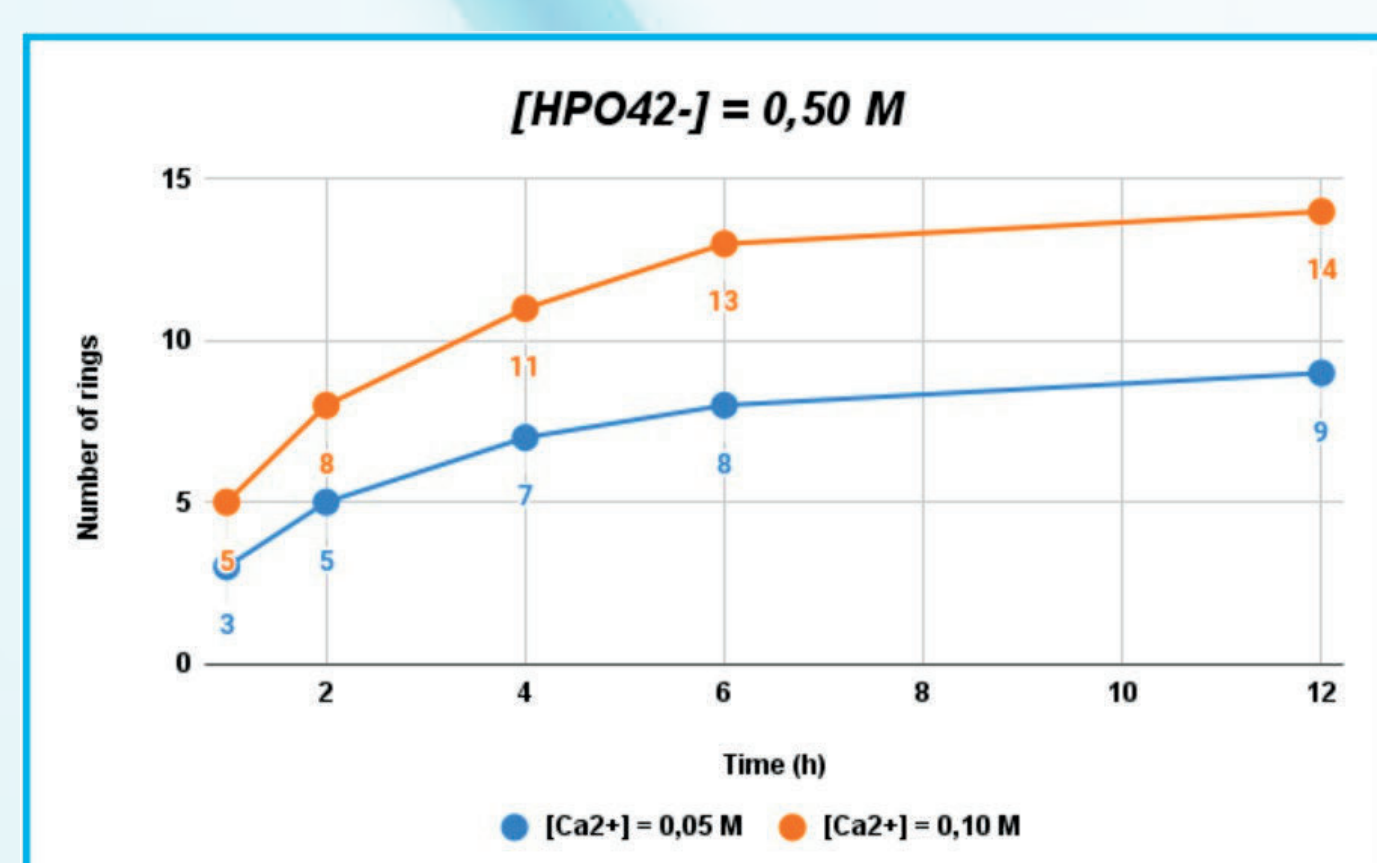
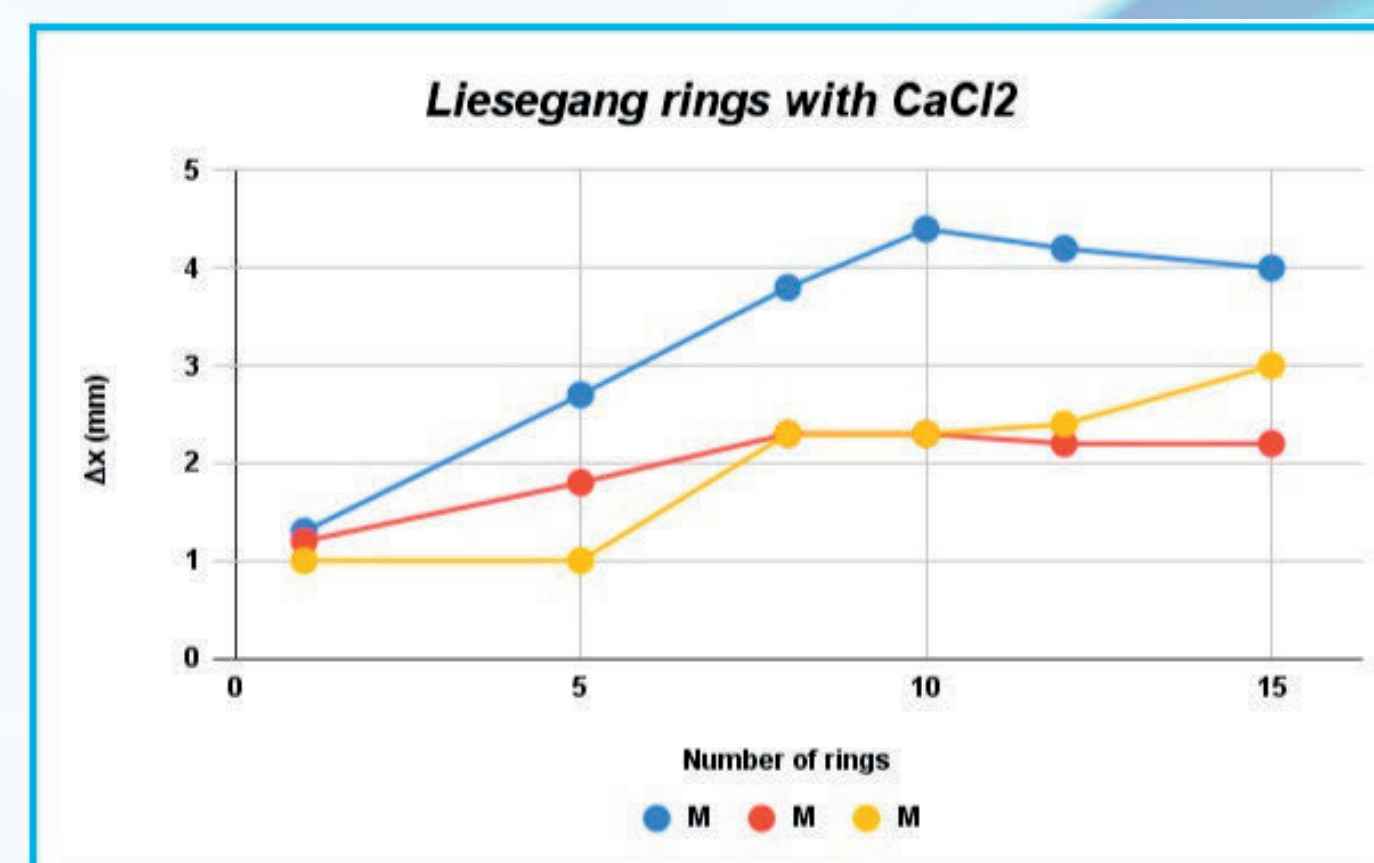
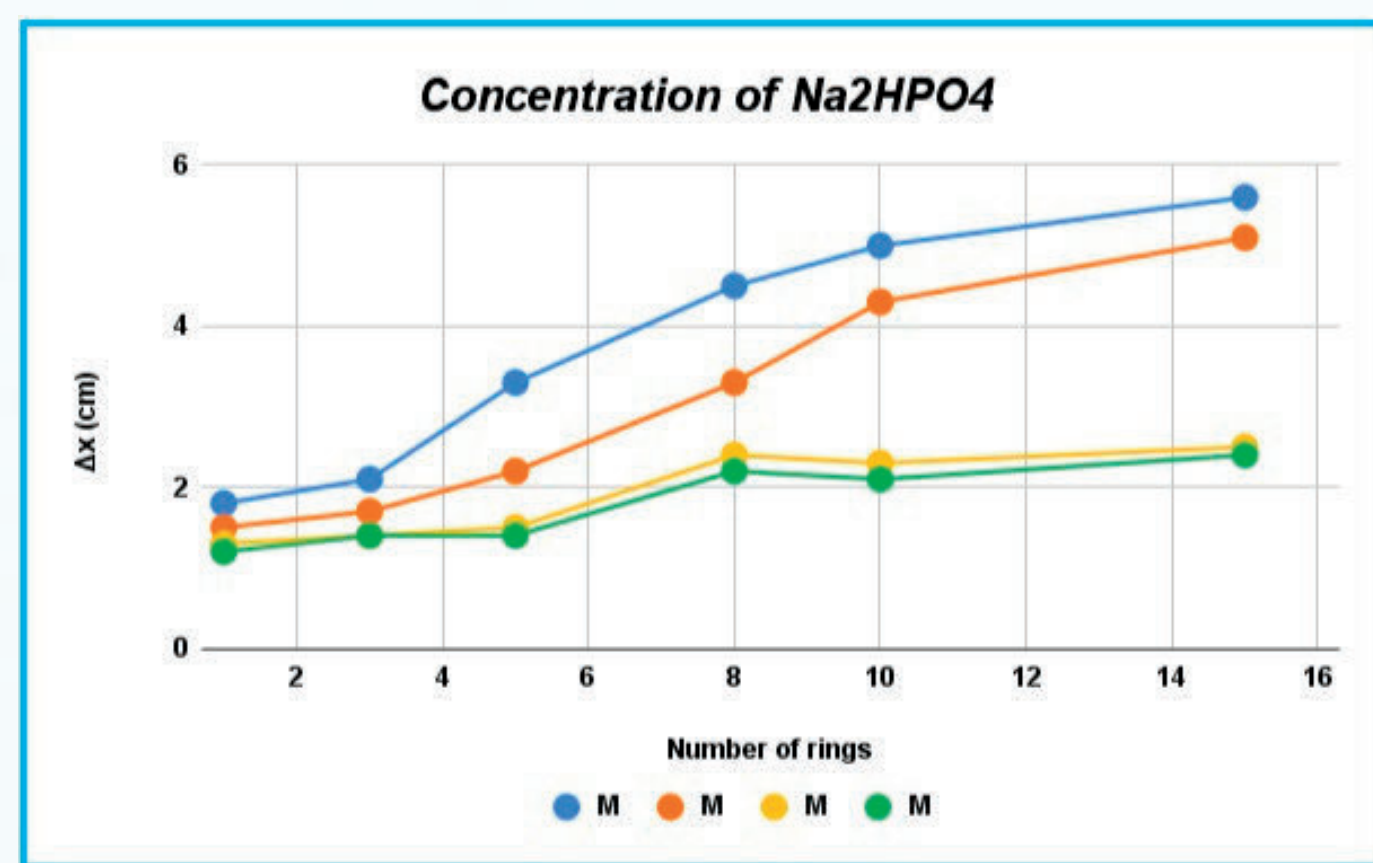
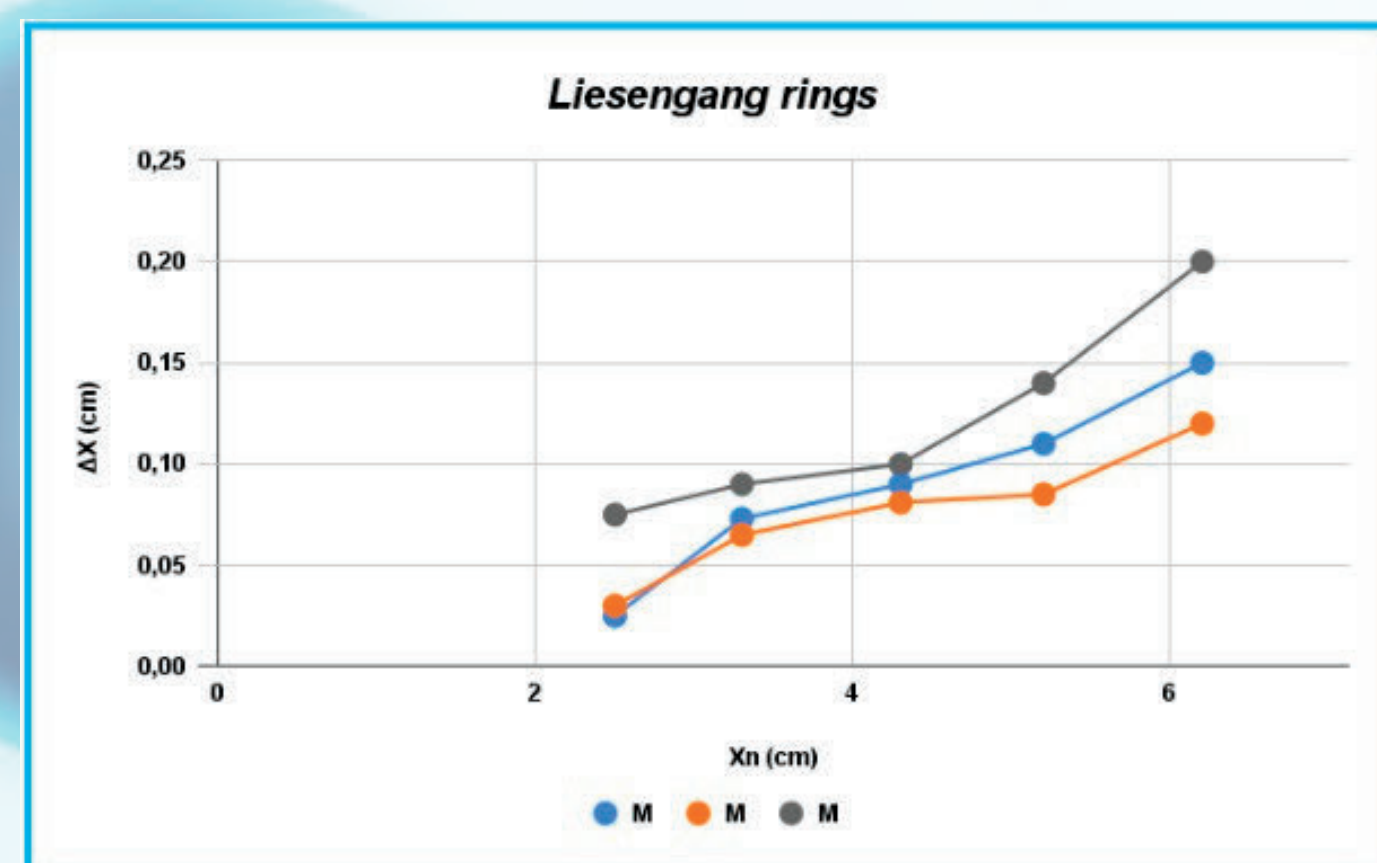
### Discussion of results

- By acting on the parameters involved in the ring synthesis process, such as the type of gelling agent, its concentration, temperature and pH, it is possible to modulate the size, number and distance between the pharmacological rings.
- Furthermore, the number of Liesegang rings increases with decreasing pH.

### Conclusions

Analyses (DLS, UV, AA) confirm that the drug delivery works well for rings made with  $\text{CaHPO}_4$ . Synthesis of Liesegang rings used as pulsed drug delivery systems has produced reproducible data for the release of acetylsalicylic acid. The data are less reproducible for the release of ZnO nanoparticles and ibuprofen.

### Date and results



### References

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