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Determination of Drug Entrapment Efficiency of Curcuminoids in Nanocomposite Hydrogel Beads via UV-vis Spectroscopy

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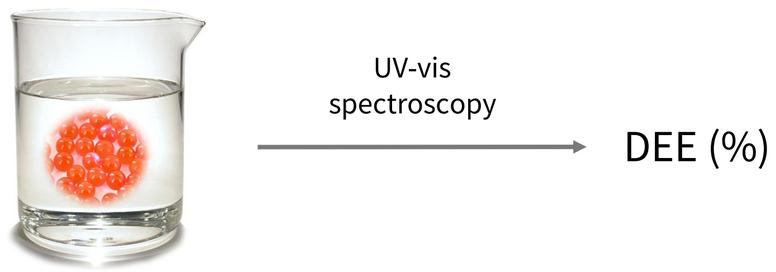
ABSTRACT

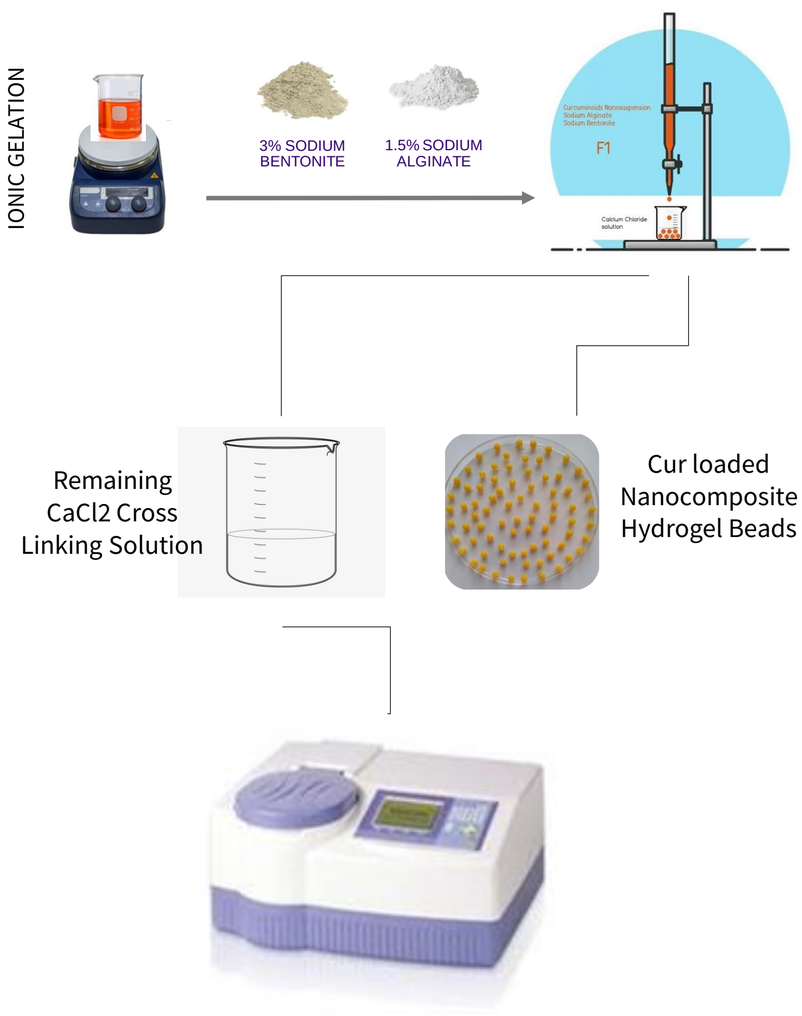
Entrapment efficiency (EE) or encapsulation efficiency, which is defined as the percentage of drugs entrapped into the nanocarrier matrix in reference to the total drug input. Most methods used for entrapment efficiency of hydrogel beads resulted low percentages. To enhance the values of EE (%), the free drug remained in CaCl2 solution during the preparation by ionic gelation were measured by spectroscopy at 420 nm. The results showed more than 99% for both formulations with and without HPMC, the enhanced value can be explained by the different properties of bentonite. In conclusion, the measurement of free drug in CaCl2 is the method of choice to get efficient results of encapsulation.



INTRODUCTION

EE is a crucial parameter used to evaluate the preparation and the quality of the formulations, Imprecise or inaccurate measurement of EE may not only misguide the screening of formulations but also lead to mal-dosing or even undesired side effect in clinical applications,

Most methods used for entrapment efficiency of hydrogel beads resulted low percentages. Herein, we introduced an approach to enhance the values of EE (%) to encapsulate more drug into the formulation, curcuminoids were used as the active pharmaceutical ingredient, while hydrogel beads were prepared by ionic gelation method.



METHODOLOGY

- The drug entrapment efficiency (DEE %) was determined by analyzing indirectly the free drug amount remained in $CaCl_2$ solution.
- 3mL of $CaCl_2$ solution that contained the beads was used as the sample to measure the absorbance of curcuminoids at 420 nm,
- 2% (w/v) $CaCl_2$ solution was used as a blank.
- All samples were analyzed in triplicates. The entrapment efficiency was calculated using the equation:

$$\text{DRUG ENTRAPMENT EFFICIENCY} = \frac{\text{Total curcuminoids added} - \text{Amount of free curcuminoids}}{\text{Total curcuminoids added}} \times 100$$

RESULTS

The DEE % of the curcuminoids loaded beads with different compositions is reported in chart below

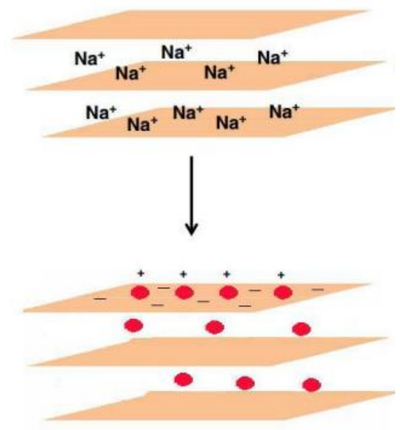
Without HPMC
99,29 +/- 0,08 %

With HPMC
99,13 +/- 0,08 %

Chart of the Percentage of Drug Entrapment Efficiency in different formulations

DISCUSSION

- Both entrapment efficiencies had a high percentage of encapsulation with the presence of HPMC concentration at a fixed concentration of sodium alginate (1.5 % w/v) and sodium bentonite (3% w/v). The DEE didn't vary considerably with the composition of the HPMC for a constant concentration of sodium alginate and sodium bentonite.
- The enhancement of drug entrapment efficiency is explained by the higher specific surface area, porosity and cationic exchange capacity of the sodium bentonite clay



Adsorption of curcuminoids molecules on bentonite layers

CONCLUSION

Alginate/Na-Bentonite/HPMC nanocomposite combination system was able to efficiently enhance the drug entrapment efficiency of over 99%

REFERENCES

Dai YN, Li P, Zhang JP, Wang AQ, Wei QJB, disposition d. A novel pH sensitive N-succinyl chitosan/alginate hydrogel bead for nifedipine delivery. 2008;29(3):173-84.