



# SOLUBLE POLYMER-CURCUMIN ENCAPSULATION TO PROTECT AGAINST GAMMA IRRADIATION AND INCREASE THE WATER SOLUBILITY

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## 1. Introduction

The most abundant curcuminoid in *Turmeric* is THE curcumin. Curcumin is a polyphenol, XXX chromophore present in turmeric rhizomes that is one of the factors responsible for giving it antimicrobial, antibacterial, AMONG characteristics, and IS responsible for its yellow/red color. Although its characteristics help TO combat bacteria and microorganisms; its hydrophobicity hampers the development of drugs since curcumin does not interact well with biological fluids. Thus, the search to develop new paths to work with curcumin in aqueous solutions and with high concentration and stability shows multiple strands within its studies. THE use of encapsulated curcumin is one of them [1, 2, 3, 4]. In addition to using this compound in aqueous solutions, this project FOCUSED THE gamma radiation at a dose of 25 kGy in order to study its interaction.

## 2. Methodology

The encapsulated curcumin, called C-PVP, was synthesized by solubilizing 114.1 mg of sodium citrate and 10 mg of PVP K30 in 120 mL of distilled water. This solution was poured into a round-bottomed flask using a mechanical stirrer and a condenser and heated to boiling for 45 minutes. After this process, the solution was cooled to room temperature and added to 25 mL of ethanol containing curcumin at a concentration of 3 mg/mL and submitted to distillation for 3h. The final solution must be stored at room without sunlight incidence. Afterwards, the solution was submitted to gamma irradiation PROCESS OF 25 kGy dose at dose rate of 5.5 kGy·h<sup>-1</sup>.

The techniques used to characterize the C-PVP solutions were UV-Vis Spectroscopy, SEM-FEG and DLS. Furthermore, centrifugation was used to remove the unencapsulated curcumin and calculate the encapsulation efficiency following the equation 1.

$$\text{Curcumin encapsulated} = \text{Inicial Curcumin} - \text{Centrifuged curcumin} \quad (1)$$

## 3. Results and Discussion

### ENCAPSULATED EFFICIENCY

After the encapsulation, the solution was centrifuged in two stages, obtaining only the supernatant and separating the bottom for drying and weighing. With this process, the efficiency of C-PVP was 84.28% and only 11 mg of unencapsulated curcumin was removed.

### FEG-SEM

The Figure 1 shows that PVP can encapsulated the curcumin, however, this encapsulate is polydisperse and with agglomerates. These results cooperate with DLS data's where WAS possible to VERIFY the diameter of C-PVP particles.

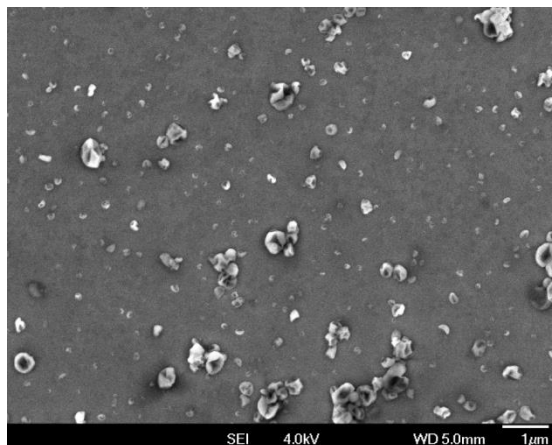


Figure 1: The FEG-SEM imagen from C-PVP solution.

### DLS

The DLS technique it was used to understand the particle size of C-PVP. The results shows that there are three different average diameters with different intensity (%): 25 nm (42,2 %), 390 nm (55,6 %) and 5400 nm (2,2 %) with a polydispersity index around 0,550. That's possible to high size by agglomerates as seen on FEG-SEM technique.

### UV-Vis

The UV-Vis technique was used to prove the existence of curcumin on C-PVP encapsulates and C-PVP with radiation. The results shows that the curcumin are present on C-PVP without radiation, however, the maximum of absorbance changed the wavenumber from around 400-500 nm in natural stage to 300-400 nm encapsulated, This data could be explained, as the literature shows, by the pH changed of curcumin in aqueous solution for basic pH [5]. For C-PVP irradiated, the curcumin lost absorption intensity.

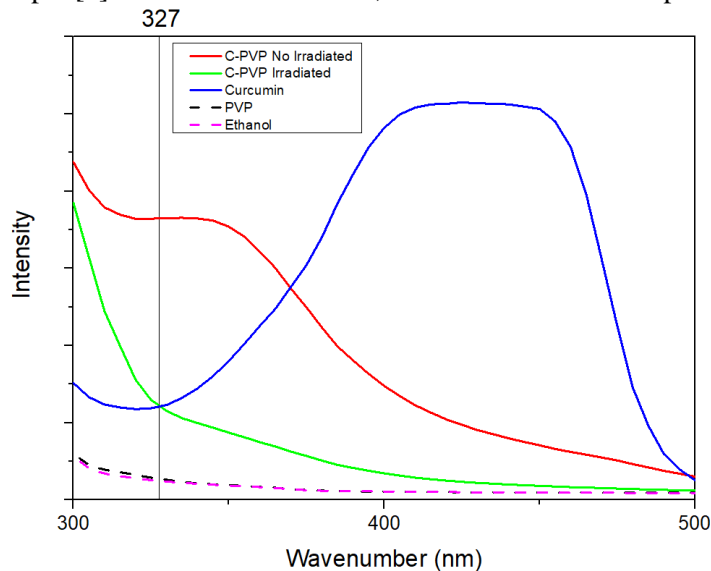


Figure 2: The UV-Vis spectra from all reagents, C-PVP no irradiated and C-PVP irradiated.

#### 4. Conclusions

From the data presented, it is possible to conclude that PVP K30 is a polymer capable of encapsulating curcumin making it available in aqueous solutions, since the polymer itself has a high solubility. SEM images show both nanometer-scale particles and agglomerates larger than 1  $\mu\text{m}$ ; the DLS technique confirms this data from its measurements, while UV-Vis spectroscopy proved the existence of curcumin present in the both samples from its absorption between 300-400 nm, Thus, the irradiated C-PVP lost intensity, which shows that gamma irradiation modifies and destroy the curcumin molecule.

#### Acknowledgements

CAPES funding agency and to the Multipurpose Gamma Irradiation Facility – CETER/IPEN.

#### References

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