P-056 **Solubility and stability evaluation of microparticles of quercetin**

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INTRODUCTION AND OBJECTIVES

Dimorphandra mollis (DM) is one of the most interesting medicinal plants of Brazilian biodiversity. DM has high economic potential especially for pharmaceutical companies. From DM are extracted flavonoids such as rutin and quercetin, used as raw material for medicines and cosmetics (Lorenzi 2000). Quercetin is an important flavonoid known for exceptional antioxidant, antiinflamatory and anticarcinogenic activities, but presents difficulties of application on pharmaceutical industry due to its low solubility in water and photo-instability (Calabro 2005). The microencapsulation protects the active component from the environment, minimizing its degradation. Several studies have shown that the microencapsulation increase the solubility of numerous substances. This study aimed to increase the quercetin solubility and stability through the microencapsulation by methods as molecular inclusion with β-cyclodextrin (CD) and spray drying with Arabic Gum (AG).

MATERIAL AND METHODS

Microencapsulation by molecular inclusion and spray drying The microencapsulation was performed using different weight proportions of quercetin (Merck) and β-cyclodextrin (Sigma Acros), or Arabic Gum food grade (Synth) in water. In the series with CD, the polymer was added in a proportion of 1:10 and 1:3.3. In the series with AG, the gum was added in a proportion of 1:10. The resulting solutions were shaken in Ultra Turrax (Ika, model T-10, Staufen, Germany) and processed through two methods: 1) Spray drying using a mini spray dryer (Buchi, model B-290, Flawil, Switzerland) under these conditions: Inlet and outlet temperature; 180 and 60 oC, respectively, liquid flow rate; 6 mL/min, nitrogen pressure; 470 L/h and nozzle diameter; 2.2 mm. 2) Freeze drying using a freeze dryer apparatus (Virtis, model 8L, Winchester, United Kingdom) during 72 hours.

Phase Solubility Studies Solubility studies were performed according to the method reported by Higuchi and Connors. Aliquots of the resulting solutions of quercetin were diluted suitably and assayed against blank at 372 nm.

Morphological analysis by scanning electron microscopy Small amounts of samples was properly prepared and submitted to the procedure of sputtering in Balzers-Sputter Coater, model SCD 050, Germany (Rosemberg 1993) and evaluated in a scanning electron microscope (JEOL, model JSM-T300, Tokyo, Japan), under acceleration of 10kv. The images were digitalized allowing detailed visualization of the structures formed.

Stability assay The samples and the quercetin were evaluated spectrophotometrically before and after being exposed to fluorescent lamp with 700 lux of illumination at room temperature (25ºC) during 5 days. The same procedure was followed for samples and quercetin placed in stability chamber (TECNAL, model TE4003, Piracicaba, Brazil) at 45ºC and 75% relative humidity equilibrium.

RESULTS & DISCUSSION

The samples obtained in the microencapsulation process presented in shades of yellow color, characteristic of quercetin. Considering that the quercetin is virtually insoluble in water it was possible to note an increase in solubility of quercetin in the samples obtained by both the processes of microencapsulation.

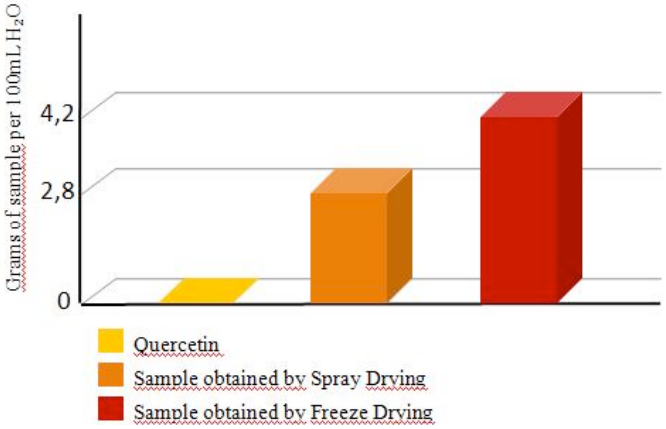

Chart 1: Samples solubility processed with AG.

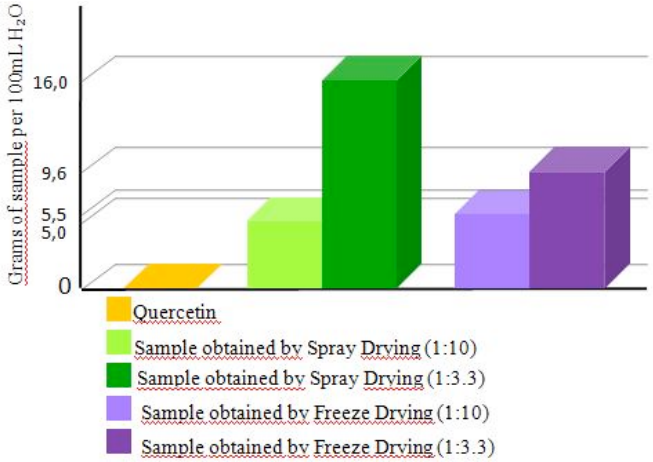

Chart 2: Samples solubility processed with CD.

The results obtained in the stability study indicate that the microencapsulation process were satisfactory to protect the samples from the conditions under which they were exposed.

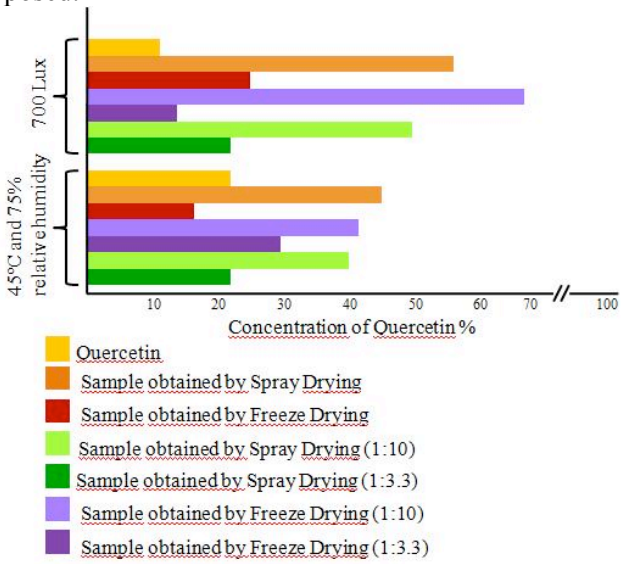

Chart 3: Samples and quercetin concentrations after 5 days of exposure.

The analysis of micrographs taken by scanning electron microscopy (SEM) revealed the formation of microcapsules in samples obtained spray drying and the formation of an amorphous material obtained in the process of freeze drying.

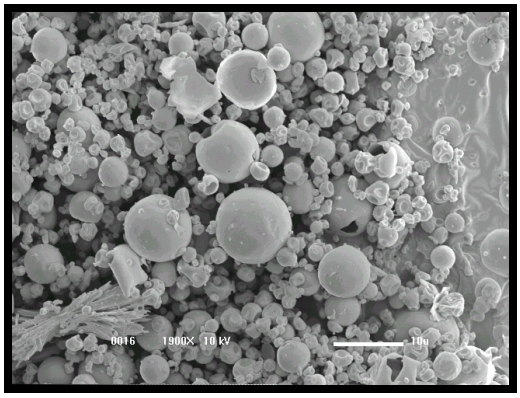

Figure 1: SEM of the quercetin sample plus CD processed by spray drying.

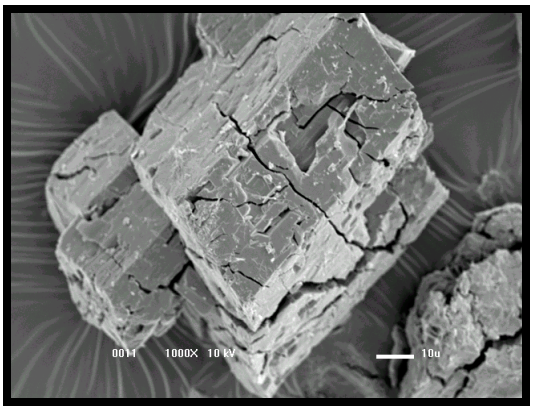

Figure 2: SEM of the sample of quercetin plus CD processed by freeze drying

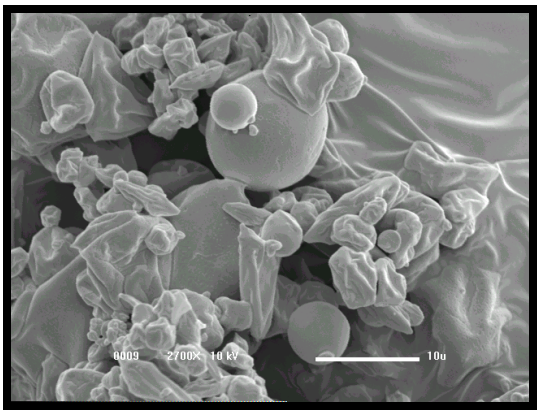

Figure 3: SEM of the quercetin sample plus AG processed by spray drying.

CONCLUSION

The present study demonstrated a significant increase in the solubility of quercetin when it was submitted to microencapsulation processes. The microencapsulated quercetin was protected from the environmental effects, its degradation being minimized. The analysis of the photomicrographs, taken through scanning electron microscopy, revealed the formation of microcapsules in the samples treated by spray drying. It showed also that the samples obtained by the freeze drying process, instead of microcapsules, formed an amorphous material. However, it would be necessary to perform other more sensitive techniques to confirm this specific fact. The study was conclusive and favourable for use of quercetin in aqueous solutions.

REFERENCES

- Lorenzi, H. (2002), in Árvores Brasileiras - Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil. Ed. Plantarum Ltda., Nova Odessa - SP: 169p.
- Calabro, M.L. et al.(2005) *The rutin/β-cyclodextrin interactions in fully aqueous solution: spectroscopic studies and biological assays.* Journal of Pharmaceutical and Biomedical Analysis. v. 36; p. 1019-1027.
- Higuchi, T. et al. (1965), in Advances in Analytical Chemistry and Instrumentation(CN Reilley, ed.), Vol. 4, Wiley- Interscience, New York, , p. 117.
- Rosemberg, M. et al. (1993) *Whey proteins as microencapsulating agents. Microencapsulation of anhydrous milk fat-structure evaluation.* Food Structure. Chicago 12(1) 31-41.