

Effect of the different encapsulation methods on the physicochemical and biological properties of *Clitoria ternatea* flowers microencapsulated in gelatine

ABSTRACT

Clitoria ternatea flowers are known as butterfly pea flowers which contain many bioactive compounds and can be found in tropical countries. However, the bioactive compounds are easily lost when exposed to various environmental conditions. Encapsulation technologies are introduced to provide maximum protection to the encapsulated bioactive compounds. The main objectives of this study were to determine the physicochemical properties of *C. ternatea* flowers encapsulated in gelatine prepared using different encapsulating methods and the microbiological properties of the best encapsulating methods for *C. ternatea* flowers with gelatine. In this study, the moisture contents for ultrasonic spray dried powders recorded the lowest ($5.94 \pm 0.44\%$) while samples of convection oven recorded the highest ($14.33 \pm 1.30\%$). However, the ultrasonic spray dried powders demonstrated the highest total flavonoid contents, but convection oven dried powders showed the lowest. The results for total anthocyanin contents were similar to total flavonoid contents. The highest encapsulation efficiency based on anthocyanin contents was found in freeze dried powders ($95.75 \pm 0.24\%$). These results showed the same antioxidant activity (DPPH assay) with the highest percentage inhibition of freeze dried powders and the lowest percentage inhibition of ultrasonic spray dried powders. The phytochemical functional group that revealed from Fourier Transform Infrared spectroscopic (FTIR) analysis also indicate the presence of high amount of phenolic compounds in freeze dried powders although with 'collapse building' shape with fibrillary structure. The freeze dried powder showed the highest L^* value (45.62 ± 0.54), yet ultrasonic spray dried powders highest a^* , b^* and C^* value. Thus, the analysis for microbial properties was carried out on freeze dried powders as freeze dryer was chosen as the best encapsulating methods. The freeze dried powders showed inhibition against gram positive and gram negative bacteria such as *Bacillus cereus*, *Staphylococcus aureus*, *Escherichia coli* and *Salmonella enterica* and fungi such as *Aspergillus niger* and *Candida albicans*. The current study demonstrated the potential of using gelatine to encapsulate technique to retain antioxidant compounds in gelatine encapsulated *C. ternatea* flowers. This finding provides useful information on the use of different encapsulated methods for the development of functional food products for gelatine encapsulated flowers of *C. ternatea*.