

## Synthesis and characterization of inclusion complexes of *Ageratum conyzoides* L. essential oil in $\beta$ -cyclodextrin

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*Ageratum conyzoides* L. (Asteraceae) is an essential oil bearing weed shrub grown in various regions of the globe including Sri Lanka. *Ageratum conyzoides* L. essential oil (ACEO) possesses a wide range of chemical, biological and pharmacological properties which allow ACEO to be used in different applications, including in agricultural practices as herbicides and insecticides. However, low water solubility, high volatility and thermal instability of ACEO limit its uses. In order to overcome the aforementioned limitations of ACEO, host-guest inclusion complexes (ICs) of ACEO with  $\beta$ -cyclodextrin ( $\beta$ -CD) can be prepared. Therefore, this research focused on synthesis followed by physicochemical characterization of  $\beta$ -CD-ACEO ICs. The chemical composition of hydro-distilled ACEO was analyzed using gas chromatography-mass spectrometry (GC-MS). The ICs and physical mixtures (PMs) of  $\beta$ -CD-ACEO were synthesized using co-precipitation and grinding methods, respectively for two initial mass ratios of ACEO to  $\beta$ -CD, 1:2 and 1:4. The formation of  $\beta$ -CD-ACEO ICs and corresponding PMs along with their physicochemical properties were

evaluated and compared using Fourier transform infrared spectroscopy, thermogravimetry/derivative thermogravimetry and differential scanning calorimetry. The encapsulation efficiency (EE) of  $\beta$ -CD-ACEO ICs was determined using ultraviolet-visible spectroscopy. The GC-MS profile of ACEO exhibited thirty-three chemical constituents, with precocene II, a chromene, being the major chemical component (62.7%). The co-precipitation method resulted in experimental yields of 38.7% and 51.9% for 1:2 and 1:4 ICs, respectively. The complementary treatment of qualitative and quantitative data obtained from the thermal analysis of ICs and PMs of  $\beta$ -CD-ACEO indicated characteristic volatility reduction and thermal stability enhancement of ACEO, leading to successful formation of ICs. EE values, up to 35%, were obtained for  $\beta$ -CD-ACEO ICs. The findings of this study suggested that the limitations in utilization associated with the properties of ACEO could be successfully overcome by preparation of  $\beta$ -CD-ACEO ICs.

**Keywords:** *Ageratum conyzoides* L., essential oil, encapsulation,  $\beta$ -cyclodextrin, inclusion complex