**Photochemical and oxidative degradation of chamazulene contained in *Artemisia*, *Matricaria* and *Achillea* essential oils and setup of protection strategies**

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APPENDIX

(Supplementary data)

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A graph showing the difference between a red line and a white line

Description automatically generated with medium confidence

**Figure S1.** Spectral radiation power distribution of Osram Ultra-Vitalux**®** lamp at various wavelengths. Data provided by the lamp manufacturer, reported only as a reference.

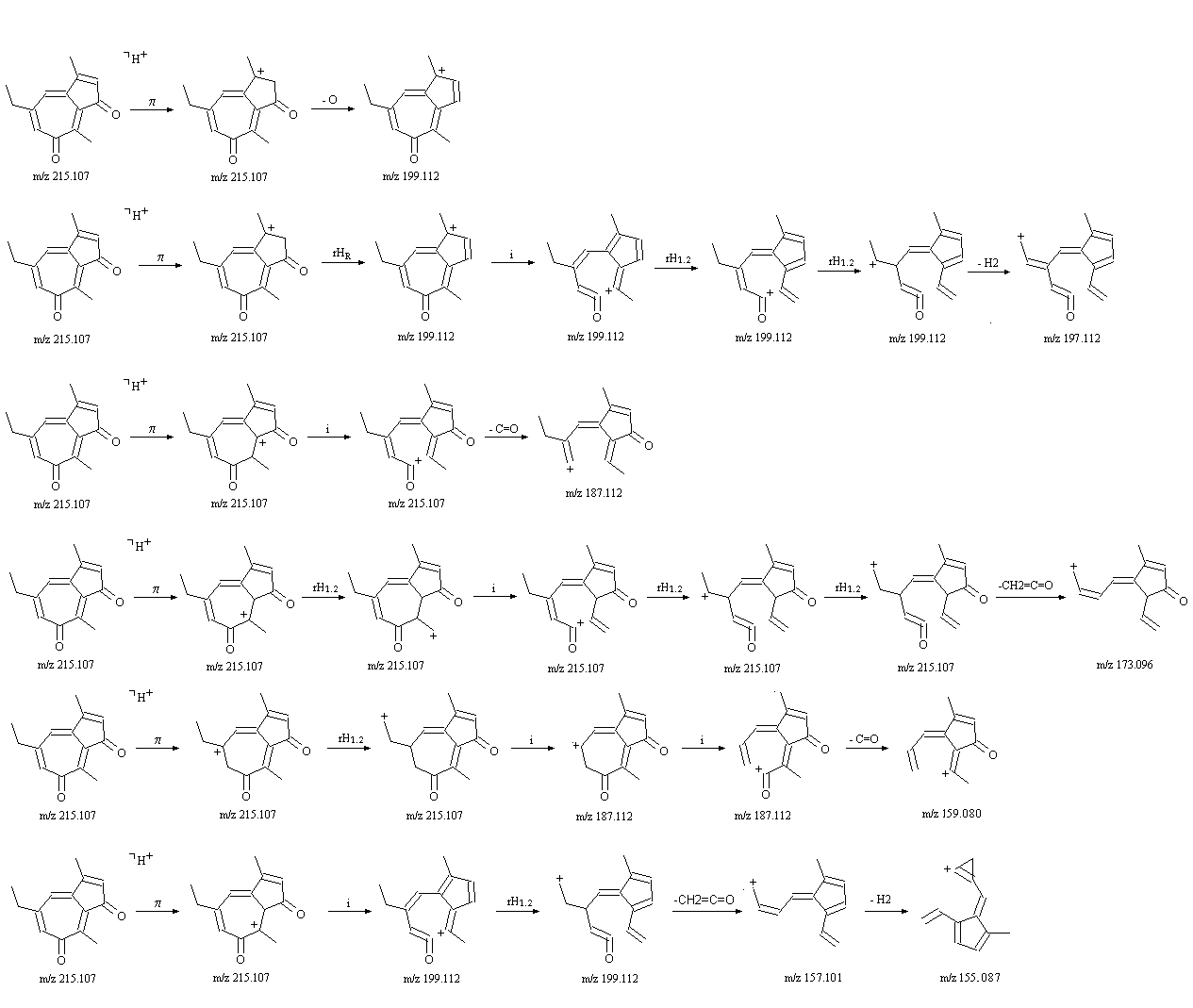
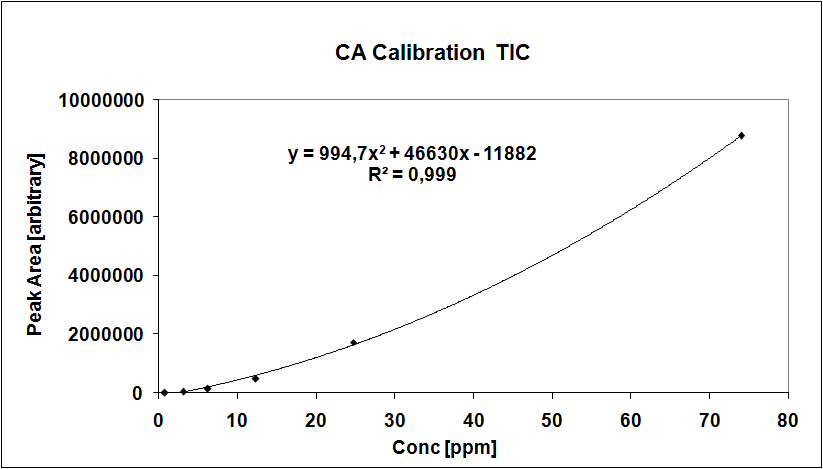
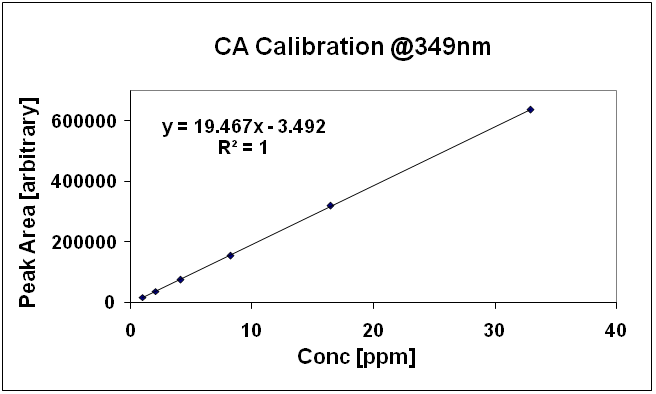
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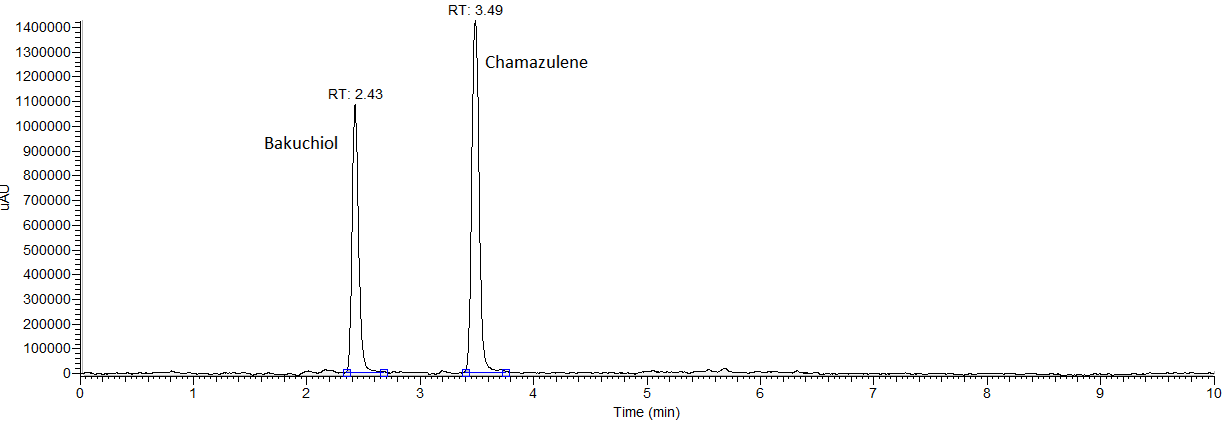
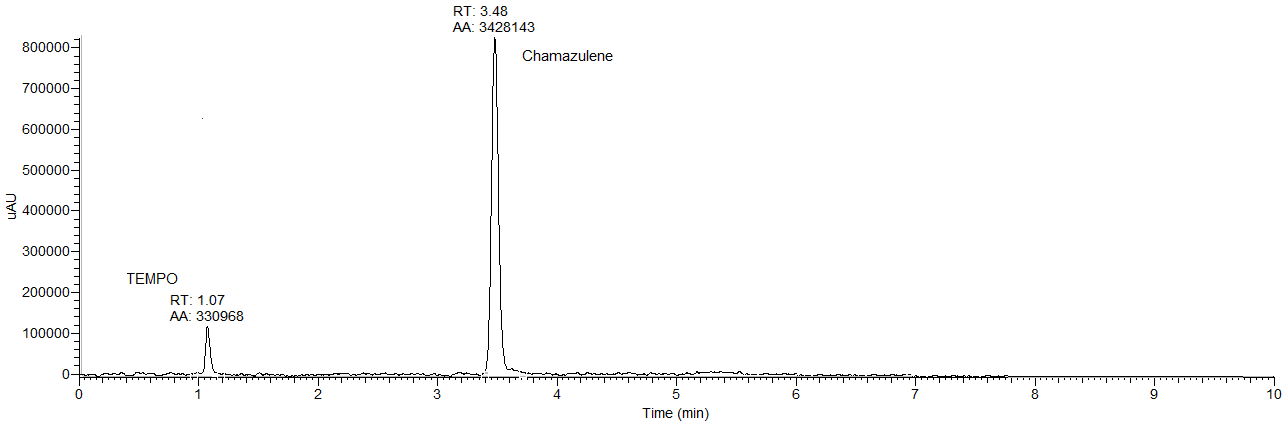
Figure S2. Fragmentation ions of parent peak *m/z* 215, in positive mode attributed to chamazulene quinone (6), calculated by Mass Frontier software. The fragmentation pattern explains ions with *m/z* 197, 187 and 159 shown in Figure 9.

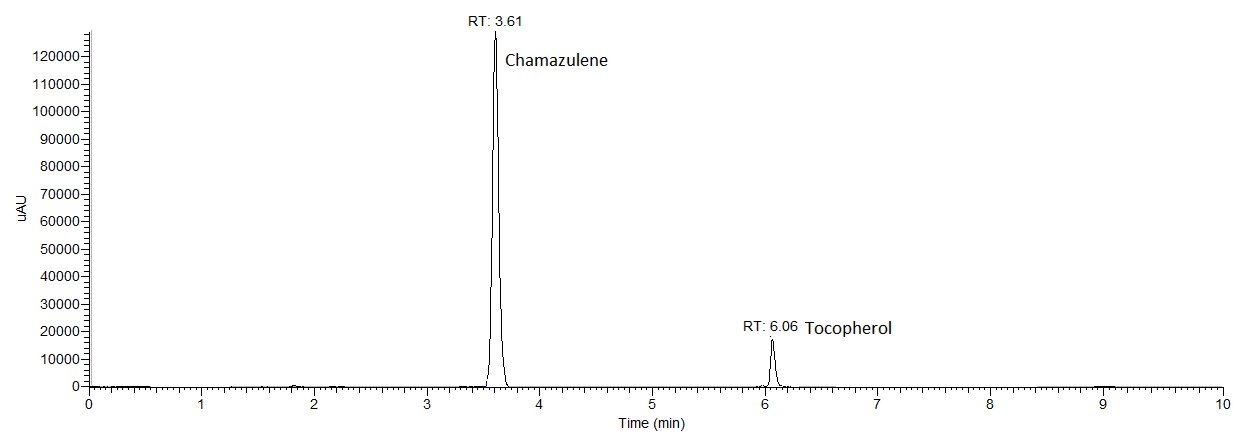
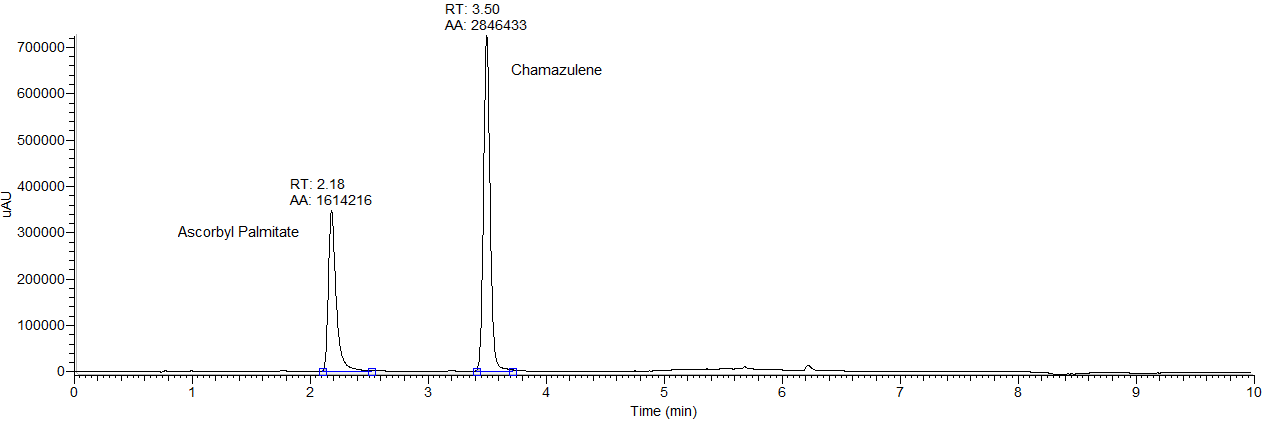


**Figure S3**. GC-MS calibration curve of CA in Total Ion Count (TIC) mode, used to evaluate the influence of solvent type and presence of oxygen on the photostability of CA alone.

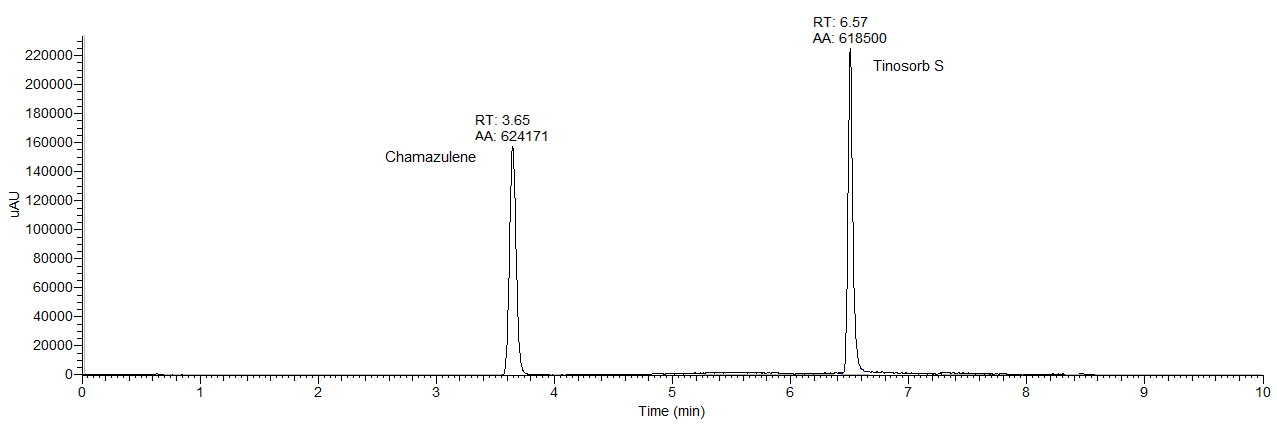


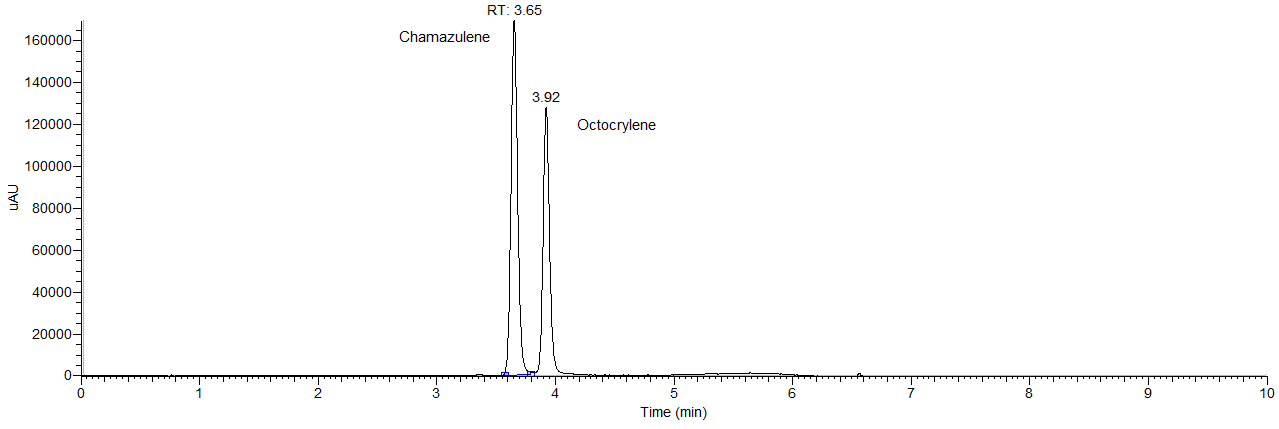
**Figure S4**. LC-PDA calibration curve of CA at 349 nm used for evaluation of photo and thermal stability experiments of CA in presence of antioxidants and sunscreens.

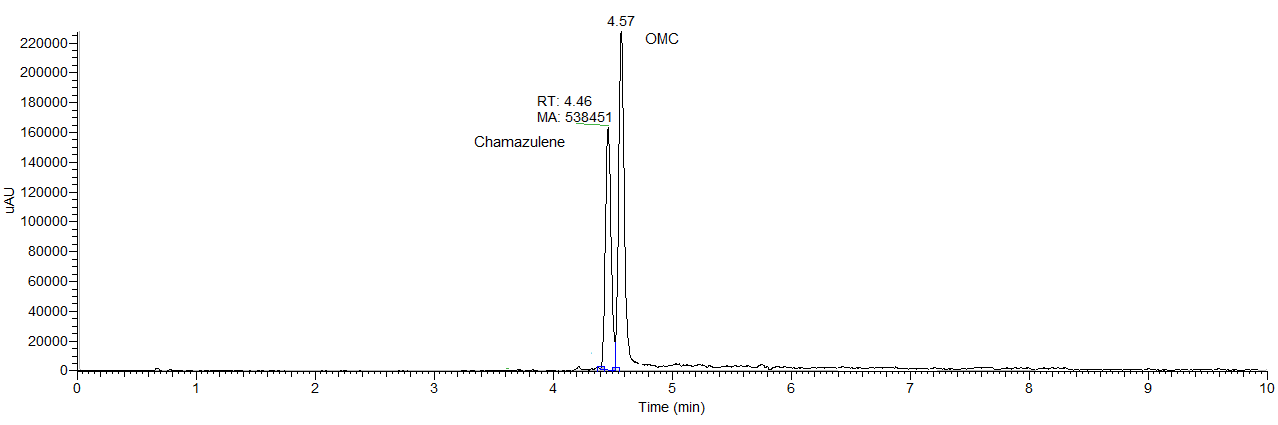




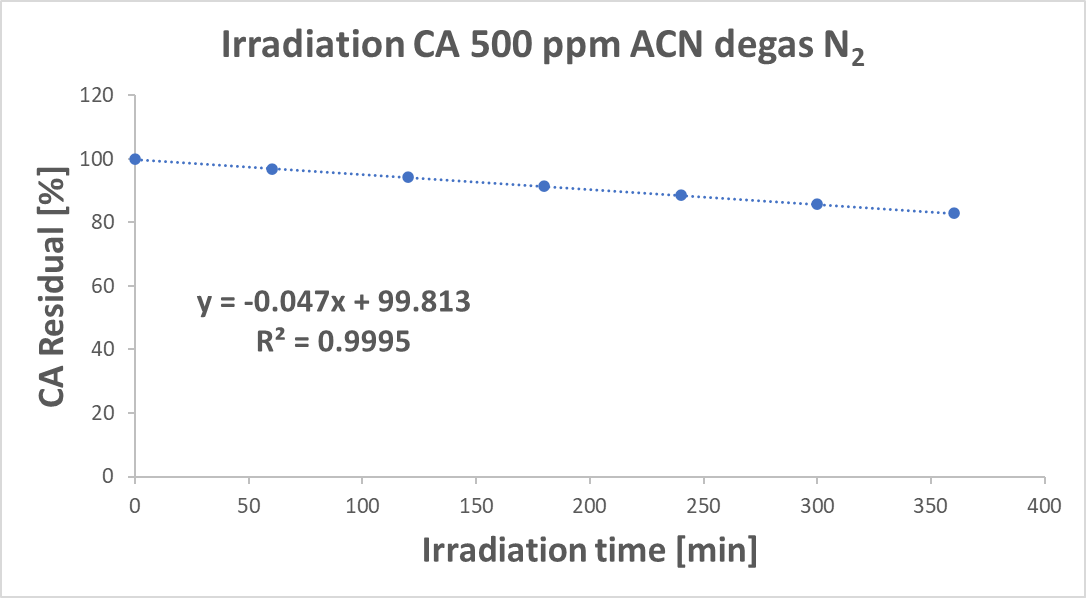
**Figure S5**. Example of HPLC-PDA chromatograms of mixtures of CA:antioxidants in molar ratio 1:10. From top to bottom: TEMPO, bakuchiol, ascorbyl palmitate, tocopherol.







**Figure S6**. Example of LC-PDA chromatograms of mixtures of CA (0.17 mM) with UV filters at a concentration of 5% w/v (from top to bottom:, Tinosorb**®** S, octocrylene, octyl methoxycinnamate). The choormatographic conditions were slightly changed for octlyl methoxycinnamate to resolv coelution with chamazulene..

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**Figure S7.**Spectrophotometric evaluation of CA photodegradation in the absence of oxygen. Measurments were perfomed in a sample of CA 500 ppm in acetonitrile in a 3.5 mL Teflon sealed quartz cu-vette and degassed for 5 minutes with an abundant N2 stream. The cuvette was subjected to UVA-UVB radiation at100 mW/cm2 (strong photooxidation conditions)for 6 hours. At regular time intervals a spectrophotometric reading was performed without opening the cuvette. The rate of the CA degradation is reported.

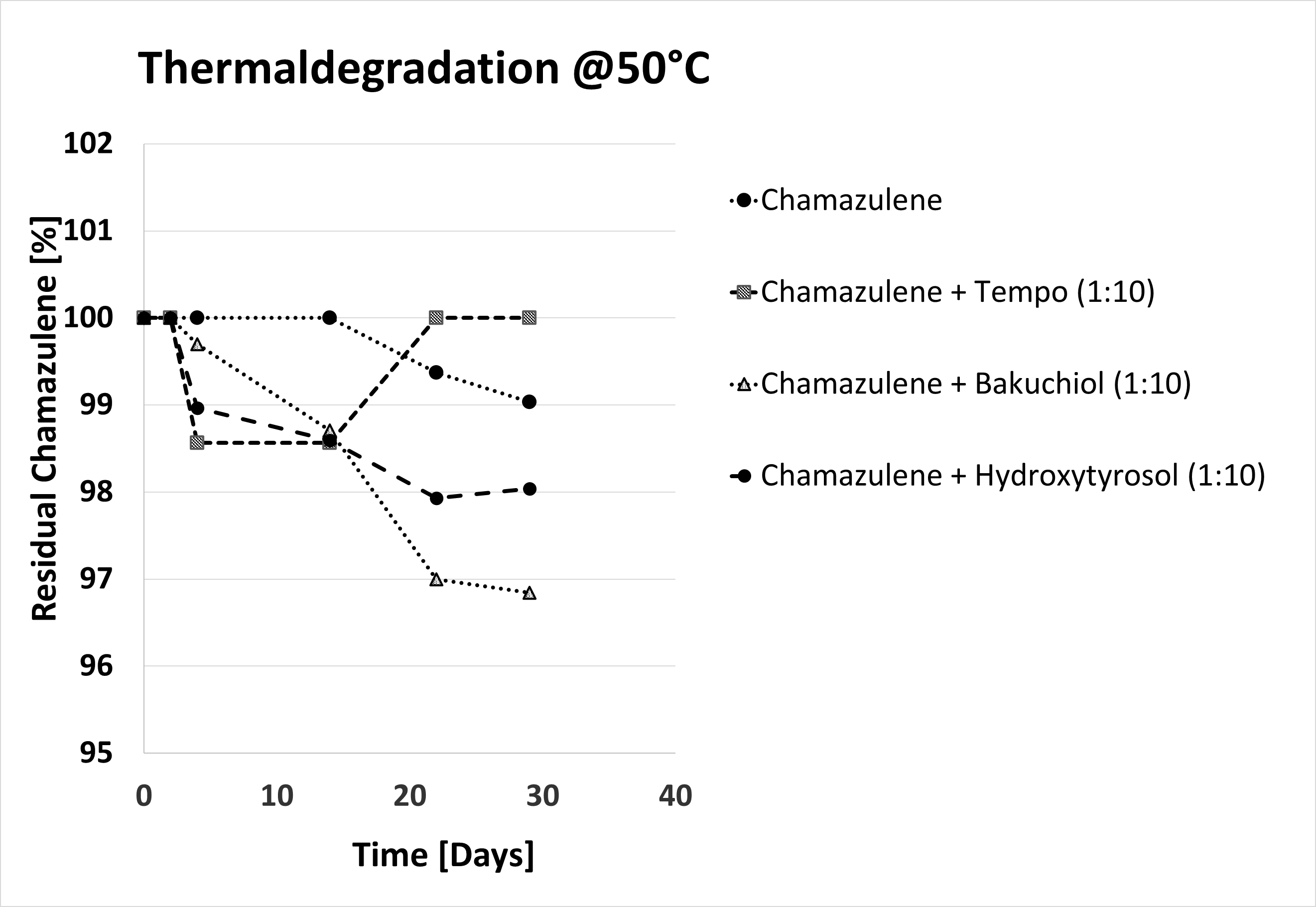
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Figure S8. Detail of thermal degradation of chamazulene in solution, alone or in the presence of selected antioxidants, incubated at 50°C. This figure represents and expansion of Figure 12 in the manuscript.