

Natural Versus Synthetic Curcuminoids as Photosensitizers – Photobleaching and Photodynamic Inactivation Evaluation

N J MELO¹, J M SOARES¹, J S D TOVAR¹, L D DIAS¹, AND N M INADA¹

¹*São Carlos Institute of Physics, University of São Paulo, Av. Trabalhador São-Carlense, 400, São Carlos, Brazil. Contact Phone: +5516988584085*

Contact Email: nicolas.junhiti.melo@usp.br

Curcumin is a well-established photosensitizer in photodynamic therapy due to its natural origin, though its composition can change based on soil conditions. As such, a synthetic analogue is preferred since concentration is well set and environmental impact is reduced. However, the differences between natural curcumin and a synthetic analogue as photosensitizers are not well understood and can impact photodynamic inactivation (PDI) reproducibility. Thus, the study on a photophysical level through photobleaching and in PDI was performed. Natural curcumin contains two other curcuminoids, demethoxycurcumin (DMC) and bis-demethoxycurcumin (BDMC), but they are yet to be explored thoroughly in this field and could be as effective or better than the well-known curcumin in, whether individually or mixing all three of them. As such, the photobleaching tests were conducted using spectra from UV-vis spectroscopy and analyzed through numerical solutions to a series of equations of macroscopic photodynamic therapy. The synthetic photosensitizers were tested individually and in six different mixtures, as to investigate how different proportions of naturally found curcumin affect its photodynamic activity. Results obtained show that synthetic curcumin absorbed more of the given light irradiance but generated less singlet oxygen than natural curcumin while also degrading faster than it. Additionally, PDI results showed no significant difference in their inactivation of *S. aureus*. Regarding the other curcuminoids, both DMC and BDMC inactivated up to 5 logs while curcumin inactivated 3.6 logs, this difference raises interest in those molecules. Mixtures of the 3 molecules showed good inactivation results and the best mixtures were those with a medium amount of curcumin and higher content of DMC or BDMC, though they inactivated comparatively to the individual curcuminoids. Therefore, it was observed that synthetic curcumin can replace the natural one as it is also a great photosensitizer, DMC and BDMC could be even better alternatives that should be further studied in biophotonics.