

Nonionic and anionic polymers affect methylene blue aggregation in formulations for antimicrobial photodynamic therapy

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Abstract (300 word limit)

Statement of the Problem:

Methylene blue (MB) is a cationic phenothiazinium dye with interesting properties for application in antimicrobial photodynamic therapy (aPDT). The aggregation state directs the mechanisms of action, which means that type I or II oxidative reactions can be favored according to the medium in which MB is conveyed^(1,2). The purpose of this study is to develop MB formulations associated to polymers for aPDT, considering the optimization of rheological properties, dimer-to-monomer ratio (D/M) and aims to bring improvements in clinical applicability.

Methodology & Theoretical Orientation:

Hydroxypropyl methylcellulose (HPMC) and Carboxymethyl cellulose (CMC) were used, respectively, as nonionic and anionic polymers, to reach a viscosity between 30 and 450 cP. The modulation of the MB aggregation state was evaluated in the presence or absence of the anionic surfactant sodium dodecyl sulfate (SDS). In triplicate, absorption spectra were recorded in a UV-Visible UV-1800 spectrophotometer (Shimadzu,

Japan) from 250 to 800 nm using a 2 mm pathway cuvette. The D/M was determined by absorption values at 614 nm (dimer) and 662 nm (monomer). The D/M values underwent logarithmic transformation and were statistically analyzed using the one-way ANOVA test, followed by the Tukey *post test*, adopting $\alpha=0.05$. **Findings:** There was a lower D/M ratio with increasing concentration of polymers in the absence of SDS, however with the addition of surfactant, there was D/M reduction in formulations containing both polymers studied, with lower MB aggregation being observed in the formulation containing the anionic polymer CMC when compared to the nonionic polymer HPMC. **Conclusion & Significance:** The addition of SDS to the medium in which the photosensitizer was conveyed and the ionic charge of the polymer, influenced the MB aggregation behavior. Further adjusts to this formulation will be necessary to control MB aggregation.

Images (If any)

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Biography (150 word limit)

Carolina Montovam Monteiro is a Ph.D. student in Biophotonics applied to Health Sciences, has a Master's degree in Pharmacy (area of bioactive natural and synthetic products), a specialist in Homeopathic Pharmacy, graduated in Pharmacy and Biochemistry and Biological Sciences. She has experience as a compounding pharmacist for 21 years and as a professor in the pharmaceutical area for 12 years. She has been working as an undergraduate and graduate professor, including as the author of books and teaching materials. She is currently a dative defender for the Ethics Committee of the Regional Council of Pharmacy of the State of São Paulo (CRF-SP) and a pharmaceutical consultant in compounding pharmacies, working mainly with legislation and regulatory matters, technical-administrative management, quality assurance, pharmacotechnical development of cosmetics, homeopathic and allopathic medicines intended for topical, systemic and dental purposes, for human and veterinary use.

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