# Photobleaching in Endotracheal Tubes Functionalized with Curcumin

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To mitigate this issue, a process for functionalizing an endotracheal tube (ETT) with the photosensitizer curcumin has been developed. Curcumin is widely utilized in antimicrobial photodynamic therapy due to its strong antimicrobial properties and effectiveness in preventing biofilm formation. In this case, its use aims to mitigate biofilm formation on the tube's surface. The adopted methodology is as follows:

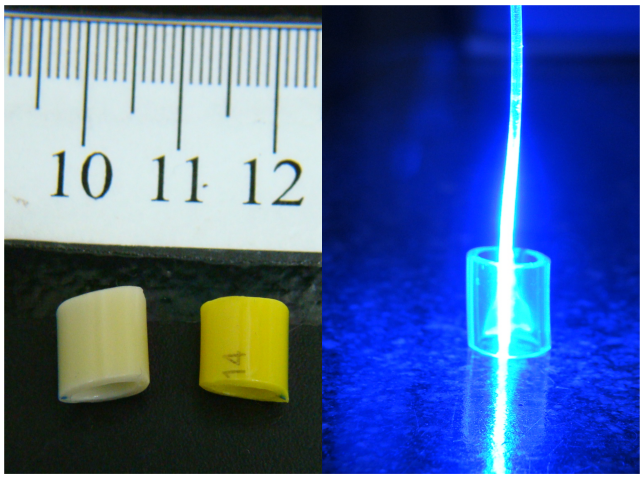

Figure 1: Effects of Photodegradation and Fiber Optic Illumination on Curcumin-Functionalized Endotracheal Tubes

The functionalization process involved immersing a polyvinyl chloride (PVC)-based ETT in a mixture of curcumin and cesium carbonate ($Cs_2CO_3$) in dimethyl sulfoxide ($C_2H_6OS$) (DMSO) solvent for 4 hours at 30°C under constant agitation. Following immersion, the tube was washed in DMSO for 40 minutes and subsequently in absolute ethyl alcohol for 40 minutes, both under constant agitation. Afterward, the tube was irradiated internally with a laser using an optical fiber to conduct the light, and evaluations were performed at each 100 J/cm$^2$ dose of radiation as you can see in Figure 1.

This study aims to evaluate the photodegradation of curcumin as a function of the total exposure dose to 445 nm radiation, used for curcumin excitation, with a source of 140 mW. The photodegradation process is expected to produce specific structural changes and by-products, which will be analyzed through various techniques, including Fourier-transform infrared spectroscopy (FTIR), fluorescence spectroscopy, absorption spectroscopy, and microbiological analyses. The expected outcomes include a detailed understanding of the photodegradation mechanisms and identification of resultant by-products. This study holds significant potential for clinical applications, as preventing biofilm formation on ETTs could substantially reduce the incidence of ventilator-associated pneumonia (VAP), improving patient outcomes in intensive care units.