# THE EFFECT OF CTAB ON THE RADIATION SENSITIVITY OF BENZOCAINE TO HYDRATED ELECTRONS AND HYDROXYL RADICALS IN AQUEOUS SOLUTION

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The primary chemical result of the irradiation of water after the deposition of energy is the formation of the following species.

$$H_2O \longrightarrow e^-_{aq} + \cdot H + \cdot OH + H_2 + H_2O_2 + H_3^+O$$

In a previous communication of some preliminary studies on the effect of surfactants on the radiation sensitivity of benzocaine in aqueous solution (Fletcher and Davies, 1974) no attempt was made to determine which of the radiolytic products of water resulted in the degradation of benzocaine, nor their apparent behaviour in the presence of surfactants. Bansal and others (1971) have reported that radiation-induced free radical reactions both with micelle-forming and solubilized substrates occur at significantly different rates when aggregation occurs. The present communication is a report on the effect of CTAB on the reaction of the hydrated electron ($e^-_{aq}$) and the hydroxyl radical (·OH) with benzocaine in aqueous solution.

To study the reaction of the $e^-_{aq}$ with benzocaine, methanol is used to scavenge ·OH and adjustment of pH of solution to 10-11 removes ·H. Similarly to study the reaction of ·OH with benzocaine, nitrous oxide ($N_2O$) is used to scavenge $e^-_{aq}$. 2 ml samples of $1.2 \times 10^{-4}$M aqueous solutions of benzocaine containing $10^{-2}$M methanol, $10^{-3}$M sodium hydroxide and CTAB (0, $10^{-4}$, $10^{-3}$ and $10^{-2}$M), and 2 ml samples of $1.2 \times 10^{-4}$M aqueous solutions of benzocaine containing CTAB (0, $10^{-4}$, $10^{-3}$ and $10^{-3}$M) and previously bubbled with $N_2O$ for 1 hour, were irradiated in a $Co_{60}$ source. The triple distilled water prior to use in preparing all the solutions was bubbled with $O_2$ for 1 hour. Following irradiation 1 ml samples were subjected to a modified Bratton-Marshall reaction and the absorbances of the resulting solutions were measured spectrophotometrically at 548 nm (Meakin and others, 1971). From the initial slope of curves from plotting percentage residual concentration of benzocaine against dose of radiation (k rads), the number of benzocaine molecules destroyed (G-value) per 100eV of absorbed energy was calculated. G-values for the $e^-_{aq}$ and ·OH in the absence and presence of CTAB are given in table 1.

Table 1. G-values for the Reactions of $e^-_{aq}$ and ·OH with Benzocaine and in the presence of CTAB

| CTAB concentration M | $G_{e^-_{aq}}$ + benzocaine | $G_{\cdot OH}$ + benzocaine |
|---|---|---|
| 0 | 0.18 | 1.59 |
| $10^{-4}$ | 0.27 | 1.39 |
| $10^{-3}$ | 0.24 | 1.27 |
| $10^{-2}$ | 0.27 | 0.81 |

These results would suggest that while CTAB increases the degradation effect of the hydrated electron on benzocaine it protects the drug against the ·OH particularly above its C.M.C.

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