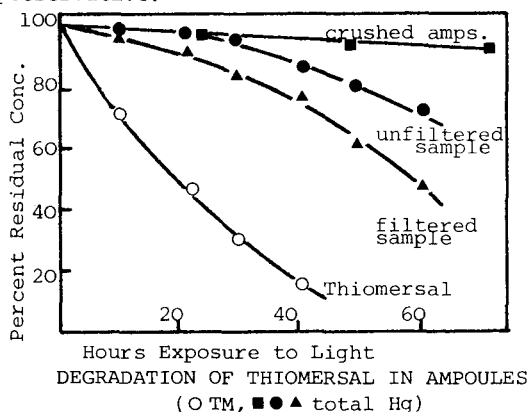


THE PHOTOSTABILITY OF THIOMERSAL

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Thiomersal (TM) is widely used as a preservative although its antibacterial efficiency is relatively low (Norton and others,1974), it is subject to thermal and photodegradation, (Tsuji & others,1964; Ludtke & others,1977) and it can be completely lost from solutions stored in plastics containers (Richardson & others 1977). The latter is unexpected since organic anions are not generally taken up by plastics (Kakemi & others,1971) and TM is the sodium salt of 2-ethyl-thiomercuri-benzoic acid, pKa 3.04 at 25°.

Tanaka & Mitsuno (1951) have reported that TM degrades to ethylmercuri 2-ethyl-thiomercuri-benzoate (II), 2-thiobenzoic acid (III) and ethylmercuri-hydroxide (IV). We have confirmed the presence of II, as a precipitate, and III in photo-degraded solutions of TM by chromatography and mass spectrometry. The assay techniques used in the TM stability and plastics interaction studies previously reported are thus non-specific for the preservative since UV spectroscopy estimates TM, II and III and both the dithizone and atomic absorption methods involve pre-oxidation to inorganic mercury and this determines TM, II and IV. The development of an hplc assay using a 25cm Spherisorb ODS column jacketed at 50°, 95% ethanol-Sorensen's citrate buffer, pH 6.5-17% tetrabutylammonium phosphate (200:797:3) as mobile phase and detection at 234nm has enabled us to compare the TM and total mercury content of degraded solutions. The figure shows TM in glass ampoules is rapidly degraded in a high intensity simulated daylight source (Cox,1975) and that total mercury determination by atomic absorption grossly overestimates the residual TM. 0.22µm membrane filtration of the samples prior to assay reduces the total mercury since II has a very low water solubility and initially precipitates as fine particles. Adhesion on to the ampoule walls and aggregation probably accounts for the fall in total mercury of unfiltered samples. Crushing the ampoule and its contents directly with the oxidation mixture prior to atomic absorption shows much smaller total mercury losses, perhaps arising from volatile degradation products. Studies in uniform cylinders showed the data for buffered systems could be reasonably fitted to first order rate plots although the rate constants were concentration dependent. The addition of 0.1% EDTA did not improve the photo-stability of the preservative.



TM Conc. (%x10 ³)	Rate Const. (s ⁻¹ x10 ⁶) *	Corr. Coeff
4.5	6.09(0.55)	0.988
4.5	6.09(0.55)	0.988
4.5	5.06(0.45)	0.988
4.5	5.25(0.45)	0.989
4.5+EDTA	5.27(0.52)	0.985
4.5+EDTA	5.57(0.71)	0.976
45.0	30.31(2.36)	0.991
45.0	32.50(1.09)	0.988

First Order Rate Constants
for the Photochemical
Degradation of TM in Citrate
Buffer pH 5.0
(*Standard deviation of rate
constant)

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