Ultrasonic Degradation of Thymine

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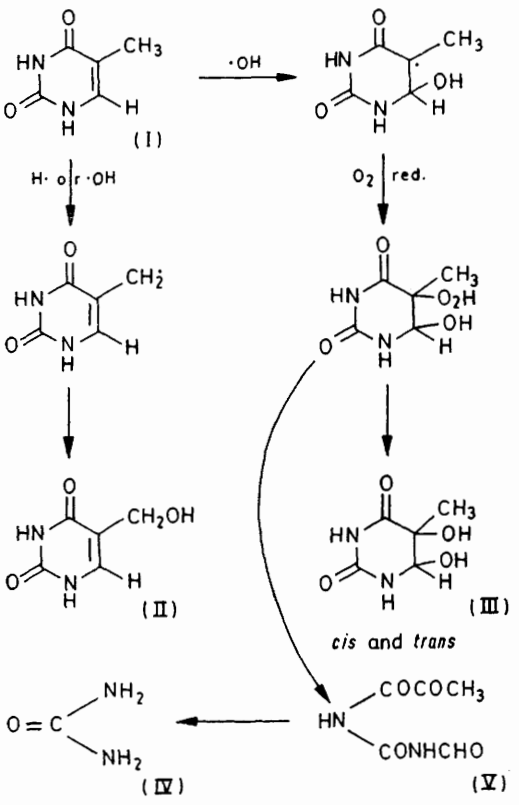
Summary Sonolysis at 450 kHz degrades an aqueous solution of thymine into at least six products of which four, 5-hydroxymethyluracil, *cis*- and *trans*-5,6-dihydroxy-5,6-dihydrothymine, and urea have been identified and a fifth tentatively assigned as *N*-formyl-*N'*-pyruvoylurea.



SCHEME

PREVIOUS studies of the sonolysis of thymine by Elpiner[1] showed that the chromophore at 264 nm was reduced by insonation at 560 kHz but no products were isolated. Re-investigation of the effect of ultrasound on aqueous solutions of thymine (I) (1×10^{-3}—2×10^{-2} M) at 450kHz† has resulted in the isolation of six components by various chromatographic procedures from solutions which were approximately 60% degraded. Four products which have been identified are 5-hydroxymethyluracil (II), *cis*- and *trans*-5,6-dihydroxy-5,6-dihydrothymine (III), urea (IV), and the fifth product is probably *N*-formyl-*N'*-pyruvoylurea (V).

The photochemical[2] and radiolytic[3] degradation of thymine have been extensively studied owing to the considerable interest in biological radiation damage. The above results clearly indicate that the effect of ultrasound is comparable to the effect of radiolysis on aqueous solutions of thymine. The primary event in sonolysis is cavitation with the probable production of the species ·OH, e^-_{aq}, ·OH_2, and H radicals,[4] and H_2O_2 and H_2 molecules. These radicals can then diffuse back into the bulk medium where they interact with the solute as shown in the Scheme which is similar to that proposed in the radiolysis of aqueous thymine.

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† Insonation of the solutions was carried out with a Macrosonics MC500-1 generator coupled to a Macrosonics HFS-450 cobalt barium titanate transducer mounted in a water cooled reaction cell.

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