A new UV photocatalytic dosimeter based upon I_3^- formation shows that gamma irradiation and photocatalysis produce similar destructive chemical species.

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Ionizing radiation (gamma/x-rays) produces radicals, oxidants, and reductants (ROR), useful for decontamination, which can be measured by dosimetry. Proposed dosimeters for gamma rays are based upon ROR mediated formation of tri-halide anions. We have developed a photocatalytic dosimeter that uses safer, long-wave UV irradiation, measuring tri-iodide (I_3^-) product formation from iodide (I^-). A KI solution in buffer (pH 7.2) was mixed with the commercial TiO_2 photocatalyst Evonik P-25 at a concentration of 0.1mg/mL and exposed to UV irradiation for 5 minutes. The production of I_3^- was measured by its absorbance at 350nm. The reaction kinetics were linear (plot of absorbance versus time), revealing reaction rate as the slope: 0.107 for Evonik P-25. Controls showed that if UV irradiation, the photocatalyst, or the iodide was absent, tri-iodide formation was almost not observed. We synthesized and screened several doped TiO_2 photocatalysts and 1% silver (0.067 slope) was the most effective for tri-iodide production. Our experiments demonstrate that photocatalytic oxidation of iodide can be used as a dosimeter to rank the effectiveness of photocatalysts, and that photocatalysis mimics gamma irradiation.