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This research explores the synthesis of a disulfide triazole organophosphate (DSTP) flame retardant via photochemistry approach. This method provides a safer, more sustainable alternative to traditional halogenated flame retardants, which have been banned due to their environmental persistence and toxicity. DSTP integrates phosphorus and sulfur for radical scavenger, and triazole moieties for environmental safety, aligning with NASA's Fire Protection Program and Green Chemistry principles. The synthesis follows a modular strategy designed to enhance efficiency, selectivity, and scalability. It begins with light-induced copper(I)-catalyzed click chemistry to form a triazole intermediate that undergoes nucleophilic substitution with phenyl phosphonic acid. Sulfurization using elemental sulfur converts the phosphonic acid to thiophosphate intermediate. This thiophosphate undergoes photocatalytic aerobic oxidation with Eosin Y to generate the DSTP. This metal-free, photochemically driven approach minimizes environmental impact while improving reaction efficiency and product stability. The results highlight the capabilities and flexibility of photochemical synthesis. This innovation is crucial for the development of next-generation, high-performance flame retardants with lower toxicity and greater thermal stability. The findings contribute to advancements in flame-retardant materials, sustainable photochemical methodologies, and scalable industrial applications. By reinforcing flow photochemistry's potential in functional material synthesis, this research develops safer, more effective fire protection technologies applicable to aerospace, industrial, and commercial settings.