Title:	A ‘self-activating’ Bi3TaO7–Bi4TaO8Br photocatalyst and its use in the sustainable production of pro-fluorophoric rhodamine-110
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Abstract:	We counter two common notions that (i) photocatalysts are likely to degrade during use with barely any strategy to counter it and (ii) rhodamine-B (RhB) photo-degradation lacks any useful or commercial prospects even after 53 years of its discovery by developing a photocatalyst that continues to improve its activity for ~300 h due to a leaching induced ‘self-activation’ process. Rhodamine-110 (Rh110) is a widely used pro-fluorophore in biological studies. However, its commercial production is highly challenging due to the formation of various side-products originating from the presence of the two labile amino side-groups that induce the pro-fluorophore activity, leading to purification difficulties, low yield, and unusually high costs. Herein, we demonstrate a facile strategy to produce pure Rh110 using extremely inexpensive RhB and Bi3TaO7–Bi4TaO8Br heterostructures as a catalyst in sunlight. The catalyst is not just stable over 30 catalytic cycles but also gets activated continuously in successive cycles to produce a reaction yield as high as 88%. The role of the heterostructure, the origin of surface activation, and the RhB → Rh110 transformation mechanism have been established. Based on 150 days of sunlight experiments, large-scale production prospects (~4000 times scale-up) and isolation of Rh110 have also been realized, paving a novel way for its production by anyone, inexpensive biological essaying, and device fabrication. Continuously improving catalysts are unknown and compensatory leaching of metal atoms from the catalyst surface may pave the way to realize them.
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