# Supporting Information

## Photocatalytic Hydrogels for Removal of Organic Contaminants from Aqueous Solution

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## 1. Light absorption by methylene blue

The molar absorption coefficient of methylene blue for light at a wavelength of 665 nm was determined by preparing solutions of MB at concentrations of 2.34, 4.69, 9.38, 18.76, and 37.52 µM (0.75, 1.5, 3, 6, and 12 mg $L^{-1}$ respectively) in DI water. Absorption spectra were collected for each, as shown in Figure S1. A linear regression of the absorbance at 665 nm versus the molar concentration was used to determine the molar absorption coefficient, as described by Beer's Law (Equation S1), where $A$ is the absorption at a given wavelength, $\varepsilon$ is the molar absorption coefficient in units of $M^{-1}$ $cm^{-1}$, $b$ is the optical pathlength in cm, and $c$ is the MB concentration in units of M. The molar absorption coefficient was determined to be 6.71 x $10^4$ $M^{-1}$ $cm^{-1}$.

$$A = \varepsilon bc \qquad (Equation\ S1)$$

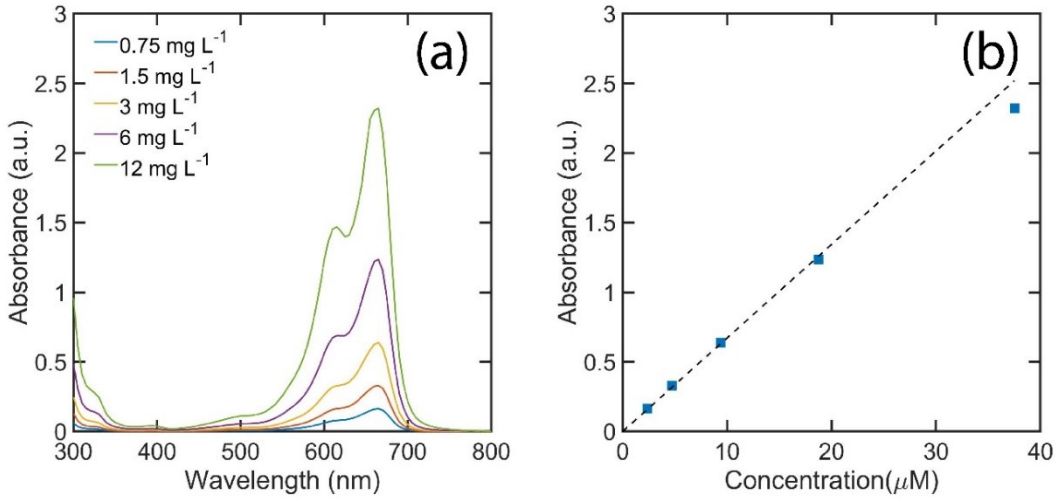


Figure S1: (a) Absorption spectra of methylene blue at several concentrations in DI water. Peak absorbance (at 665 nm) was used to calculate the molar absorption coefficient, represented as the slope in panel (b) for a path length of 1 cm. The absorption coefficient was determined to be 6.71 x $10^4$ $M^{-1}$ $cm^{-1}$. The same method was used to obtain the absorption coefficient at 365 nm (975 $M^{-1}$ $cm^{-1}$).

## 2. CAD design of photoreactor molds

The hard molds used in the first step of photoreactor fabrication were designed using Autodesk Fusion. Design schematics are shown in Figure S2. These molds were filled with PDMS resin which was crosslinked inside the mold. The cured PDMS was then used as the reaction vessel for hydrogel

polymerization and crosslinking. The as-fabricated hydrogels were 37.54 mm long, 11 mm wide, and 2 mm thick. The channels were 0.94 mm wide and had a total length of 25.54 mm from the center of the inlet reservoir to the center of the outlet reservoir. Inlet and outlet reservoirs were circular, with a radius of 1.5 mm.

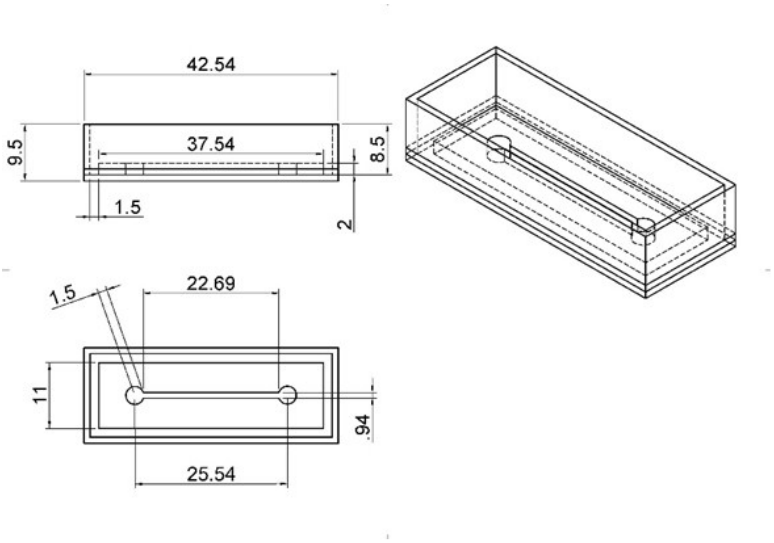


Figure S2: CAD design schematic of the mold used to fabricate hydrogel reactors. The mold shown was 3D printed and used to cast a PDMS soft mold with inverted features. The PDMS was then used as a mold for photopolymerization and crosslinking of HEMA and AA. All dimensions shown are in mm.

## 3. Light source emission spectrum

A VWR UV hand lamp (catalog number 89131-492) was used to provide irradiation. The hand lamp has 365 nm and 254 nm bulbs and was operated at 365 nm. The emission spectrum of the 365 nm bulb was measured using a Stellarnet BLK-C spectroradiometer (CR2 cosine receptor) at 3.8 cm (the distance between bulb and monomer mixture during polymerization) and at 2 cm (the distance between bulb and PS slide during reactor operation. The light source provided illumination of 0.28 mW $cm^{-2}$ at 2 cm and 0.25 mW $cm^{-2}$ at 3.8 cm.

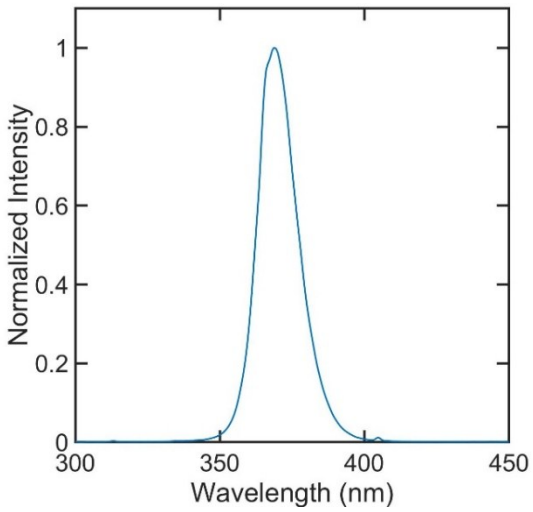


Figure S3: Normalized emission spectrum of the UV hand lamp used for reactor illumination. Light intensity at 365 nm was measured as 0.28 mW $cm^{-2}$ at a distance of 2 cm and 0.25 mW $cm^{-2}$ at 3.8 cm.

## 4. Light absorption by polystyrene cover and hydrogel

The open face of the hydrogel channel was sealed with a polystyrene (PS) slide held in place with a 3D-printed scaffold. Light absorbance spectra of the PS and hydrogel were measured, given that light emanating from the UV lamp would pass through both before reaching $TiO_2$ photocatalysts embedded in the gel. Absorbance spectra are shown in Figure S4. The path length of the PS cover was fixed at 0.73 mm and transmitted 79.5% of incident light at 365 nm. The 2 mm thick hydrogel did not absorb strongly in the visible light region, but absorbed substantially more in the UV. From this spectrum, the light absorption coefficient of the hydrogel at 365 nm was determined to be 0.412 $cm^{-1}$, indicating half of incident 365 nm light was absorbed within the first 730 μm of hydrogel (Figure S4b). The penetration depth of MB, especially over 2 hours of operation, was comparatively small (~100 μm). However, for longer operation the penetration depth approached 800 μm. On this longer length scale, light attenuation by the hydrogel was significant enough that photocatalytic activity would decrease throughout the length of the gel.

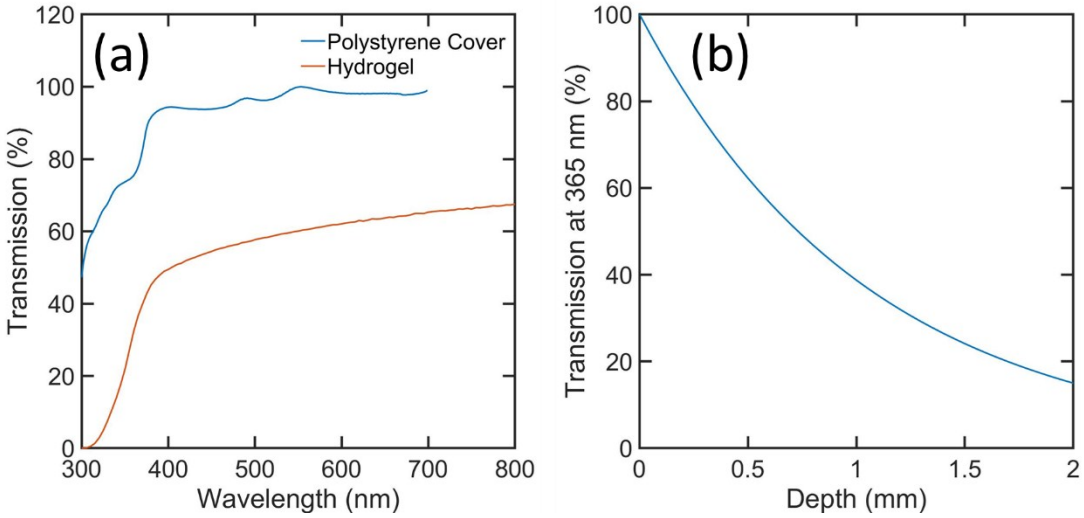


Figure S4: (a) UV-visible transmission spectra of the 0.73 mm thick PS cover (blue) used to seal the open face of the channel and the 2 mm thick hydrogel (orange). (b) Calculated transmission profile of the hydrogel for 365 nm light indicated 50% of incident 365 nm light was transmitted beyond the first 730 μm.