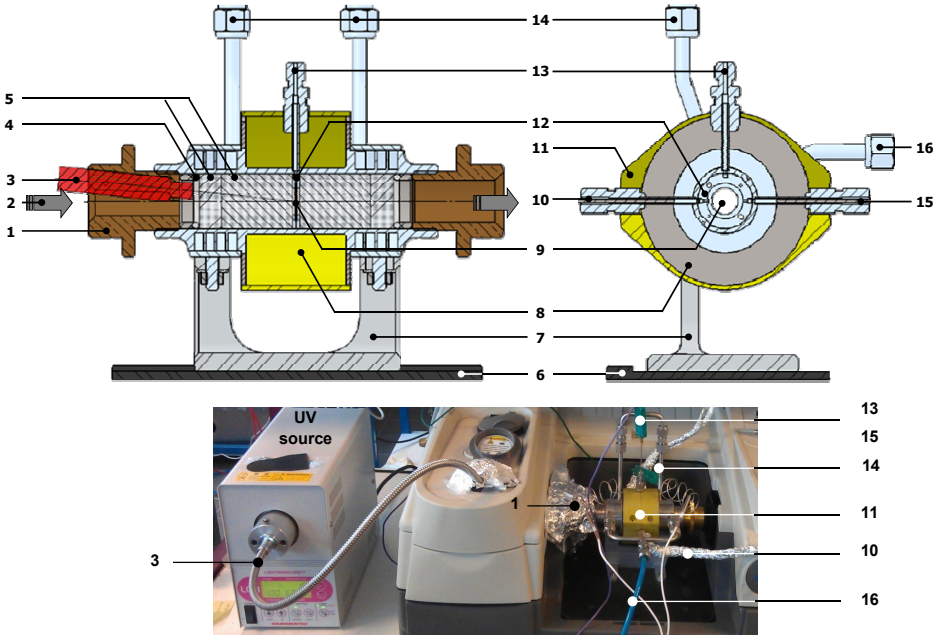
Supplementary information for publication



Scheme-S1 Longitudinal (Top-left) view, radial (Top-right) view and picture (bottom) of the sandwich reactor-IR cell modified for UV catalysis study. 1 - Adjusting nut for airtightness (modified for UV-guide position), 2 - IR *BEAm, 3 -UV-light guide, 4 – Kalrez O-ring, 5 – KBr windows, 6 - Spectrometer base-plate, 7 - IR cell support, 8 – Oven location, 9 – Sample (wafer), 10 - Gas inlet, 11 - External shell, 12 - Wafer holder, 13 - Thermocouple location, 14 - Air cooling outlet, 15 - Gas outlet, 16 – Air cooling inlet.

Table-S1. Characteristics of different photcatalysts used in this work.

sample	**Specific surface area (m^2/g)**	**Mesoporous volume (cm^3/g)**	**Mesoporous diameter (nm)**
Fibres luffa	< 1	<0.001	--
TiO_2/luffa	16	0.016	4.4
TiO_2-L	90	0.14	10.0
TiO_2 powder	235	0.24	4.2
TiO_2-P25	55	_	--

Table-S2. Reactivity, selectivity and turnover frequency of the photooxidation of 1900 ppm of methanol under different polychromatic irradiation intensities using TiO_2/Luffa composite as photocatalysts (Flow= 25 cm^3/min, I_0=25%, m_{pellet}=90 mg →m_{TiO2}~ 2.9mg).

I_0 (%)	[MeOH] converted (ppm)	Conversion (%)	CO_2-selectivity (%)
25	1102	58	30
50	1445	71.6	100
75	1433	75.4	100
100	1440	76	100

Synthesis procedure

The sol gel synthesis conditions of TiO_2 have been optimized prior to the preparation of the TiO_2/Luffa composites. Two parameters were considered: the synthesis time duration and the temperature. The X-ray diffraction patterns of the samples prepared at different temperatures for 48 hours are reported in Figure S1. It has been observed that the anatase phase begins to appear at 60 °C but with very low yield (Figure S1). For the samples that have been prepared at temperatures above 60 °C, the cristallinity and the yield were much higher. Thus the temperature that has been used for the preparation of the Luffa composites was 100 °C. It should be noted that higher temperature could affect the mechanical properties of Luffa fibers.

The synthesis time duration was also investigated in this study. Figure S.2 shows the X-ray diffraction patterns of the resulted samples obtained at 100 °C for different time durations. It has been observed that the yield increases when the time duration increases. Indeed the anatase phase appears at 100 °C after 2 hours but the formation yield is very low (Figure S2).

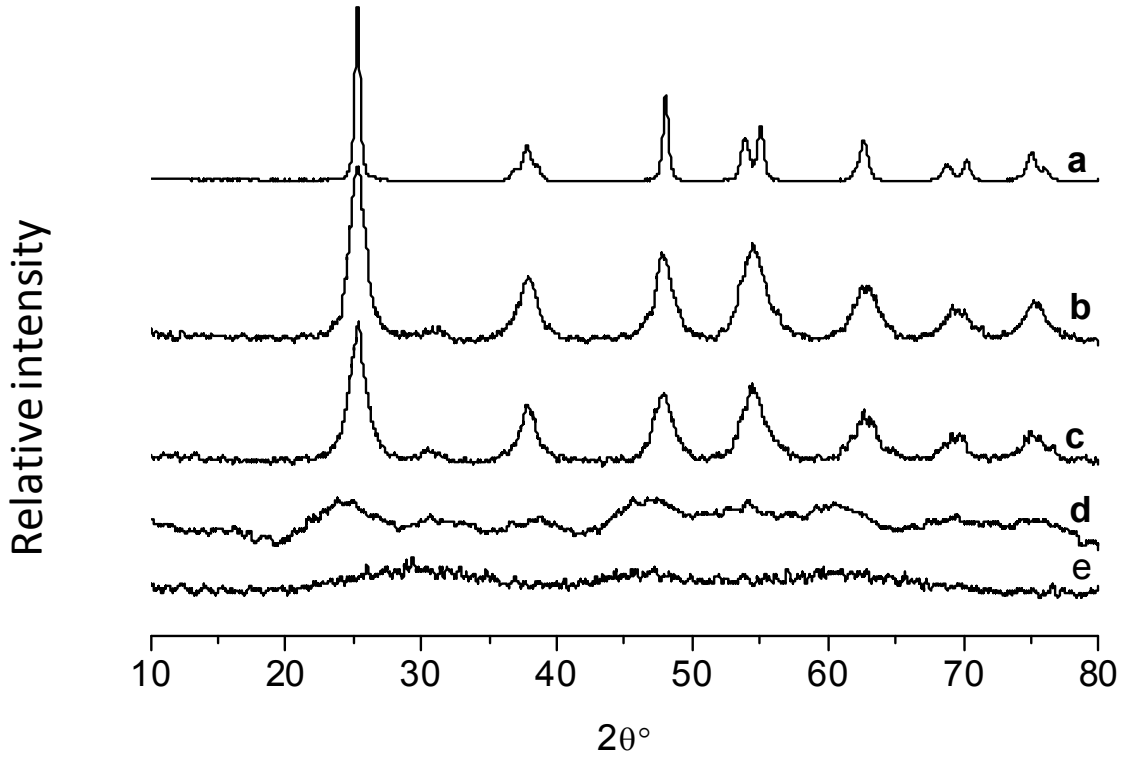


Fig. S1. X-ray diffraction patterns for anatase phase (a) and TiO_2 prepared for 48 hours at 100°C (b), 80°C (c), 60°C (d) and 35°C (e).

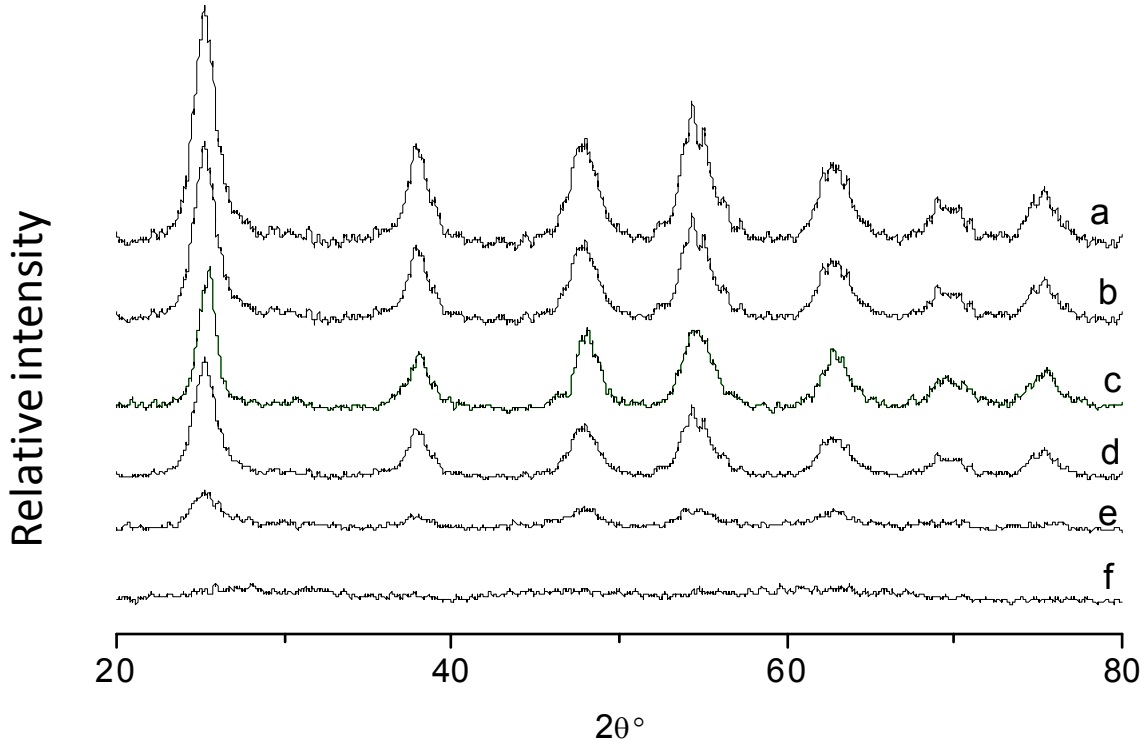


Fig. S2. X-ray diffraction patterns for TiO_2 samples prepared at 100 °C for : (a) 48 h,(b) 12 h,(c) 7h,(d) 3 h,(e) 2 h, (f)1h .

Water purification

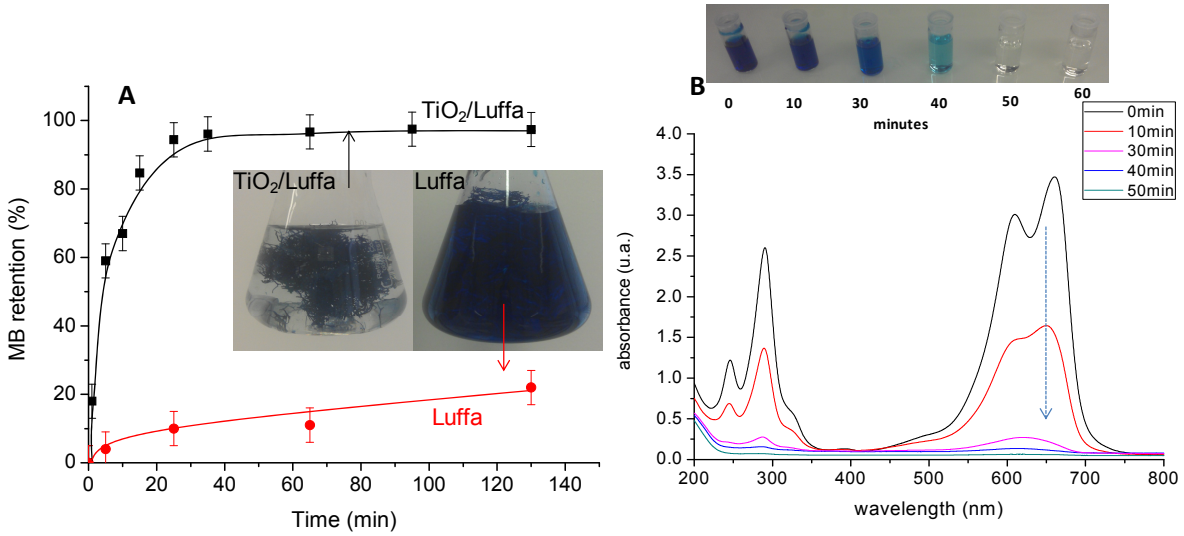


Fig. S3. A) Removal of MB (*0,27 mM*) From 500 ml of water using Luffa fibers and TiO_2/Luffa composite. B) The original UV-spectra of MB solution at different filtration times using TiO_2/Luffa composite.

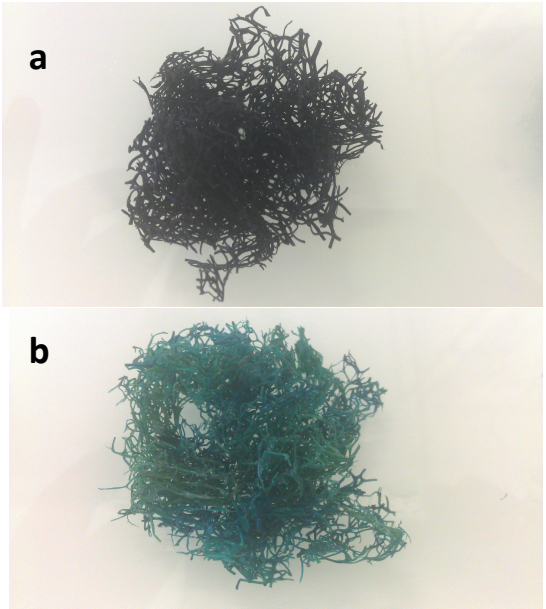


Fig. S4. Luffa fibers (a) and TiO_2/Luffa composite after the removal of MB(0.13 mmol) followed by 10 minutes of polychromatic UV-irradiation under air condition.