

Supporting Information

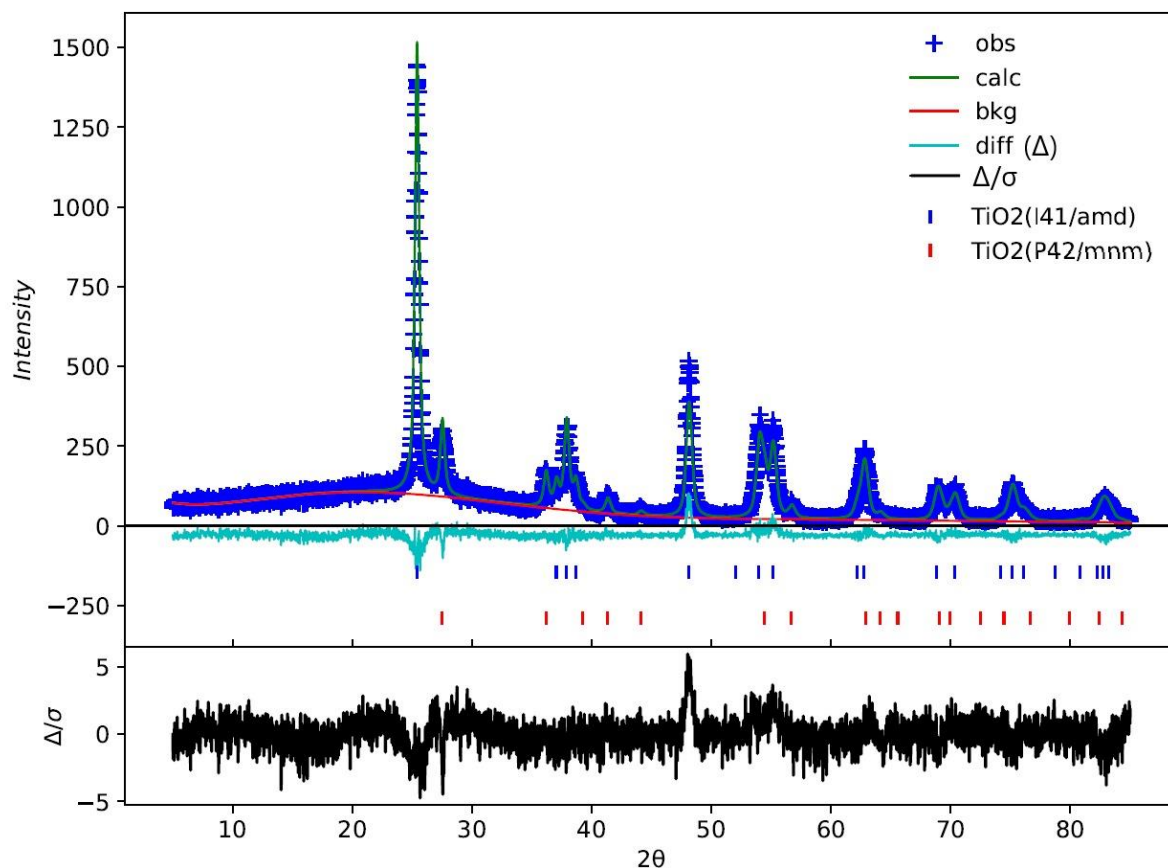


Figure S1. Observed (blue line) and calculated (green line) X-ray diffraction patterns and their difference profile (turquoise line: $I_o - I_c$) for the X-ray diffraction pattern of TiO₂ using the Le Bail method by GSAS-II program. The lowest curve (black line) shows the difference between the observed and calculated powder diffraction patterns divided by standard deviation $\sigma(I_o)$ of observed pattern plotted against 2θ .

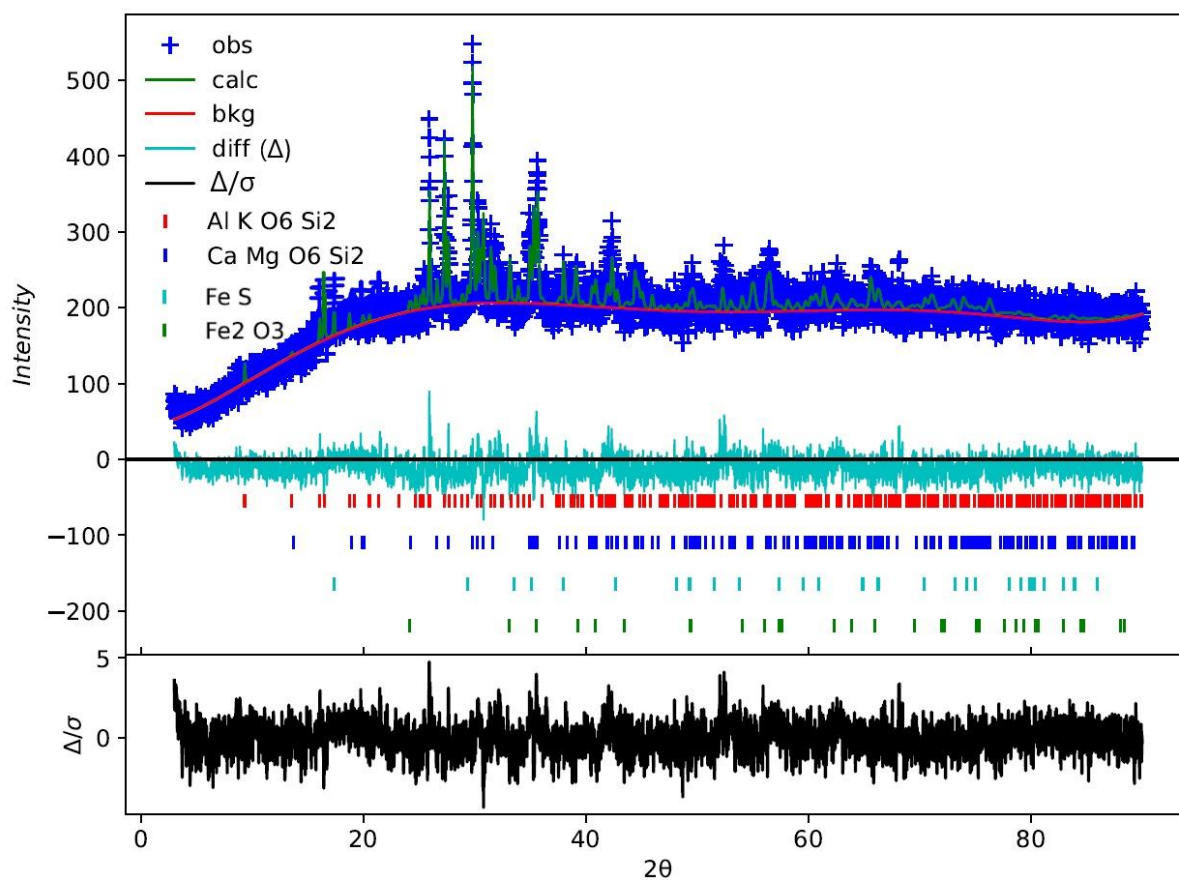


Figure S2. Observed (blue line) and calculated (green line) X-ray diffraction patterns and their difference profile (turquoise line: $I_o - I_c$) for the X-ray diffraction pattern of volcanic glass using the Le Bail method by GSAS-II program. The lowest curve (black line) shows the difference between the observed and calculated powder diffraction patterns divided by standard deviation $\sigma(I_o)$ of observed pattern plotted against 2θ .

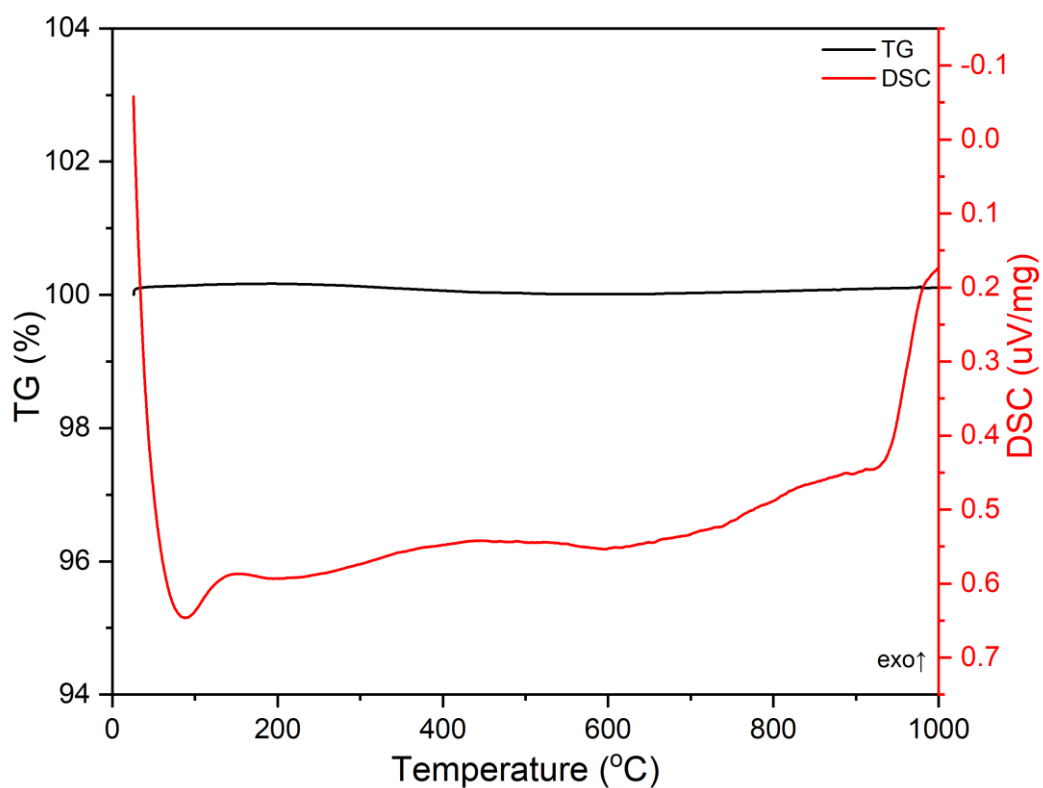


Figure S3. TG/DSC curves for volcanic glass sample measured in dry nitrogen using a thermoanalyzer (NETZSCH 449F3A–0372–M) over the temperature range of 20– 1000 °C. The parameters during measurements were as follows: crucible of DSC/TG pan Al₂O₃; heating rate 10 K min^{–1}

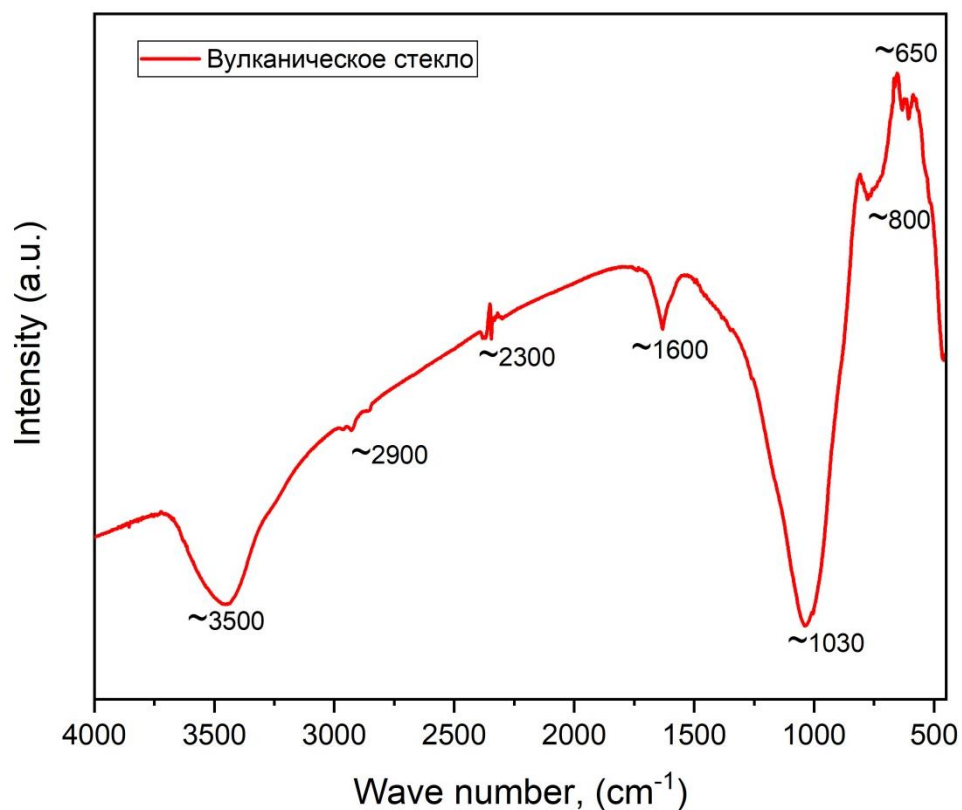


Figure S4. An IR spectrum was conducted for a sample of volcanic glass substrate, encompassing wavenumber values ranging from 450 to 4000 cm⁻¹. Through factor group analysis of the vibrations associated with Si–O–Si and Al–O–Si bonds within the glass sample, the IR spectrum reveals several significant features. These include a principal absorption peak at 1035 cm⁻¹, a relatively strong peak at approximately 1600 cm⁻¹, and a weaker peak around 800 cm⁻¹. Additionally, there are minor peaks observed at approximately 650 cm⁻¹, 2300 cm⁻¹, and 2900 cm⁻¹.

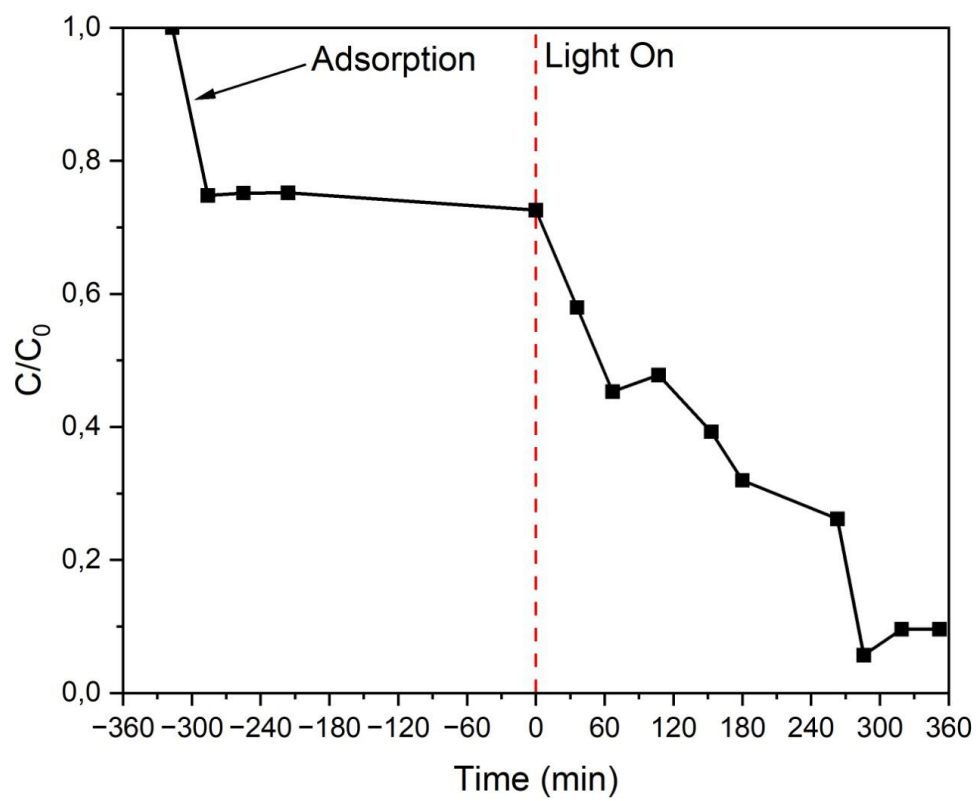


Figure S5. Evolution of the toluene concentration with time under recirculation over TiO_2 /volcanic glass

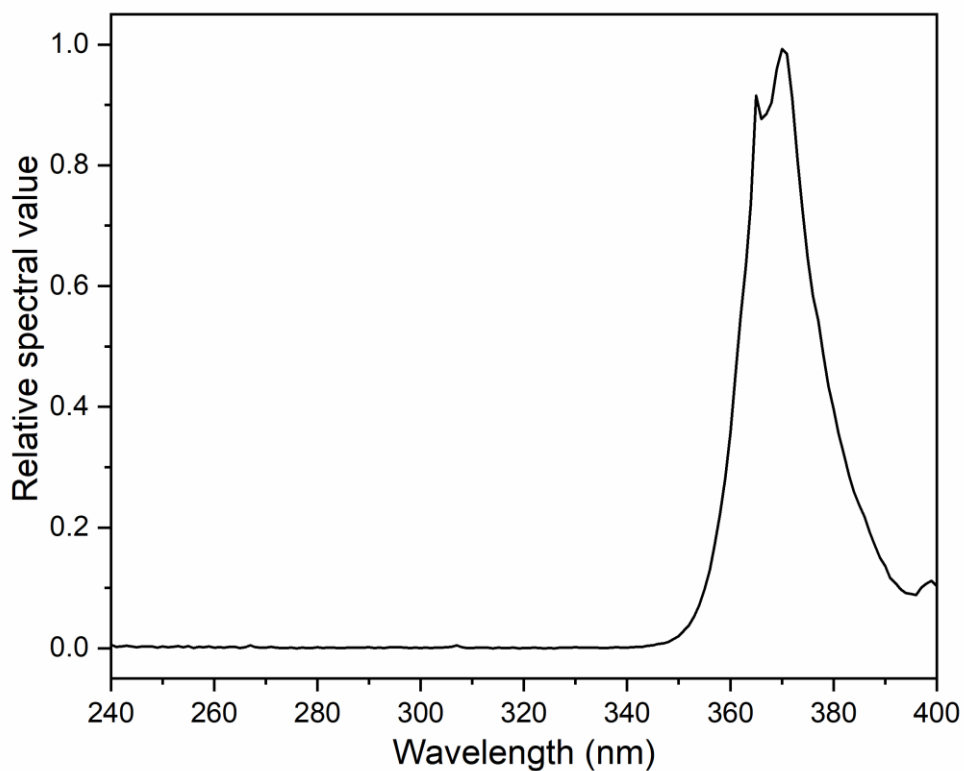


Figure S6. Emission spectrum of the 36W fluorescent tube (Philips-PL-L-36W/10/4)

with a spectral peak centered on 371 nm. The lamp emits with an irradiance:

Items	value	Items	value	Items	value
Eu _{vb} (mW/cm ²)	3.3117E-2	Eu _{vc} (mW/cm ²)	6.3672E-2	Eu _{va} (mW/cm ²)	1.5051E1
L _p (nm)	370.8	HW(nm)	16.2	E _e (240.0~300.0)(mW/cm ²)	8.0666E-2