SUPPLEMENTARY INFORMATION

2.2 Fabrication of photoanodes

The $BiVO_4$ purchased from Chem Scene Sdn. Bhd. was used directly to prepare the $BiVO_4$ photoanode. The preparation process consisted of two main steps: (1) synthesis of photoanode material (catalyst), and (2) deposition of the catalyst onto the fluorine-doped tin oxide (FTO) film.

2.2.3 Fabrication of fibrous silica (SiO_2)

As previously reported by our group, fibrous silica (KKC-1) was successfully synthesized using the microemulsion approach [1]*. In a brief, about 15 g of surfactant (CTAB) together with 6 g of hydrolyzing agent (urea) were dissolved in distilled water with vigorous stirring for 1 h under room standard room conditions. After that, a 5:2 M ratio of toluene and butanol was added to the blend solution and constantly agitated for 1 h. Next, approximately 10 mL of TEOS was mixed with this mixture and agitated for 4 h prior to the heating at 423 K. Then, the solution was transferred into the beaker before let dried overnight at 383 K. After that, the white solid obtained was ground into a fine powder before undergoing heating treatment at 823 K with a ($q = 3\ K\ min^{-1}$, $t = 8\ h$).*

2.2.3 Fabrication of fibrous silica supported bismuth vanadate ($BiVO_4$@SiO_2)

The composite of ($BiVO_4$) loaded onto fibrous silica (SiO_2) was synthesized by the effortless impregnation method [2]. In a typical synthesis, the pristine $BiVO_4$ was used as the metal seed and the preparation procedure for $BiVO_4$/SiO_2 was as follows. Initially, $BiVO_4$ and SiO_2 with a ratio of 0.1:1 by weight were transferred into two separate beakers containing 50 mL of distilled water and then stirred at medium speed for 30 min at 323 K. The solution containing $BiVO_4$ catalyst was labelled as solution A. Meanwhile, the solution containing the SiO_2 catalyst was labelled as solution B. After 30 min of homogeneous stirring, solution A was then mixed with solution B and continuously stirred at 353 K for 2 h. Then, the temperature of the solution was rise to 373 K and let continuously stirred until the solution is completely dried. Next, the obtained catalyst was dried in the oven at 383 K to ensure the complete removal of residual moisture. Finally, the obtained greenish-white solid was ground into a fine powder and calcined for 8 h ($T = 823$ K, $q = 3$ K min^{-1}).

2.2.3 Fabrication of fibrous silica bismuth vanadate (FSBVO)

Fibrous silica bismuth vanadate (FSBVO) was successfully prepared via an in-situ microemulsion technique, following the method outlined in a previous study as shown in Fig. 1 [3]. Importantly, commercial $BiVO_4$ was used as the metal seed instead of MoO_3. Briefly, a perquisite amount of urea, water, and CTAB was mixed in a 2 L Teflon flask, and the resulting solution was vigorously stirred for 30 minutes to ensure uniform mixing. Afterward, toluene and butanol were introduced to the mixture in a 5:2 molar ratio and stirred

continuously for 1 hour. Subsequently, TEOS was added gradually dropwise to the reaction mixture, which was continuously stirred for 8 hours at 423 K. The resulting solution was then subjected to microwave irradiation at a power of 480 W for 2 hours. Following this, the mixture was centrifuged to isolate a bright yellow precipitate. The precipitate was thoroughly washed with acetone and distilled water and then dried overnight at 403 K. The dried product was finely ground into a powder and underwent calcination in a muffle furnace at 853 K for 8 hours, with a controlled heating rate of 3°C per minute. The resulting product was placed in a sample bottle and labeled as FSBVO.

2.2.4 Deposition of photoanode materials

The fabricated FSBVO photoanode was deposited onto a fluorine-doped tin oxide (FTO) coated glass substrate (1 cm × 1 cm) using the carbon paint method, as described in a previous study [4]. The photoanode was initially pre-dried on a hot plate at 50°C for 10 minutes, followed by overnight drying in a desiccator. An identical procedure was applied for the preparation of the commercial $BiVO_4$ photoanode.

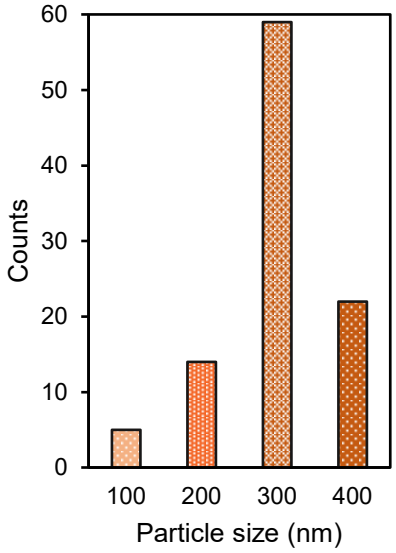

Fig. S1 Particle size distribution of FSBVO catalyst.

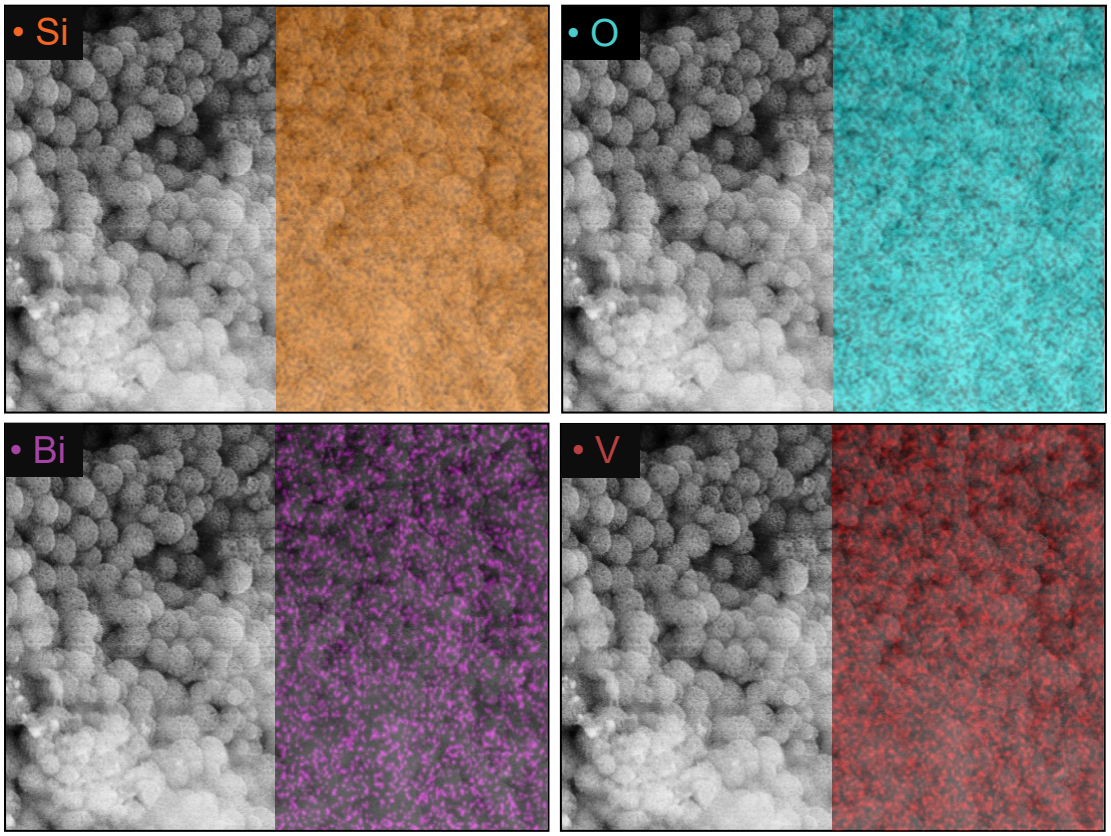

Fig. S2 FESEM images of FSBVO catalyst with elemental distribution of Si, O, Bi and V.

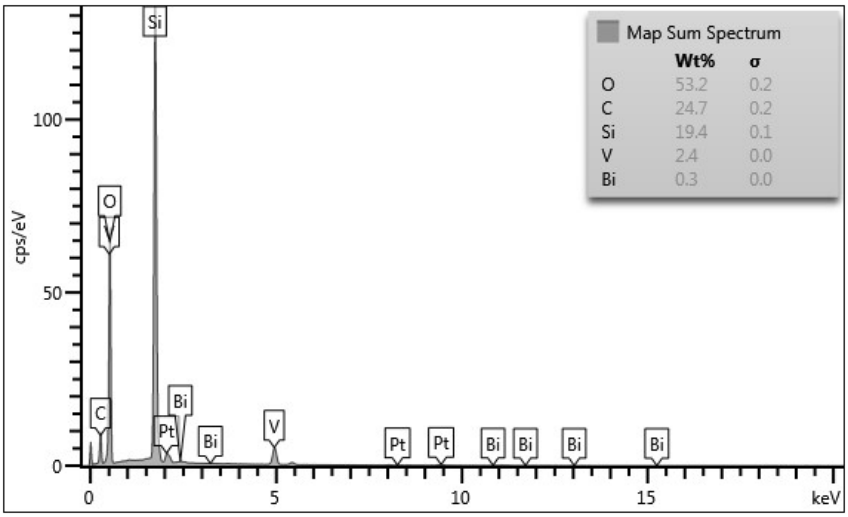

Fig. S3 FESEM-EDX analysis of FSBVO catalyst.

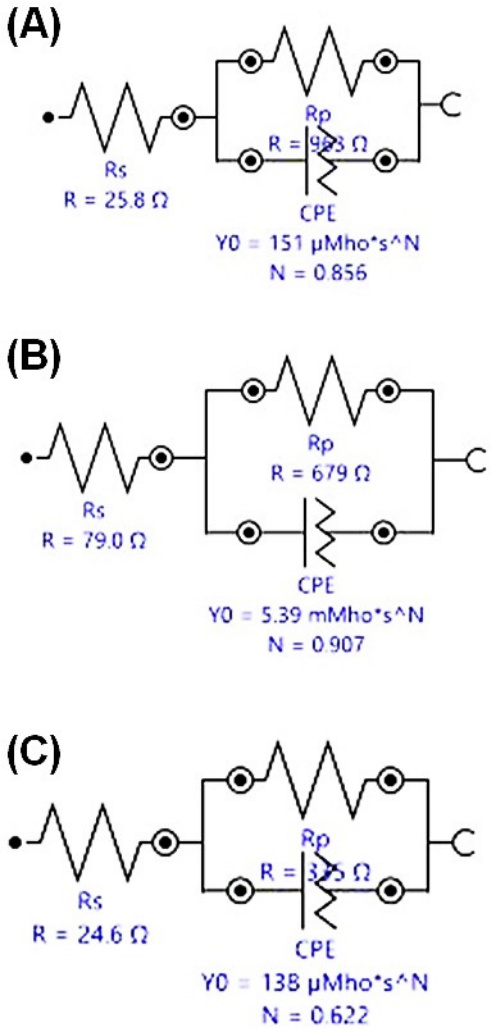

Fig. S4 Equivalent circuit for (A) $BiVO_4$, (B) $BiVO_4$@SiO_2 and (C) FSBVO photoanodes.

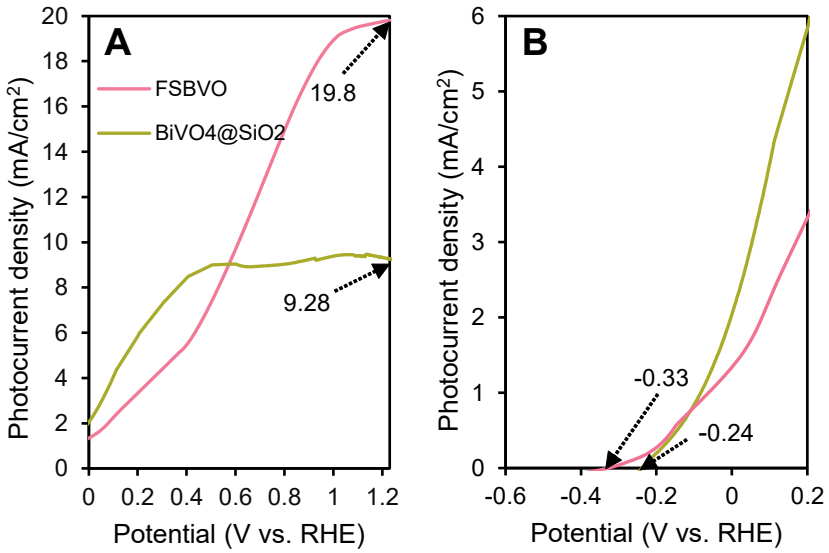

Fig. S5 Linear sweep voltammetry and (B) onset potential of FSBVO and $BiVO_4$@SiO_2 photoanode.

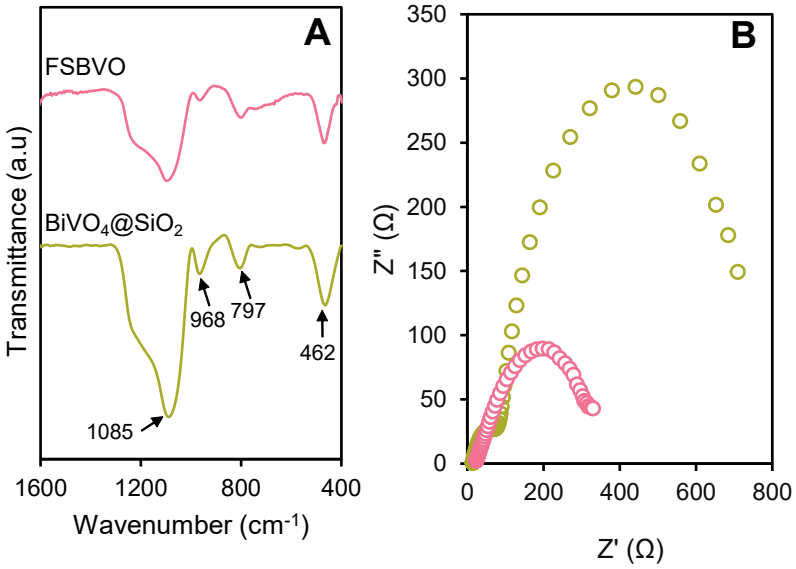

Fig. S6 FTIR spectra and (B) Nyquist plot of FSBVO and $BiVO_4$@SiO_2 photoanode.

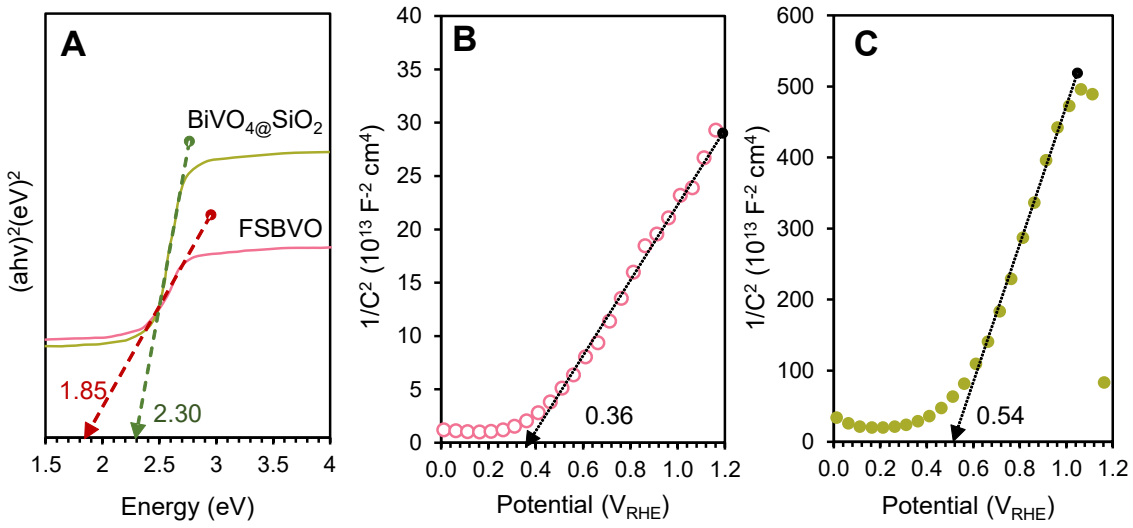

Fig. S7 (A) Plot of Kubelka-Munk transform versus energy of light; Mott-Schottky plot for (B) FSBVO and (C) $BiVO_4$@SiO_2 photoanodes.

Table S1

Optical and photoelectrochemical properties of $BiVO_4$-based photoanodes.

Photoanodes	Bandgap[a] (eV)	N_D (x 10^{26} cm^{-3})	E_{fb} (V_{RHE})	R_s (Ω)	R_{ct} (Ω)
$BiVO_4$	2.35	1.99	0.56	25.82	962.68
FSBVO	1.85	32.66	0.36	24.58	334.56
$BiVO_4$@SiO_2	0.36	1.14	0.54	79.04	679.08

[b] *Bandgap calculated using Kubelka-Munk (K-M) plots.*

**N_D: carrier density, E_{fb}: flat band potential*