Electronic Supplementary Information

Pyridine intercalated facile synthesis of ultra-long V$_2$O$_5$ nanowire from commercial V$_2$O$_5$: Catalytic application in selective dye degradation

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S1. Reagents Used:

All reagents used for the synthesis process were of AR grade and applied without any further purification. Distilled water was employed for carrying out the whole experiment. We use commercial V$_2$O$_5$ from Merck, HNO$_3$ acid from Merck 69% GR, SRL extrapure pyridine for synthesis ultra-long V$_2$O$_5$ NW. For washing purpose, ethanol from Changshu Yangyuan chemical china and acetone are used.

Dyes used for analytical purpose are methylene blue (MB), methyl green (MG), rhodamine B (Rh B), crystal violet (CV) is supplied from LOBA Chemie. Malachite green (Mal. G) is supplied by Merck.

S2. Instrumentation:

Powder X-Ray diffraction (XRD) was recorded with a Philips PW-1710 X-ray diffractometer (40kV, 20 mA) using Cu Kα radiation (λ = 1.5418 Å) in the range of 5°-90° at a scanning rate of 0.5° min$^{-1}$. For analysing the XRD data, JCPDS software guided us.

Fourier transform infrared (FTIR) spectral studies were done in KBr pellets in reflectance mode with Thermo- Nicolet continuum FTIR microscope.

Surface morphology was analysed using field emission scanning electron microscopy (FESEM) with a supra, Carl Zeiss Pvt. Ltd. Elemental detection of material was done with an energy dispersive X-ray microanalyser (OXFORD ISI 3000 EDAX) attached to the scanning electron microscopy.

For gaining further information in structural analysis, transmission electron microscopy (TEM) analysis was done with the help of Hitachi H-9000 NAR transmission electron microscope, using accelerating voltage at 200 kV.

X-ray photoelectron spectroscopy (XPS) analysis was performed to determine the different chemical states of the elements on the surface with the help of VG Scientific ESCALAB MK II spectrometer (UK) equipped with Mg Kα excitation source (1253.6 eV) and a five-channeltron detection system.

UV-visible spectral analyses were done using SPECTRASCAN UV 2600 digital spectrophotometer (Chemito, INDIA).

Diffusion reflectance spectroscopy (DRS) analysis was done using Cary model 5000 UV-vis NIR spectrophotometer.
Ion chromatography (IC) analysis was done using model 803 basic IC plus supplied by M/s, Metrohm, Florida, USA.

**Tab. S1**: Concentration of sulfate ion (SO$_4^{2-}$) present in the solution of 20 ml (5X10$^{-5}$) M MB after degradation by V-1 at catalyst dose of 0.25 g/L.

<table>
<thead>
<tr>
<th>Peak number</th>
<th>Retention time (min)</th>
<th>Area (μS/cm) x min</th>
<th>Height (μS/cm)</th>
<th>Concentration (ppm)</th>
<th>Component name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15.698</td>
<td>0.3623</td>
<td>0.756</td>
<td>5.073</td>
<td>Sulfate (SO$_4^{2-}$)</td>
</tr>
</tbody>
</table>

**Fig. S1**: Degree of decolouration of MB in dark condition.
Fig. S2: FTIR spectra of (a) bulk V$_2$O$_5$ used as precursor. (b) Represents comparison of FTIR between as-synthesised V-1 and V-2 type of NW.

Fig. S3: Determination of size parameter for (a) V$_2$O$_5$ NW (V-1) prepared from pyridine-HNO$_3$ system and (b) V$_2$O$_5$ NW (V-2) prepared from pyridine derived synthesis.
**Fig. S4:** FESEM images of V$_2$O$_5$ nanostructure using (a) PVP (neutral), (b) SDS (anionic) and (c) CTAB (cationic) surfactants.
**Fig. S5:** UV-vis spectra of (a) Crystal violet (CV), (b) Malachite green (Mal. G), (c) Methyl green (MG) when reaction carried out with 0.25g/L catalytic dose V-1 NW.

**Fig. S6:** Band gap determination of different samples; bulk V$_2$O$_5$, V-2 NW, V-1 NW and MB/V-1 NW.
**Fig. S7:** Comparison of degree of decolouration of MB amongst different sets e.g. $\text{H}_2\text{O}_2 + \text{V}_2\text{O}_3$ bulk, $\text{H}_2\text{O}_2 + \text{V}_2\text{O}_5$ NW, only $\text{H}_2\text{O}_2$ and only V-1 NW.