Design and fabrication of Ag₃VO₄/g-C₃N₄ heterostructure photocatalyst for enhanced visible light degradation of various organic pollutants

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Abstract

In later years, numerous viable photocatalysts have been created in order to illuminate the issues of natural toxins. In this work, heterostructured photocatalysts $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ were prepared by effortless hydrothermal route in order to anchor Ag_3VO_4 on the surface of the $\text{g-C}_3\text{N}_4$ nanosheets. The prepared samples were fairly characterized using X-ray diffraction (XRD), Energy dispersive analysis of X-rays (EDAX), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), UV-vis diffuse reflectance spectroscopy (UV-DRS), photoluminescence, and X-ray photoelectron spectroscopy (XPS) techniques. The photocatalytic activity of the samples was evaluated by degrading malachite green (MG) and 2,4 dimethyl phenol (DMP) in aqueous solution under visible light irradiation. Compared with Ag_3VO_4 and $\text{g-C}_3\text{N}_4$, the heterojuncted photocatalyst 50 wt% $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ exhibits the best activity such as high degradation efficiency (99%), high apparent constant (0.0923 min^{-1}) and long term stability towards DMP under visible light irradiation. The development of a phase scheme heterojunction between Ag_3VO_4 and $\text{g-C}_3\text{N}_4$ improved the photocatalytic efficiency of $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ composites. Furthermore, the porous structure of $\text{g-C}_3\text{N}_4$ and the effect of Ag surface plasmon resonance (SPR) speed up the isolation and transfer of electron-hole pairs, reducing the likelihood of recombination.

1. Introduction

Natural disasters and oil crises have been the most pressing issues for humanity in recent decades, as the human population has increased and the planet has become more developed. Fortunately, photocatalysis is regarded as a potential solution to dealing with these crises as a novel green breakthrough that can produce renewable hydrogen energy and dispose of natural toxins using solar light [1–4]. Numerous efforts have been focused on producing tall execution photocatalysts [6–10] since Fujishima and Honda first demonstrated that TiO_2 would part water to create hydrogen under UV light in 1972 [5]. About the fact that TiO_2 has a high photocatalytic activity and is non-toxic, its large band-gap (3.2 eV) can only be energized by UV radiation, which only accounts for around 4% of sun-based light [11]. Alternatively, the solar radiation is transcendently provided for by visible light (around 45 %). Visual light reacting photocatalysts have been deliberately planned in order to take advantage of solar light more efficiently [12–15]. Graphitic carbon nitride ($\text{g-C}_3\text{N}_4$), a novel visible-light catalytic substance, was recently fabricated from cyanamide [16]. The $\text{g-C}_3\text{N}_4$ may be a nontoxic metal-free semiconductor with excellent thermal, electrical, and optical properties [17]. These unique properties have piqued the interest of many scientists, especially in terms of its possible applications in the production of hydrogen or oxygen from water, as well as natural toxin debasement [18–20]. In either case, $\text{g-C}_3\text{N}_4$ has a few disadvantages, including a small surface area and low quantum effectiveness [21], all of which result in poor photocatalytic activity.

In this way, improving the photocatalytic activity of $\text{g-C}_3\text{N}_4$ needs forethought. The developed nanocomposites will benefit from the synergistic effects of suppressing recombination of photo-generated electron-hole pairs and increasing visible-light absorption potential by combining two or more

semiconductors with matching band energies [22]. As a result, multiple studies on mixing g-C₃N₄ with various semiconductors to prepare various nanocomposites have been conducted in recent years such as g-C₃N₄/ZnO, g-C₃N₄/TiO₂, g-C₃N₄/SnO₂, g-C₃N₄/BiVO₄, g-C₃N₄/WO₃, g-C₃N₄/AgCl, g-C₃N₄/AgBr, g-C₃N₄/AgI, and g-C₃N₄/Ag₃PO₄ [23–30]. Ag₃VO₄ (band gap: almost 2.26 eV) is a type of silver-based photocatalyst that has a high action in the degradation of natural toxins under visible light illumination [24, 25]. As a result, this semiconductor can absorb a significant amount of solar energy, making it an ideal candidate for the production of highly effective visible light-driven photocatalysts. As a result, visible-light photocatalysts have been described as pure Ag₃VO₄ and its mixtures with other semiconductors. In this analysis, Ag₃VO₄ particles were hydrothermally loaded on the surface of g-C₃N₄ to create visible light-responsive heterojunctioned photocatalysts Ag₃VO₄/g-C₃N₄. Under visible light irradiation, the Ag₃VO₄/g-C₃N₄ catalysts exhibit outstanding photocatalytic behaviour against the degradation of RhB, which is attributed to the efficient transfer of photoinduced charge carriers. The effect of the Ag₃VO₄/g-C₃N₄ ratio on photocatalytic behavior was studied. The mechanism of Ag₃VO₄/g-C₃N₄ photocatalytic activity enhancement was also discussed.

2. Experimental Procedure

2.1. Materials

Melamine (C₃H₆N₆, 99.99%), sodium orthovanadate (Na₃VO₄), silver nitrate (AgNO₃), malachite green (MG), and dimethyl phenol (DMP) were obtained from Sinopharm Chemical Reagent Co. Ltd. 18.25MΩ deionized water (DW) was used for this study.

2.2. Synthesis of g-C₃N₄ nanosheets

A one-step method was used to make the g-C₃N₄ nanosheets. In order to achieve a uniform arrangement, 1.5 g of melamine and 1.54 g of cyanuric acid is dispersed in 40 mL ethanol under attractive agitation for 40 minutes. The arrangement was placed in a stainless autoclave and warmed for 24 hours at 160 °C. The solvent was centrifuged and dried to produce a yellow item, which was heated to 550 °C in an open discuss at a pace of 2.3 oC min⁻¹ for 4 hours. Finally, it was given the designation g-C₃N₄ nanosheets.

2.3. Preparation of Ag₃VO₄/g-C₃N₄ nanocomposites

Ag₃VO₄ anchoring on the surface of g-C₃N₄ was used to make the Ag₃VO₄/g-C₃N₄ composites. The following is a detailed description of the hydrothermal process: Ultrasonication was used to diffuse 0.25 g of g-C₃N₄ in 50 mL of 20 for 0.5 hours. After that, 2.5 g of AgNO₃ was applied to the solution, which was then magnetically stirred for 0.5 hours. Following that, 50 mL of aqueous solution containing 2 g of Na₃VO₄•12H₂O was slowly applied to the latter suspension and stirred for 4 hours. The suspension was then mounted in a Teflon-lined autoclave and held at 180°C for 24 hours. Finally, the resulting precipitate was washed by deionized water and dried at 90 °C to obtain the Ag₃VO₄/g-C₃N₄ nanocomposites. The

same methods were used to make Ag_3VO_4 , but without the addition of $\text{g-C}_3\text{N}_4$ to the suspension. The prepared samples were assigned the names AVG-10, AVG-30, and AVG-50, respectively, based on the weight percentages of Ag_3VO_4 in the composites. In $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ -10 mg, $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ -30 mg, and $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ -50 mg, the mass percent of Ag_3VO_4 was 10%, 30%, and 50%, respectively.

2.4. Photocatalytic activity setup

The degradation of the organised photocatalysts was tested in a 50 mL quartz glass vessel using MG and DMP (20 mg/L, 30 mL) as natural poisons under the light of a 50W 410 nm Light Emitting Diode (Led). The distance between the LED light source and the reactor was set to 50 millimetres. The suspensions were blended for 1 hour in the dark before brightening to achieve an adsorption-desorption equilibrium between the photocatalyst and RhB. The arrangement was then subjected to visible light irradiation when being combined attractively. 2 mL of the arrangement was taken out, centrifuged, and spectrophotometrically analysed at a certain point in time. The UV-vis spectra at $\lambda = 615$ nm and 270 nm, respectively, were used to determine the concentrations of MG and DMP. Before and after the photocatalytic reaction, the total organic carbon (TOC) of dye solution was determined using a TOC analyzer (Shimadzu TOC-Vwp, Japan). Following the equation [33], the removal efficiency was determined. Removal efficiency (%) = $(C_0 - C_t)/C_t$, where C_0 is the initial concentration/COD, and C_t is instant concentration/COD of dye solutions. All the experiments were undertaken in triplicate with errors below 5 % and average values were reported.

3. Results And Discussion

3.1. Powder X-ray diffraction (XRD) analysis

The XRD technique was used to determine the structural exactness of the components, and the resulting comparison graph is seen in Fig. 1. In bare $\text{g-C}_3\text{N}_4$, two distinct peaks were observed at 27.5° and 13.2° , respectively, when compared to the (100) and (002) planes [34]. This may be attributed to the $\text{g-C}_3\text{N}_4$ conjugated aromatic framework's interlayer simple packing. The diffraction pattern of Ag_3PO_4 is monoclinic, and the effects are exactly the same as the regular value (JCPDS No. 43-0542). No other impurity phases were found in the pattern, suggesting that the samples were of high purity. The $\text{g-C}_3\text{N}_4$ and monoclinic Ag_3VO_4 diffraction peaks can easily be seen in the pattern of all composite samples, suggesting that Ag_3VO_4 was successfully loaded on the surface of $\text{g-C}_3\text{N}_4$. The average grain size [35] for $\text{g-C}_3\text{N}_4$, Ag_3VO_4 , AVG-10, AVG-30, and AVG-50 was determined from their respective patterns and found to be 18, 22, 29, 38, and 44 nm, respectively.

3.2. Morphological analysis

The SEM and pictures in Fig. 2 were used to examine the morphology of samples. In Fig. 2 (a), it is essentially discovered that $\text{g-C}_3\text{N}_4$ has ultra-thin nanosheets, which can provide more sensitive sites for the photocatalytic degradation process. The uniform-sized Ag_3VO_4 composites are evenly distributed on

g-C₃N₄, as seen in Fig. 2 (b) and (c). It demonstrates that Ag₃VO₄ granules are effectively scattered on the overall surface of g-C₃N₄, where the interaction interfaces of different catalysts can form heterojunctions. The TEM picture of pristine g-C₃N₄ (Fig. 2 (d)) clearly shows the wrinkle form of lamellar structure nanosheets, while the Ag₃VO₄ sample (Fig. 2 (e)) clearly shows independent spherical nanoparticles (20–40 nm). On the surface of the g-C₃N₄ nanosheets, the nanoparticles are evenly wrapped (Fig. 2 (f)). Interfacial association between Ag₃VO₄ and g-C₃N₄ is also seen in the HRTEM picture of the composite (AVG-50) (Fig. 2 (g)). The lattice spacing of 0.23 nm matched the d value of Ag₃VO₄ (030) crystal plane, while the interplanar dispersion of 0.33 nm matched the gap between adjoining (002) crystal planes of g-C₃N₄. The basic composition of the AVG-50 samples was encouraged assessed through EDAX and the important picture was appeared in Fig. 2 (h). The spectra clearly appear the presence of major components such as Ag, V, O, C and N.

3.3. FTIR spectra analysis

The bond motions of g-C₃N₄, Ag₃VO₄, and Ag₃VO₄/g-C₃N₄ composite samples were detected using FT-IR spectra, as seen in Fig. 3. The lattice spacing of 0.23 nm matched the d value of Ag₃VO₄ (030) crystal plane, while the interplanar dispersion of 0.33 nm matched the gap between adjoining (002) crystal planes of g-C₃N₄. EDAX was used to determine the basic composition of the AVG-50 samples, and the important picture was seen in Fig. 2. (h). The spectra clearly appear the presence of major components such as Ag, V, O, C and N. to the stretching mode of s-triazine unit of g-C₃N₄ [36]. Finally, the V–O and Ag–V bonds are attributed to the Ag₃VO₄/g-C₃N₄ composites peaks at 845 and 790 cm^{−1}, respectively [37]. Ag₃VO₄ has been successfully loaded into g-C₃N₄, according to the data.

3.4. Optical studies

The UV-Vis absorption spectra of the samples are seen in Fig. 4. In Fig. 4, it can be shown that g-C₃N₄ has a normal absorption edge at around 480 nm (a). When opposed to g-C₃N₄, the Ag₃VO₄/g-C₃N₄ composite photocatalyst has a red-shift. It reveals that Ag₃VO₄ enhances the photocatalyst's light absorption range. The absorption concentrated of the composite test is encouraged to advance from 500 nm to 600 nm after Ag₃VO₄ is joined to g-C₃N₄, implying that Ag₃VO₄/g-C₃N₄ composite needs less vitality to produce electrons and holes. The narrowing of the band gap of the composite samples causes a significant red-shift in absorption. The Kubelka-Munk equation [38, 39] was used to quantify the optical band gap energy. The optical band gap energies for g-C₃N₄, Ag₃VO₄, AVG-10, AVG-30, and AVG-50 were observed to be 2.58, 2.51, 2.42, 2.31, and 2.23 eV, respectively, as shown in Fig. 4 (b). The surface based defects and recombination cure of the samples were calculated using room temperature PL spectra, and the resulting spectra were shown in Fig. 4 (c). To trigger the emission nature of the samples, a 380 nm excitation wavelength was used. The maximum PL intensity was observed for exposed g-C₃N₄ within the unmistakable light field, as seen in Fig. The PL concentration of Ag₃VO₄/g-C₃N₄ is, however, clearly decreased. It is proposed that Ag₃VO₄/g-C₃N₄ will prevent photo-generated charge carriers from recombining. When compared to AVG10 and AVG-30 catalyst tests, charge carrier recombination of

$\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ (AVG-50) is suppressed even further. The findings showed that $\text{g-C}_3\text{N}_4$ would increase the efficiency of separating h^+ and e^- . As a result, AVG-50 composites outperform other catalyst samples in terms of photocatalytic ability.

3.6. Nitrogen adsorption and desorption analysis

BET and BJH calculations were used to examine the samples' textural properties. Figure 5 depicts the $\text{g-C}_3\text{N}_4$, Ag_3VO_4 , and $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ (AVG-50) samples N_2 adsorption and desorption isotherms, as well as the resulting pore size distribution. The N_2 adsorption curves of all samples are Type-IV, suggesting the existence of mesopores, according to the Brunauer-Deming-Deming Teller (BDDT) classification [40, 41]. The SBET of $\text{g-C}_3\text{N}_4$ and Ag_3VO_4 are 48.8 and $61.2 \text{ m}^2\text{g}^{-1}$, respectively. When compared to Ag_3VO_4 , the SBET of $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ (AVG-50) is significantly higher ($98.5 \text{ m}^2\text{g}^{-1}$). Figure 5 depicts the associated pore scale delivery curve (c). Many of the catalysts are mesoporous, as seen by the spectra (2–50 nm). For $\text{g-C}_3\text{N}_4$, Ag_3VO_4 , and $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ (AVG-50) tests, the pore size was found to be 16.1 nm, 22.5 nm, and 35.2 nm, respectively. The $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ (AVG-50) tests have a large surface range and are mesoporous, which is beneficial for improving photocatalytic efficiency.

3.7. XPS analysis

The survey scan XPS spectra in Fig. 6 (a) revealed C 1s, N 1s, Ag 3d, V 2p, and O 1s peaks, which corresponded to the chemical composition of the photocatalysts. The C1s peak at 284.1 eV is due to C–C coupling in graphitic carbons, and the peak at 287.2 eV is due to C–N–C coordination [42], as seen in Fig. 6 (b). In Fig. 6 (c), the N 1s XPS range is split into three peaks. The sp^2 - hybridization of the N factor (C–N–C) is due to the peak at 398.1 eV, while the peaks at 401.5 and 403.5 eV may be due to the marginal amino functional groups and charging results in the cyano group, respectively [43]. Two peaks at 368.1 and 374.5 eV in the Ag 3d range (Fig. 6d) belong to Ag 3d_{5/2} and Ag 3d_{3/2} [44], respectively. The binding energies of V 2p_{3/2} (515.1 eV), V 2p_{1/2} (522.1 eV) and O 1s (529.5 eV) are found in the Fig. 6 (e) and (f). The analyses distinctly indicated the presence of chemical bonds between $\text{g-C}_3\text{N}_4$ and Ag_3VO_4 .

3.8. Photocatalytic studies

The photo-degradation of MG and DMP, as a colour poison, in fluid arrangements at 25 oC, was used to analyse the arranged tests' visible-light action. Figure 7 (a) shows plots of absorbance versus wavelength for colour arrangement corruption over pristine Ag_3VO_4 and separate $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ composites at various light times (d). It is apparent that as the depletion responses proceed, the concentration of absorption peaks tends to decrease without altering their locations. As a result, the aromatic ring-opening instrument causes colour loss on the nanocomposite and $\text{g-C}_3\text{N}_4$. Within 60 minutes of visible light illumination, the catalyst assimilation had risen to the point that it was completely gone. The findings suggest that the arranged catalysts were extremely photoactive when exposed to visible light. The photocatalytic debasement execution was tested using the corruption rate of MG and DMP solutions. The temporal degradation profile is show in Fig. 8 (a) & (b). The findings indicate that the $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$

(AVG-50) composite catalyst has the maximum degradation efficiency within the equivalent period, indicating that it outperforms pristine CN and Ag_3VO_4 in photocatalytic degradation. The $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ (AVG-50) composite catalyst's MG and DMP degradation efficiency was found to be 81 and 99 %, respectively. However, as the amount of Ag_3VO_4 in the dye was raised, the rate of dyes removal reduced, which may be because too much Ag_3VO_4 spread on the surface of CN inhibits dye absorption [45]. As shown in Fig. 8 (c) & (d), there is a linear relationship between $\ln(C_0/C)$ and t [46]. The k_{app} of all catalysts are shown in Fig. 8 (c) & (d). The k_{app} of $\text{Ag}_3\text{VO}_4/\text{g-C}_3\text{N}_4$ (AVG-50) composite catalyst is 0.0923 min^{-1} , which is 10.5 and 15.4 times larger than Ag_3VO_4 (0.0087 min^{-1}) and $\text{g-C}_3\text{N}_4$ (0.0059 min^{-1}), respectively. The mineralization efficiency of MG and DMP dyes was also measured, and the resulting graphs are shown in Figs. 9 (a) and (b) (b). The findings show that after 60 minutes of visible light illumination, the TOC removal efficiency of MG and DMP is 88 percent and 95 percent, respectively (AVG-50 catalyst). When compared to other catalysts, the photocatalytic findings indicate that the AVG-50 catalyst has superior degradation and mineralization performance against DMP dye. A capture experiment is carried out to determine which active material plays the most important role in photocatalytic degradation. The capture agents for superoxide ions (*O_2^-), hole (h^+), and hydroxyl radical (*OH) are L-ascorbic acid (LAA, 50 mg), TEOA (0.13 M, 2 mL), and IPA (0.25 M, 2 mL), respectively. Without adding any capture agent, the MG and DMP degradation efficiency will exceed 87 and 98 percent, respectively, as shown in Fig. 9 (c) and (d). The DMP degradation efficiency decreases to 44.4 %, 95.0 %, and 52.3 %, respectively, when LAA, IPA, and TEOA capture agents are added. As a result, the AVG-50 catalyst, *OH , plays a minor role in dye degradation, whereas *O_2^- and h^+ play a larger role. Stability and reusability are well known to be extremely important factors in determining the efficiency of a photocatalyst and encouraging natural use. Five incremental reusing experiments in both colours were observed in this manner for both catalysts, and the resulting plot is shown in Fig. 10 (a) & (b). We can easily see that the photocatalytic performance of catalysts indicates a small decrease in efficiency after four reuses. The AVG-50 catalyst, in particular, shows almost no deactivation after four reuses, demonstrating that the presentation of $\text{g-C}_3\text{N}_4$ will effectively repress Ag_3VO_4 photo-corrosion. Figure 10 depicts a schematic image of the photocatalytic process (c). The photo-generated electrons in $\text{g-C}_3\text{N}_4$ and Ag_3VO_4 are excited when they are exposed to visible light. There are the valence bands (VB) of $\text{g-C}_3\text{N}_4$ and Ag_3VO_4 to the conduction bands (CB). Furthermore, in the VB of $\text{g-C}_3\text{N}_4$ and Ag_3VO , holes (h^+) are preserved. If h^+ from Ag_3VO_4 (2.21 eV) VB transfers to $\text{g-C}_3\text{N}_4$ (1.58 eV) VB, the accumulated h^+ cannot react with H_2O to create *OH radicals. The explanation for this is that the VB position for $\text{g-C}_3\text{N}_4$ is 1.58 eV, which is less than the necessary capacity for *OH generation ($\text{H}_2\text{O}/\text{*OH} = 1.99 \text{ eV}$). As a result, in a photocatalyst, electron-hole conversion should primarily follow the Z-scheme mechanism. In other words, electrons from the CB of Ag_3VO_4 are moved to the VB of CN, where they combine with the h^+ in the VB of $\text{g-C}_3\text{N}_4$. And Ag NPs function as an electron shuttle, transferring electrons from Ag_3VO_4 CB to $\text{g-C}_3\text{N}_4$ VB. The electrons in the CB of $\text{g-C}_3\text{N}_4$ are trapped by O_2 to create *O_2^- radicals, while the h^+ in the VB of Ag_3VO_4 reduce H_2O to reactive species *OH radicals ($\text{O}_2/\text{*O}_2^- = -0.33 \text{ eV}$). At the same time, SPR effect inside Ag NPs will result in an energized

electron. Furthermore, the tetracycline can be easily reduced by h^+ , resulting in CO_2 and H_2O . It shows that the most dynamic species are the radicals $\cdot O_2^-$ and h^+ . In addition to the synergistic effect of $g-C_3N_4$ and Ag_3VO_4 , which results in a tall surface area, narrowing the band hole, and improved visible light retention are important factors in improving photocatalytic efficiency.

4. Conclusions

The combination of $g-C_3N_4$ and Ag_3VO_4 was used to create an improved visible-light-driven photocatalyst of $Ag_3VO_4/g-C_3N_4$. XRD, EDX, SEM, TEM, UV-DRS, and PL techniques were used to investigate the microstructures, morphology, and optical properties of the prepared samples. The degradation of MG and DMP under visible-light irradiation was used to assess the samples' photocatalytic function. Under visible-light irradiation, the 50 wt% $Ag_3VO_4/g-C_3N_4$ sample had the best photocatalytic activity for DMP degradation among hybrid photocatalysts. In addition, the photocatalyst was capable of effectively extracting organic dyes like MG and DMP. Furthermore, the reusability tests revealed that the photocatalytic content was very stable. The increased visible-light absorption and effective isolation of charge carriers is attributed to the nanocomposites' improved photocatalytic behaviour. It was shown that superoxide ions formed during the degradation reaction played a key role in DMP degradation over the nanocomposite based on the effects of the scavengers. The current study proposes a cost-effective and efficient method for treating mixed toxins in wastewater.

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Table

Table 1

Samples	Band gap (eV)	Rate constant of MG		Rate constant of DMP		Degradation efficiency at 100 min	
		K (h ⁻¹)	R ²	K (h ⁻¹)	R ²	RB31	4-CP
g-C ₃ N ₄	2.58	0.0012	0.935	0.0059	0.968	29	36
Ag ₃ VO ₄	2.51	0.0037	0.951	0.0087	0.931	35	45
AVG-10	2.42	0.0067	0.945	0.0067	0.958	49	61
AVG-30	2.31	0.0078	0.971	0.0081	0.939	69	82
AVG-50	2.23	0.0094	0.995	0.0923	0.987	81	99

Figures

Figure 1

Powder X-ray diffraction pattern of the photocatalyst samples

Figure 2

SEM images of a) g-C₃N₄; b) Ag₃VO₄; c) AVG-50; TEM images of d) g-C₃N₄; e) Ag₃VO₄; f) AVG-50; g) HRTEM image of AVG-50; h) EDS of AVG-50

Figure 3

FTIR spectra of the photocatalyst samples

Figure 4

a) UV-Vis absorption spectra of the electrode samples and b) band gap plot; c) PL spectra of the photocatalyst samples

Figure 5

a) N₂ adsorption and desorption analysis g-C₃N₄, Ag₃VO₄ and AVG-50 samples b) Corresponding pore size distribution

Figure 6

XPS spectra of AVG-50 sample a) survey; b) C 1s; c) N 1s; d) Ag 3d; e) V 2p and f) O1s

Figure 7

UV absorption spectra of MG using a) Ag₃VO₄; b) AVG-50; UV absorption spectra of DMP using c) Ag₃VO₄; d) AVG-50; catalysts under different illumination time

Figure 8

Temporal degradation profile of a) MG; b) DMP; Kinetic plot of c) MG; c) DMP using all the catalysts under visible light

Figure 9

TOC removal efficiency of a) MG; b) DMP; Scavenger studies of c) MG and d) DMP

Figure 10

Stability test of a) MG; b) DMP dyes using all the catalyst; c) Schematic sketch of the proposed mechanism of Ag₃VO₄/g-C₃N₄ under stimulated visible light.