Synthesis of solar Light-driven Photocatalyst for water treatment by using graphene graphene and reduced graphene oxide

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Abstract: Abstract is limited to 100 words.

The research is focusing on synthesizing WO_3-reduced graphene nanocomposites with different doping ion. As you have already known, WO_3 has been widely used by many researchers for photocatalysis based applications due to its well-known properties such as non-toxicity, chemical stability, high oxidative power, abundance and low cost and its derivatives. Also, Graphene Oxide (GO) and reduced Graphene Oxide (rGO), serve as excellent support materials having large surface area, improved mobility of charge carriers, high thermal conductivity and good chemical stability. In a WO_3-reduced graphene nanocomposites photodegradtion experiment, the phenol degradation ratio under stimulated solar light is up to 80 to 90 percent. It increases photodegradtion efficiency up to 7 times than P25. As a result, WO_3-reduced graphene nanocomposites are a promising catalyst way to degrade phenol.

Keywords: Tungsten trioxide, Graphene Oxide, reduced Graphene Oxide, photodegradation of phenol.

1. Introduction

As the population growth and industrial development, the demand of water resource increases dramatically. Thus, water shortage becomes more and more serious. In order to fix this problem, water treatment become a promising solution. By water treatment, it can remove harmful chemicals s form waste water. There are a lot of advantages for waste treatment. For example, water treatment can indeed provide an additional source of water, prevent pollution and enhancing wetlands and riparian habitats. As a result, more and more scientists devote themselves to the field of water treatment.

One of the harmful chemicals is phenolic compounds, phenolic compounds are present in the effluents of various industries such as oil refining, petrochemicals, pharmaceuticals, coking operations, resin manufacturing, plastics, paint, pulp, paper, and wood products. Those phenolic compounds may cause serious health problem to human, animals and environment so it absolutely need to be treated before reusing or discharging to environment. Also, it's worth noting that phenol has been designated as a priority pollutant by the US Environmental Protection Agency (EPA) and the National Pollutant Release Inventory (NPRI) of Canada[1].

In my research, I synthesize WO_3-reduced graphene nanocomposites with different ratio of metal oxide compounds. Those catalysts will be tested to phenol photodegradation ability. Also, I will also test the catalyst with graphene and the catalyst without graphene in order to know the graphene effects. Furthermore, I will present the UV–vis DRS patterns, XRD patterns and BET test in my report to discuss the characteristic of those catalysts.

2. Experimental

In my experiment, I use a batch photoreactor with 300W Xenon lamp with AM1.5 filter to degrade phenol. To be more specific, this light source is to simulate the sunlight irradiation. To seal the photoreactor, I use a stainless cover to do so. Basically, various amount of the catalysts and different initial phenol concentration are placed in the photoreactor. Also, various doped metal can increase the photothe adsorption time is various for different catalysts. After the photoreactor is set up, turning on 300W Xenon lamp with a distance of 5cm from reactor to start the photo-catalytic reaction. The liquid sample in reactor was taken 1ml every hour and analyzed by high performance liquid chromatography (HPLC) to detect the phenol concentration.

Furthermore, in order to know characteristic of those catalysts, those catalysts will be analyzed by Transmission Electron Microscopy (TEM), Scanning Electron Microscope (SEM), X-Ray Diffraction (XRD), X-ray photoelectron spectroscopy (XPS), UV-vis spectroscopy (UV-vis) and BET test. Those instrument can help me know visible light absorption ability, surface property, crystalline structure and surface area.

3. Results and discussion

In a typical photodegradtion reaction(P25 as a catalyst), the phenol degradation ratio under stimulated solar light is only 5 to 10 percent by the HPLC spectra. However, it is noteworthy to know that WO_3-reduced graphene oxide can indeed increase date production rate. In a WO_3-reduced graphene nanocomposites photodegradtion experiment, the phenol degradation ratio under stimulated solar light is up to 80 to 90 percent by the HPLC spectra. The reason is that reduced Graphene Oxide (rGO), serve as excellent support materials having large surface area, improved mobility of charge carriers, high thermal conductivity and good chemical stability Also, from UV-vis spectroscopy, WO_3--reduced graphene nanocomposites indicate an adsorption between visible light region, In addition, a series of optimization tests have been conducted to find the best reaction condition for photodegradtion of phenol.

4. Conclusions

In my research, WO_3-reduced graphene oxide nanocomposites is an excellent catalyst for photodegradtion of phenol under stimulated solar light. It increases photodegradtion efficiency up to 7 times than P25. As a result, WO_3-reduced graphene oxide nanocomposites are a promising catalyst way to degrade phenol.

References

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