High-Performance Oxidizing Materials: Lithium Vanadium Oxide for Environmental Treatment Applications

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One common environmental activity at school is collecting and sorting old batteries for recycling. However, it is just the first step of the treatment process for lithium-ion batteries, which have been increasingly popular in the battery market, resulting in dramatically large quantities of waste. Therefore, simple and effective methods to utilize lithium from wasted batteries are of great interest to improve lithium-ion battery sustainability. We have implemented a new and simple method to synthesize single-phase lithium vanadium oxide ($Li_3V_6O_{16}$) material from lithium carbonate recovered from waste batteries. For the first time, $Li_3V_6O_{16}$ was found as a high-performance redox catalyst with an efficiency of 87% for a 15-minute treatment of a 20 ppm methylene blue solution. The high catalytic rate of degrading color is of great significance for applications in dye waste treatment. $Li_3V_6O_{16}$ was proven as a highly efficient redox catalyst in various conditions, such as temperature, light, recycling methods, oxidants, or reductants. The color degradation productivity was improved under light conditions with atmospheric oxygen as the oxidizing agent. In addition, the material also demonstrated the ability to inhibit the growth of Escherichia coli and Candida albicans, as microorganisms can adhere to the material surface, reducing treatment efficiency. Optimal conditions for the dye treatment process using $Li_3V_6O_{16}$ have been initially employed to treat wastewater samples from a silk village in Hanoi.

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