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Dye decomposition by inorganic−organic hybrid base on Preyssler-type polyoxometalates

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Lately, industrial growth has enhanced intensive environmental difficulty in which pollution of water is the main subject. The existence of dyes along with other pollutants prevent the biological treatment methods also enforce allergic reactions [1]. Rhodamin B (Rh.B) is a carcinogen and dangerous dye for human beings. Several procedures have been presented for the elimination of dyes such as sorption and membrane segregation. But the mentioned methods have disadvantages like high cost, be time-consuming [2]. Polyoxometalates (POMs) are nanoscale anionic metal-oxide clusters of d-block transition metals, which play a very active role in many fields such as homogeneous and heterogeneous catalyses, electrocatalysis, photocatalysis, materials science, molecular magnetism and spintronics, and macromolecular crystallography due to their structural diversity, electronic properties, modifiability, tunability, and redox properties [3]. In the vast family of POMs, the donut-shaped molecule consisting of five PO_4 tetrahedra surrounded by 30 WO_6 octahedra is termed as Preyssler-type POMs ($[M^{n+}P_5W_{30}O_{110}]^{(15-n)-}$, abbreviated as $[M^{n+}@P_5W_{30}]^{(15-n)-}$), Preyssler anions display distinctive properties, among which the most notable are their (1) high negative charges (−12 to −15), (2) large oxidation potential, and (3) reversible transformation. The diameter of the internal cavity of Preyssler clusters approaches 5 Å, large enough to accommodate at least one metal cation (M^{n+}) [4]. In this study, inorganic−organic hybrid consisting of the Preyssler polyoxometalate, $[M^{n+}P_5W_{30}O_{110}]^{(15-n)-}$ with PDA (p-phenylenediamine) were synthesized by a new straight forward method [5]. After calcinated in 500 °C, prodact characterized by field emission scanning electron microscopy (FE-SEM), Fourier transform infrared (FT-IR) spectroscopy, X-ray diffraction (XRD). At the end, used nanocatalysis for decomposition of organic dye, rhodamine B (RhB), and be reused nanocatalysis for at least 4 cycles.

Keywords: Polyoxometalate, Preyssler, Dyes, Catalysis , Inorganic−organic hybrid

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