

Supporting Information:

**Heterogeneous Photocatalytic Water Reduction Using QD-cluster Pentacobalt Polyoxotungstate
Complex**

Parvin Askari^{1,2}, Sajjad Mohebbi^{1*}

¹Department of Chemistry, University of Kurdistan, Sanandaj, IRAN. POBox 66179-416.

²Department of Chemical Engineering, Laval University, Québec, G1V 0A6, Canada

*Corresponding author: Sajjad Mohebbi: sajadmohebbi@yahoo.com, smohebbi@uok.ac.ir

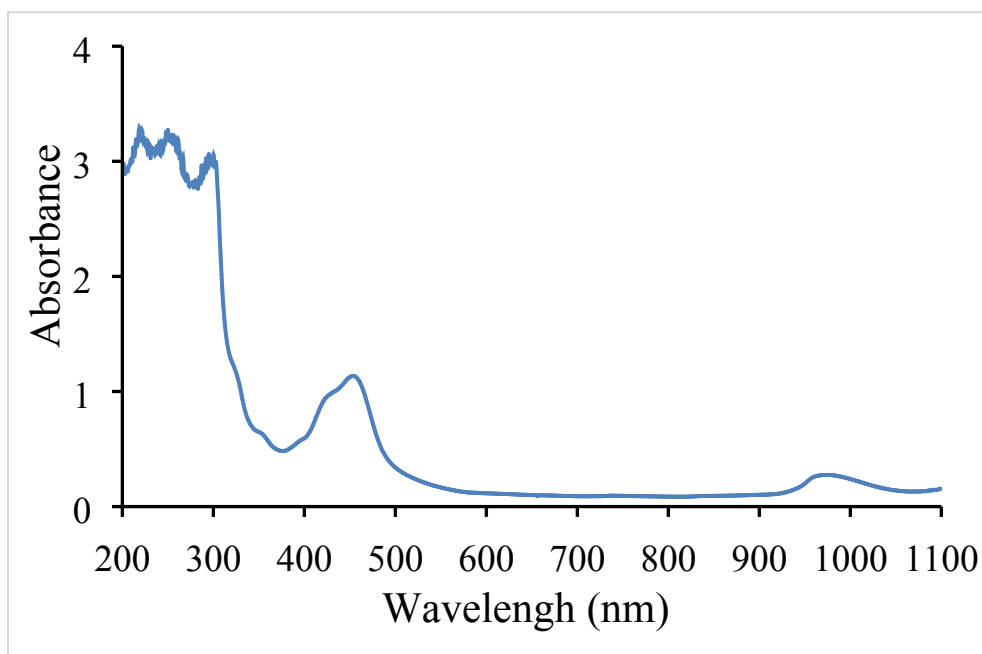


Figure S1. UV-Vis spectrum of $[\text{Co}_3\text{W}(\text{H}_2\text{O})_2(\text{CoW}_9\text{O}_{34})_2]^{12-}$ in acetate buffer pH 4.8

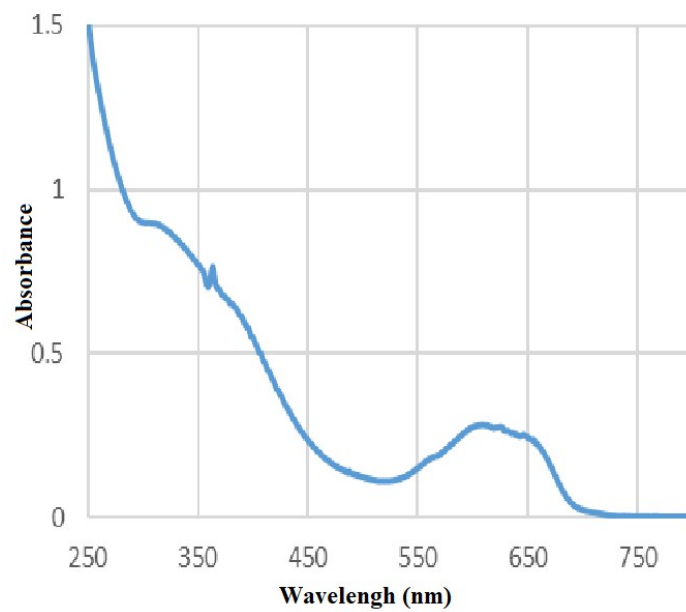


Figure S2. UV-Visible Spectrum of reduced methyl viologen (rMV) 0.1mM.

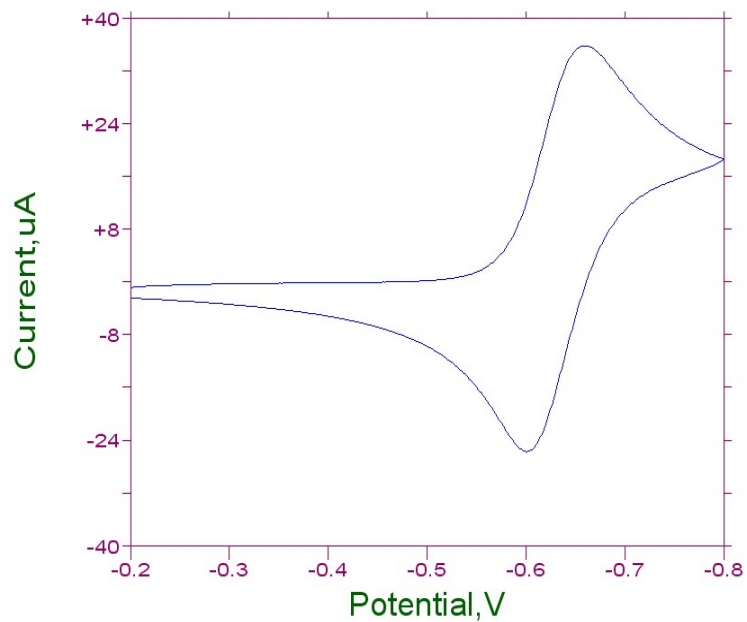


Figure S3. Cyclic voltammogram of methyl viologen 30 mM in sodium acetate buffer (0.4M) pH 4.8 at scan rate 10 mV/s

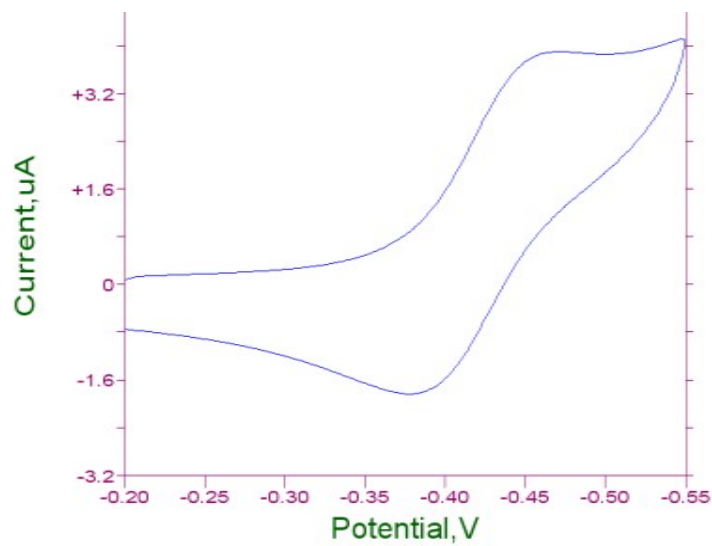


Figure S4. Cyclic voltammogram of $[\text{Co}_3\text{W}(\text{H}_2\text{O})_2(\text{CoW}_9\text{O}_{34})_2]^{12-}$ (0.3 mM) in sodium acetate buffer (0.4 M) pH 4.8. and scan rate 25 mV/s

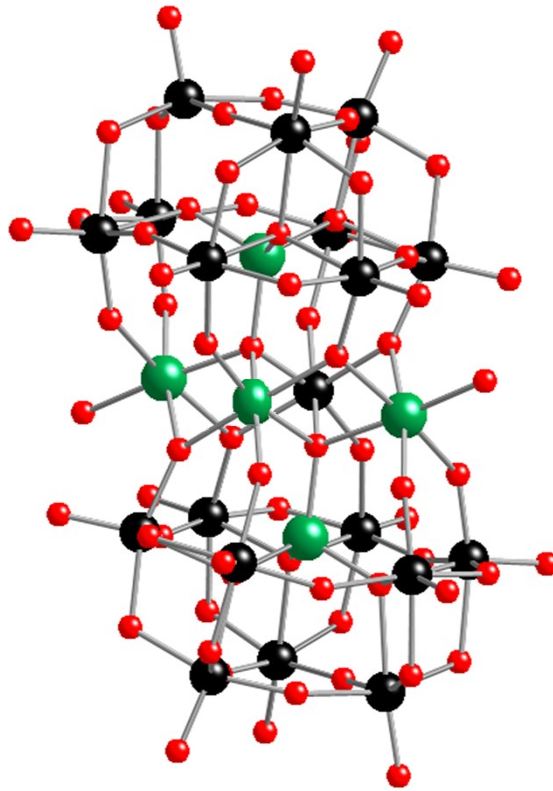


Fig. S5. The X-ray structure for Pentacobalt Polyoxotungstate, $[\text{Co}_3\text{W}(\text{H}_2\text{O})_2(\text{CoW}_9\text{O}_{34})]^{12-}$

Quantum yield calculation:

In a photochemical process, the quantum yield is the number of electrons that produced molecules divided by the number of photons absorbed by the system. Since not all photons are absorbed productively, the typical quantum yield should be less than 100%.

η = number of electrons produced/ number of photons absorbed

OR

$\eta = [(2 \cdot \text{the no. H}_2 \text{ Molecules Produced}) / (\text{the No. of photons absorbed})] \cdot 100$

$$\eta = \frac{r}{J} = \frac{2.9 \times 10^{15}}{2.4 \times 10^{16}} \times 100\% = 12.1\%$$

Where $r = 2.9\text{E}+15$ and $J = 2.4\text{E}16$

Example of Calculation :

Planck constant	h	6.62E-34	m2kg/s
Rate	1.472 $\mu\text{mol}/10 \text{ min}$	0.002467	$\mu\text{mol}/\text{s}$
Avogadro Constant	N0	6.02E+23	
Rate of H2	r	1.48E+15	
Light Speed	c	3E+08	m/s
Pi	10 mW	0.01	W
Photon Flux	J	2.37E+16	
QE	η	0.062746	

Cut of filter 420-520 nm

