Treatment of cyanide and phenolic mixture using sequential CMC-PVP-Pd-nZVI / *Rhodococcus pyridinivorans* strain PDB9T N1 nano biohybrid system

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Supplementary Materials

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2. Results and Discussion

3.1. Characterization

3.1.1. XRD Analysis

Fig. 1 (S) given in the supplementary material shows the XRD spectrum of the *CMC-PVP-nZVI/Pd* nanocomposite. The use of CMC and PVP in the nanocomposite disrupted the normal arrangement of iron atoms, causing XRD to scatter in different directions. This led to a significant decrease in the distinct peak of nZVI, indicating the amorphous nature of the CMC-PVP-nZVI/Pd nanocomposite.

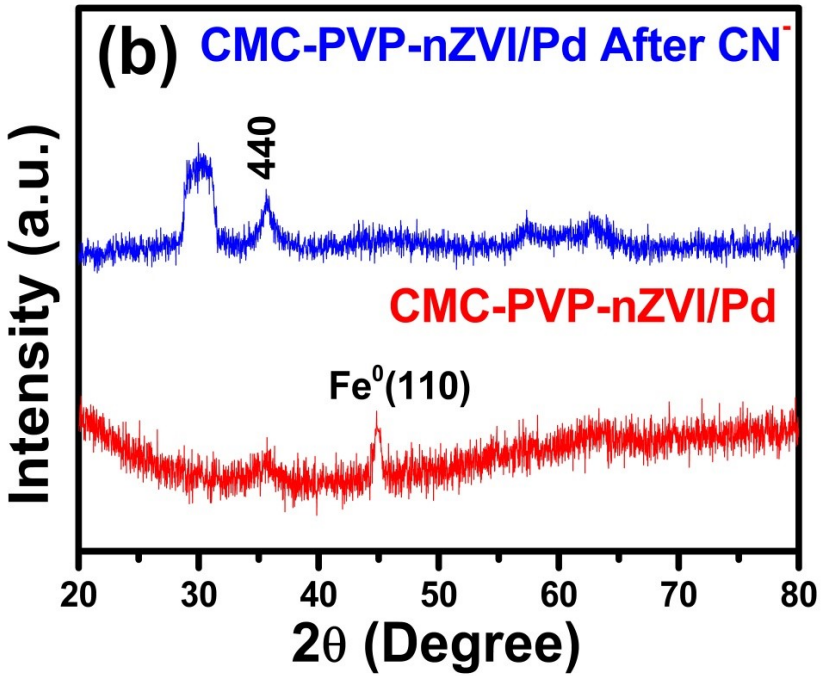

Fig. 1. (S) XRD characterization of CMC-PVP-nZVI/Pd nanocomposite before and after cyanide uptake.

The XRD patterns of Pd in CMC-PVP-NZVI/Pd were not detectable, likely due to the low Pd content and the well-dispersed nature of Pd within the PVP-NZVI/Pd framework. At 34.9°, a small peak was observed, corresponding to mild oxidation of outer layer nZVI.[28,34] These

findings align well with the previous reported literature.[34,36] After cyanide uptake an extra peak was observed in the CMPVP-nZVI/Pd composite (Fig. 1S), corresponding to iron cyanide [$Fe_4(Fe(CN)_6)_3$] at 2θ angle of 35.41° indexed to 440 plane[12], which confirmed the reductive sorption of cyanide on the nZVI surface.