

## **Fabrication of cuboidal CdS decorated UiO-66(-NH<sub>2</sub>) metal organic framework heterostructure for photocatalytic remediation of organic pesticides**

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### **Abstract:**

The UiO-66(-NH<sub>2</sub>) metal-organic framework (MOF) has been prepared by a facile solvothermal method. The UiO-66(-NH<sub>2</sub>) MOF nanoparticles were subsequently anchored on the surface of the CdS nanocube to fabricate the binary heterojunction. The CdS nanocube decorated UiO-66(-NH<sub>2</sub>) have been characterized by using series of analytical techniques like XRD, UV-Vis DRS, FESEM, PL and FTIR. The XRD results endorse the fabrication of highly crystalline phase of pure CdS. The XRD pattern of CdS/UiO-66(-NH<sub>2</sub>) heterostructure materials contain major diffraction peaks of CdS phase along with the characteristic diffraction peaks for UiO-66(-NH<sub>2</sub>). The CdS/UiO-66(-NH<sub>2</sub>) material show improved visible light absorption features in comparison to the pristine UiO-66(-NH<sub>2</sub>) species. The band position of the CdS and UiO-66(-NH<sub>2</sub>) components are suitably aligned for photo-generated electrons migration from conduction band (CB) of CdS to CB of UiO-66(-NH<sub>2</sub>) and holes are transferred from VB of UiO-66(-NH<sub>2</sub>) to VB of CdS leading to superior charge carrier separation in the composite material. The CdS/UiO-66(-NH<sub>2</sub>) heterostructure materials have been assessed as an excellent visible light driven photocatalyst for mineralization of diazinon (94%) pesticides. The comprehensive study of the characterization and photocatalytic activity assessment of this class of heterojunction materials will be presented in the conference.

**Biography:** Mr. Swagat Kumar Nayak graduated as M.Sc. in 2018 from Khallikote University, Berhampur, Odisha. He then joined the research group of Prof. B.G. Mishra at National Institute of Technology, Rourkela, Odisha in August 2021. His broad research interest includes fabrication and photocatalytic application of MOF based binary/ternary heterostructure materials towards environmental remediation.

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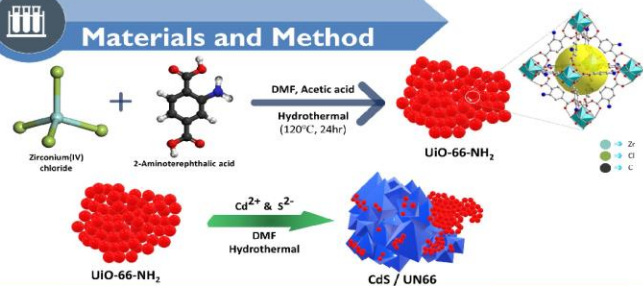
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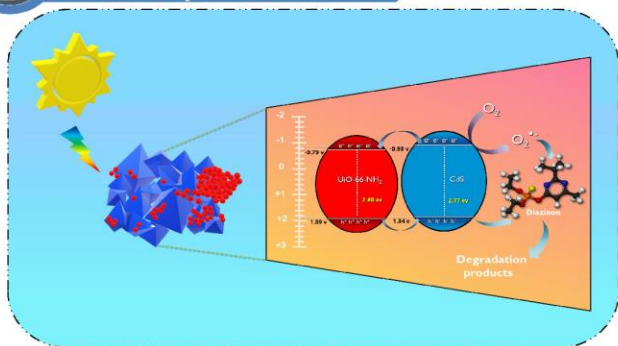
### Introduction

- Metal-organic frameworks (MOFs) are combination of metal ions and organic ligands.
- MOFs have gained attention because of their large surface area for adsorption, increased photocatalytic active sites, intimate contacted interfaces and robust 3D structures.
- Metal sulfides are principal section of semiconductor photocatalysts because they have smaller bandgap for which they are able to directly utilize visible light.
- Modern farming have extensively used pesticides for better crop production and simultaneously there is rise in use of organic pesticides and they are the cause of different health hazards.
- Diazinon, a toxic pesticide is a powerful neurotoxin which affects human nervous system and is also detrimental to wildlife even when used in low doses.

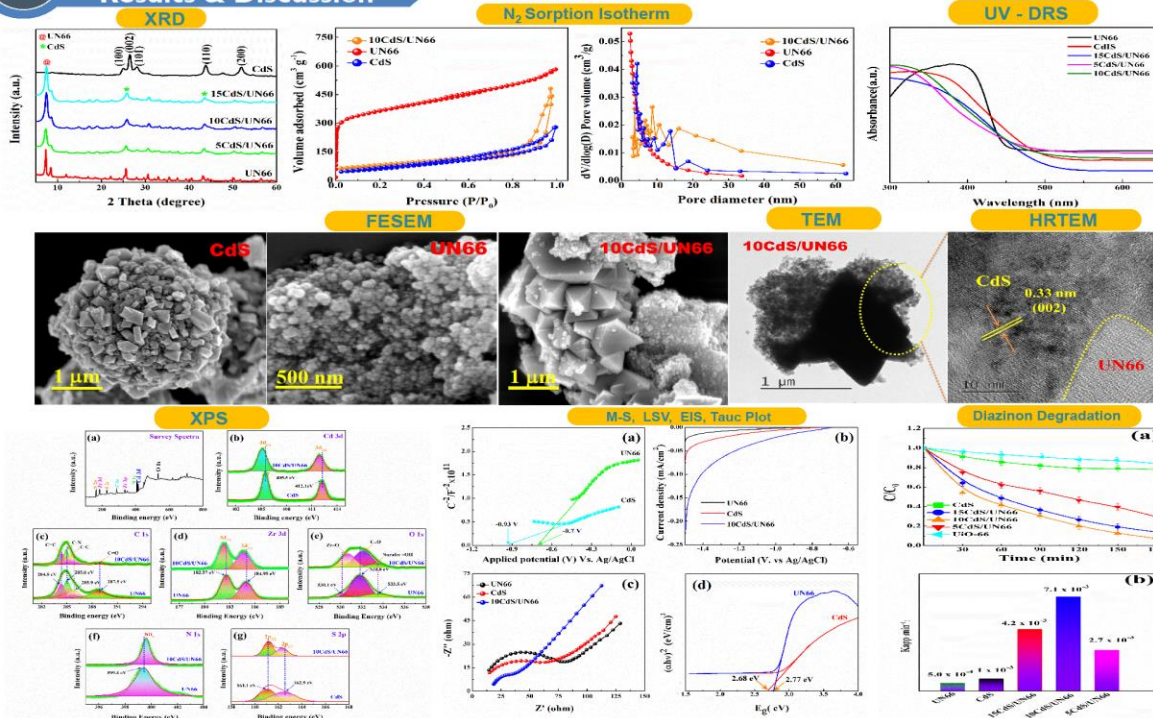
### Materials and Method



### Photocatalytic Mechanism



### Results & Discussion



### Conclusion

- The UiO-66(-NH<sub>2</sub>) metal-organic framework (MOF) has been prepared by a facile solvothermal method.
- The UiO-66(-NH<sub>2</sub>) MOF nanoparticles were subsequently anchored on the surface of the CdS nanocube Which improves interfacial charge migration and separation.
- The 10 CdS/UiO-66(-NH<sub>2</sub>) heterostructure material exhibited better photocatalytic activity and efficiently degraded diazinon pesticide(>94%).
- The reactive radical species including e<sup>-</sup> and 'O<sub>2</sub>' played a vital role during photocatalytic degradation reaction.

### References

- Jie Shen, Gongping Liu, Kang Huang, Qianqian Li, Kecheng Guan, Yukai Li, Wanqin Jin, UiO-66-polyether block amide mixed matrix membranes for CO<sub>2</sub> separation, Journal of Membrane Science, 513, 2016, 155-165, 0375-7388.
- Xia-Fei Xie, Xiao-Yao Dao, Fan Guo, Xiao-Yu Zhang, Fang-Ming Wang, Prof. Wei-Yin Sun, Synergistic Effect of CdS and NH<sub>2</sub>-UiO-66 on Photocatalytic Reduction of CO<sub>2</sub> under Visible Light Irradiation, Chemistry Select, 2020, 5, 4001 – 4007.

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