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Removal of Toxic Metal Ions from Aqueous Media by MoS_2 Hollow Nanoroses: Affinity/ Electrochemistry Matters

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Introduction

Water Treatment

- Filtration
- Distillation
- Adsorption
- Ion Exchange
- Ozonation

Adsorption

Low cost
Simple Design
Speed
High efficiency

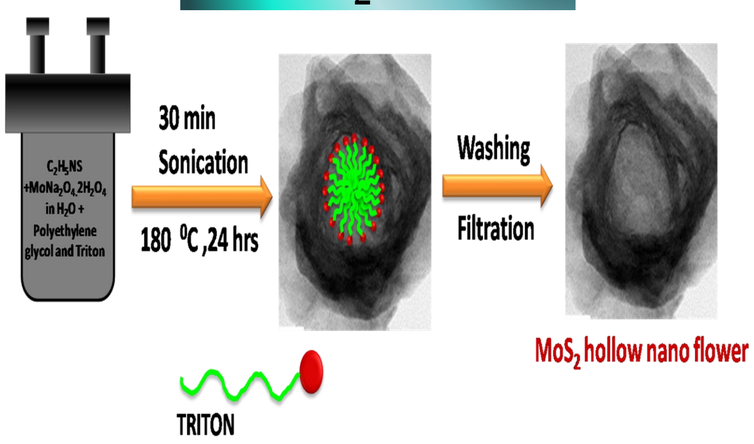
MoS_2

- Semiconductor with layered structure
- Transition metal dichalcogenide

Experimental Methods

- Remove Toxic Metal ions
- Via Adsorption technique
- Using MoS_2
- Selected Metal ions are Hg^{2+},Ag^{+} and Pb^{2+}

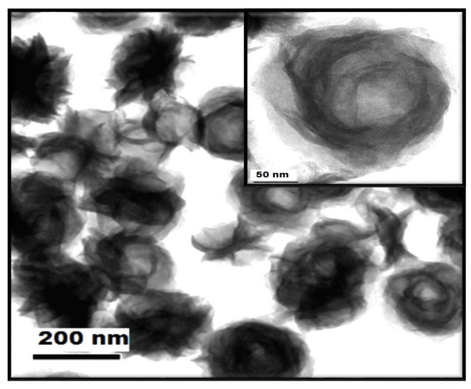
MoS_2-HNR

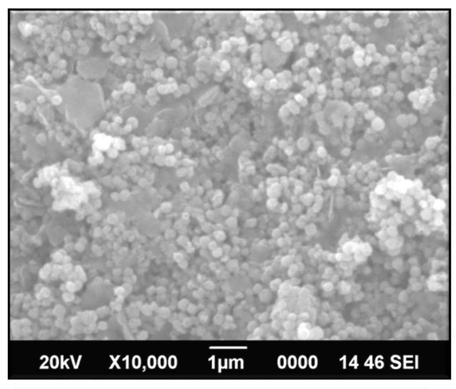


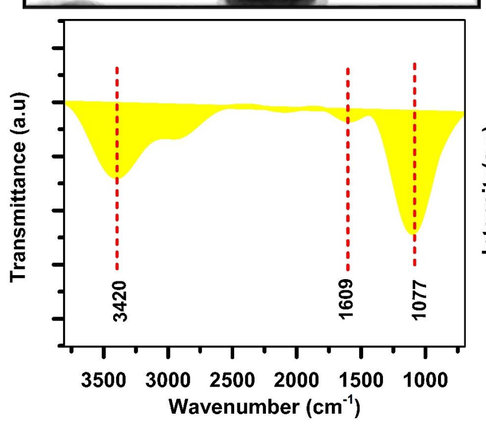
- Simple hydrothermal method at 180°C
- Utilizes water as solvent, environment friendly
- Polyethylene glycol act as capping and stabilizing agent

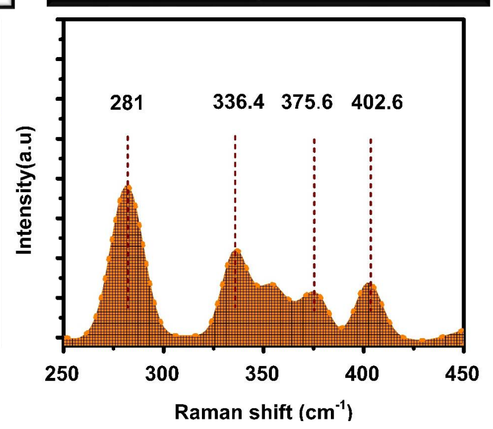
Results & Discussion

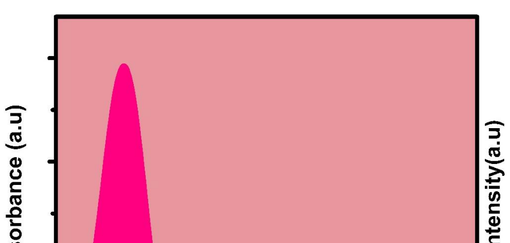
CHARACTERISATIONS

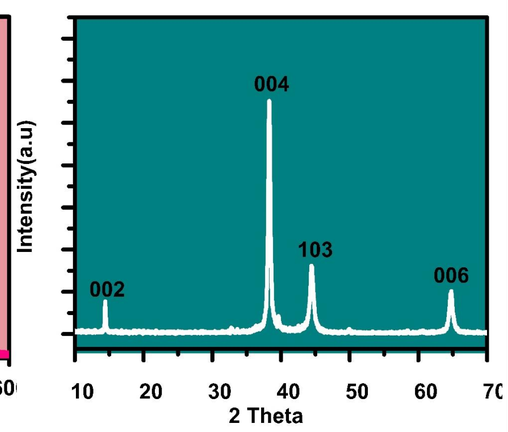


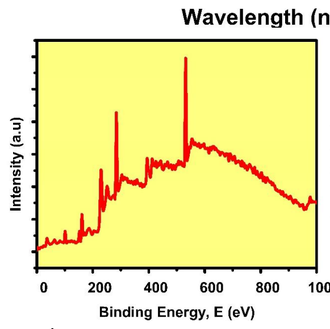


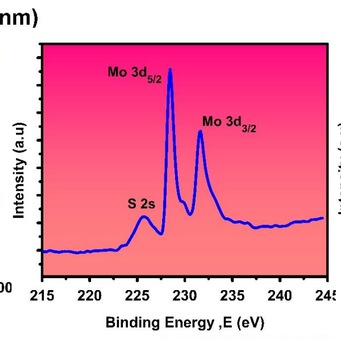


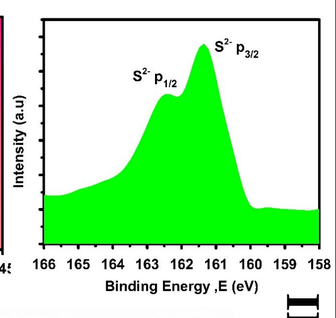




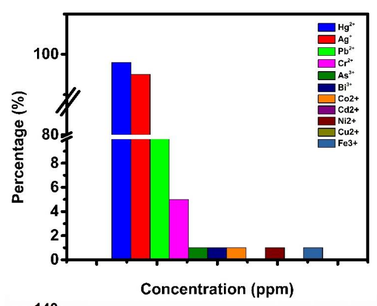


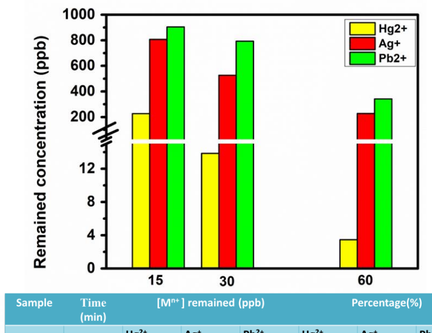




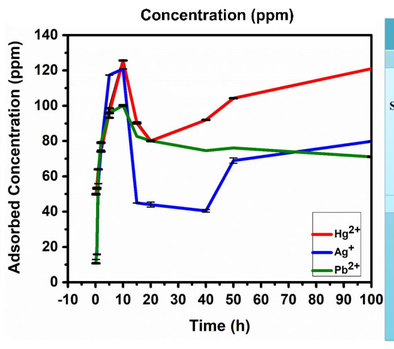


SCREENING



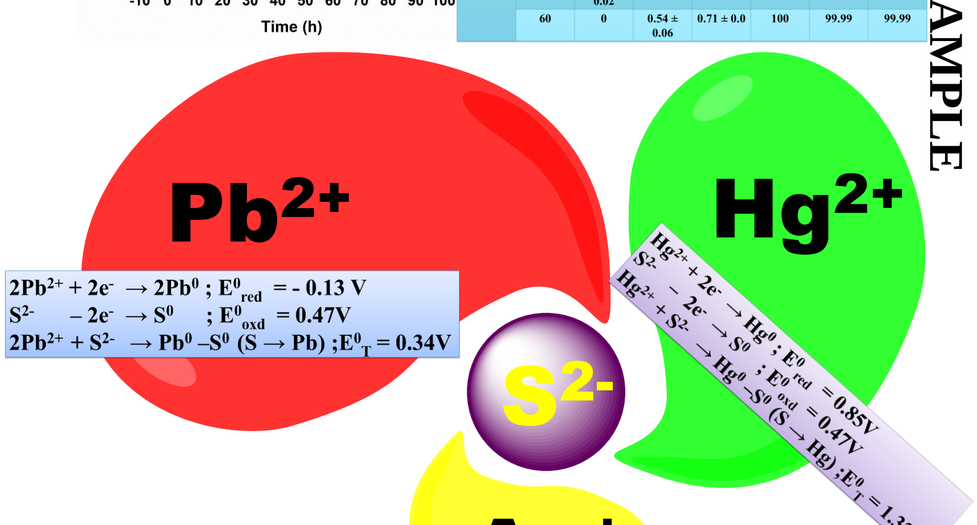


KINETICS

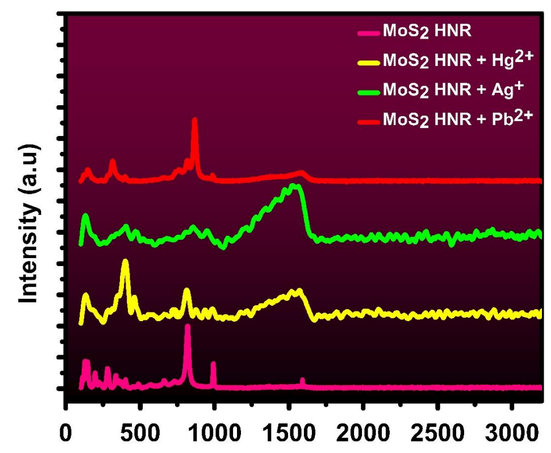


INTERFERENCE REAL SAMPLE

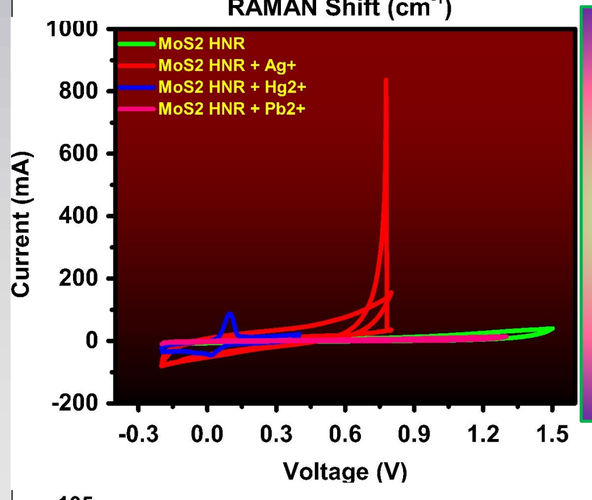
Sample	Time (min)	[M^{n+}] remained (ppb)			Percentage(%)		
		Hg^{2+}	Ag^{+}	Pb^{2+}	Hg^{2+}	Ag^{+}	Pb^{2+}
Sea water	5	1.43 ± 0.1	201.5 ± 0.05	312 ± 0.14	99.98	97.98	96.88
	10	0.91 ± 0.04	11.61 ± 0.03	20.6 ± 0.12	99.99	99.88	99.79
	30	0	0.573 ± 0.7	1.019 ± 0.2	100	99.99	99.98
	60	0	0	0.183 ± 0.3	100	100	99.99
Ground water	5	9.16 ± 0.04	205.3 ± 0.4	312.5 ± 0.4	99.90	97.94	96.87
	10	0.49 ± 0.01	12.91 ± 0.9	23.43 ± 0.1	99.99	99.87	99.97
	30	0.19 ± 0.02	2.85 ± 0.6	3.3 ± 0.03	99.99	99.97	99.96
	60	0	0.54 ± 0.06	0.71 ± 0.0	100	99.99	99.99



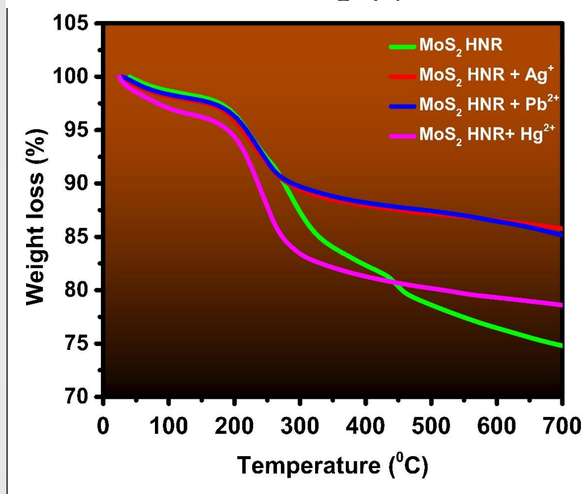
RAMAN



CYCLIC VOLTAMETRY



TGA



Conclusions

- A novel and simple micelle assisted hydrothermal method was developed for the synthesis of MoS_2 hollow nano roses.
- The flower like morphology enhances the number of active sites and surface area of MoS_2 when compared with bulk.
- Great abundance of intrinsic sulfur atoms (S^{2-}) makes MoS_2 as an competent tool for removing highly toxic metal ions from drinking water.
- The adsorption studies indicate that the prepared HNR is a potential adsorbent for removal of Hg^{2+},Pb^{2+}, and Ag^{+} from water.
- Together affinity and electrochemistry plays a significant role in the removal capability of MoS_2 HNR towards metal ions.
- Our material reaches the minimum level prescribed by the US Environmental Public Agency (EPA).
- This a first time report of the synthesis and subsequent use of MoS_2 HNR for the simultaneous removal of Hg^{2+}, Pb^{2+} and Ag^{+} .

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