Supporting information

Ag@FONPs Nanohybrids Derived from Sulfur-Functionalized Dicarbene Ligand: Efficient Catalysts and Selective Azide Ion Sensors

Rohitash Kumar[1†], Kopal Garg[1†], Vaishali Yadav[1], Rishu[2]*, Vimal K. Bhardwaj[1]*

† Authors have equal contribution

[1]Inorganic Green Chemistry Lab, Department of Chemistry, National Institute of Technology, Jalandhar, Punjab-144008, India

[2]Department of Chemistry, Mehr Chand Mahajan DAV College for Women, Sector 36 A, Chandigarh 160036, India

Email: bhardwajvk@nitj.ac.in

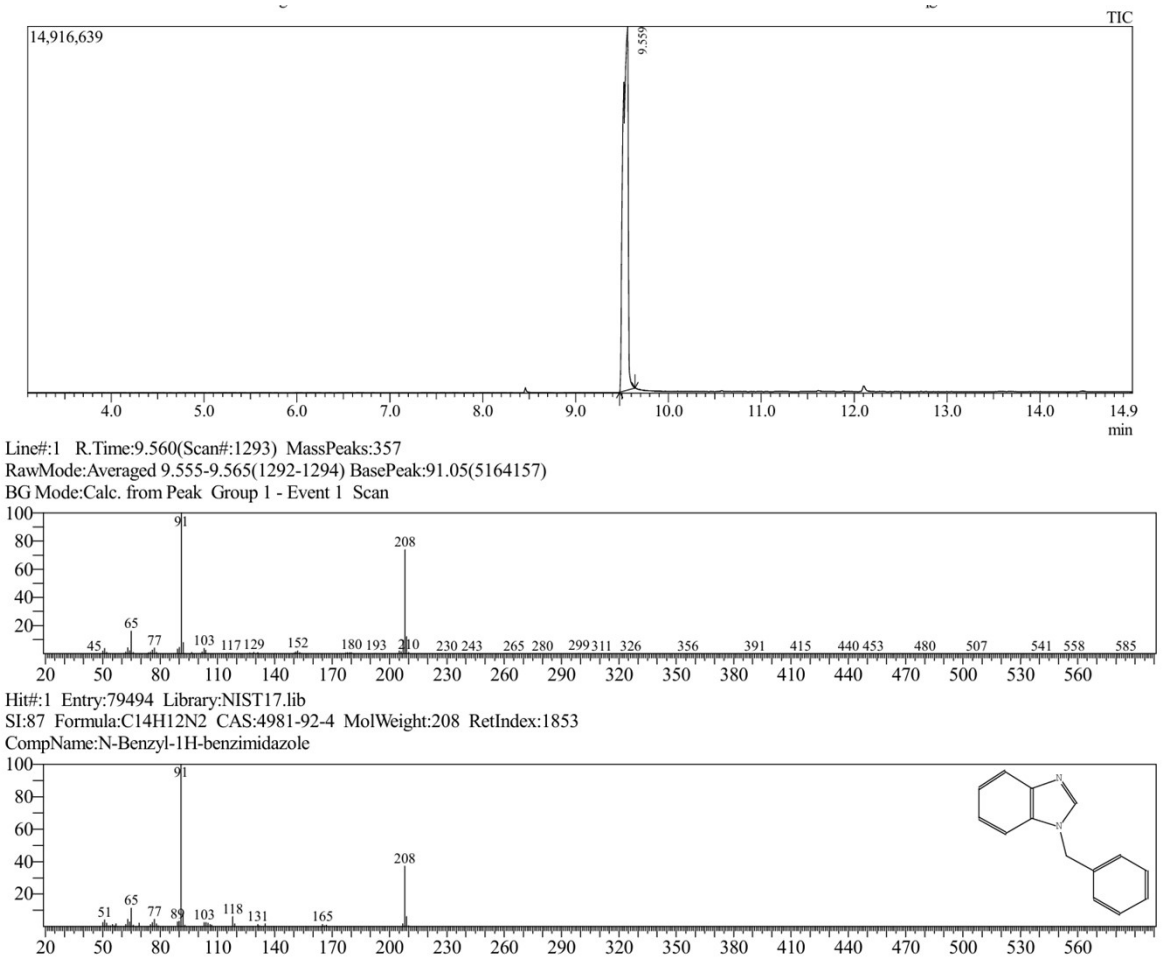

Figure ESI 1. GC-MS Analysis of 1- Benzyl benzimidazole

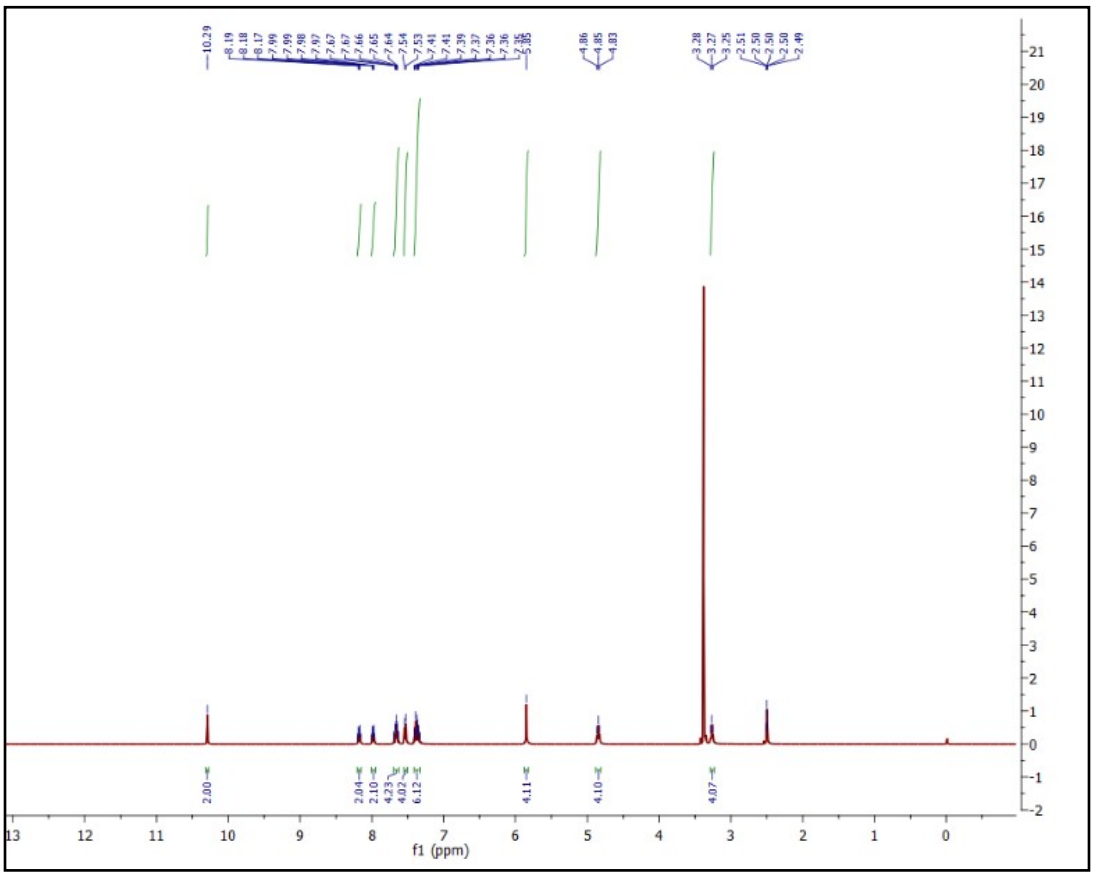

Figure ESI 2. ^{1}H NMR spectra of the synthesized compound (C)(400 MHz, DMSO-d_6)

ESI Table 1. Comparison of the structural features, synthesis strategy, sensing performance, and catalytic properties of the present Ag@FONPs system with recently reported Ag-based nanoparticle.

Sr. No.	System	Organic Ligand	Target Application	Key Performance	Ref.
1.	Schiff base-stabilized Ag nanoparticles	Schiff base-mediated stabilization of AgNPs	Antibacterial and catalytic applications	Catalytic activity toward bacterial systems	[1]
2.	Organic–inorganic Ag nanohybrids	Organic tripodal Schiff base ligand supported Ag nanohybrids	Cu^{2+} chromogenic sensing and biological studies	Selective Cu^{2+} detection	[2]
3.	Fluorescent Schiff-base hybrid nanoparticles	Fluorescent Schiff-base nanoparticle assembly	Silver extraction and biological activity	Metal extraction efficiency	[3]
4.	Organic nanoparticle-based Sr^{2+} chemosensor	Organic nanoparticle fluorescent probe	Sr^{2+} sensing	Fluorescence sensing response	[4]
5.	Hybrid nano assembly fluorescent probe	Organic–inorganic nanoparticle assembly	Amitriptyline fluorescence sensing	Turn-on fluorescence response	[5]
6.	Organic–inorganic nanohybrids	Fluorescent hybrid nanohybrids	Cr^{3+} recognition	Selective ion recognition	[6]
7.	Conventional Ag nanoparticles	Chemical reduction methods	Catalytic reduction and antimicrobial uses	Good catalytic activity	[7]

8.	Ag@FONPs nanohybrids	N-Heterocyclic carbene-based pincer ligand	Selective azide sensing, 4-NP reduction, and MO degradation	Complete 4-NP reduction in 18 min, ~80% MO degradation in 10 min, selective N_3^- turn-on sensing.	[In this work]

Reference

1. Singh, A., Bhardwaj, V. K., Kaur, G., Kaur, K., Singh, N., & Bakshi, M. S. (2014). Organic–inorganic nanohybrids and their applications in silver extraction, chromogenic Cu^{2+} detection in biological systems, and hemolytic assay. *RSC advances*, *4*(40), 21079-21088.
2. Kumar, R., Anu, Yadav, V., Singh, V., Pant, A., Jana, A. K., & Bhardwaj, V. K. (2025). Synthesis of Fluorescent Schiff Base Hybrid Nanoparticles for Silver Extraction and their Biological Activity. *ChemistrySelect*, *10*(40), e03415.
3. Kaur, S., Kaur, A., Kaur, N., & Singh, N. (2014). Development of chemosensor for Sr 2+ using organic nanoparticles: application of sensor in product analysis for oral care. *Organic & Biomolecular Chemistry*, *12*(41), 8230-8238.
4. Saini, A., Kaur, R., Singh, N., Kuwar, A., & Kaur, N. (2018). High performance fluorescent turn-on probe for amitriptyline based on hybrid nanoassembly of organic–inorganic nanoparticles. *ACS Applied Bio Materials*, *2*(1), 135-143.
5. Viviana, P. B., Huerta-Aguilar, C. A., Singh, N., & Pandiyan, T. (2018). Selective recognition of cr3+ in multivitamin formulations in aqueous medium by fluorescent organic–inorganic nanohybrids. *Research on Chemical Intermediates*, *44*(5), 3179-3197.
6. Wei, Z., Mullaj, K., Price, A., Wei, K., Luo, Q., Thanneeru, S., Sun S, & He, J. (2022). Polymer N-heterocyclic carbene (NHC) ligands for silver nanoparticles. *ACS Applied Materials & Interfaces*, *14*(49), 55227-55237.