Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supporting Information

Detection and Detoxification of Imidacloprid in food sample through Ionic Liquid stabilized CuNi alloy nanoparticle decorated Multiwall Carbon Nanotubes

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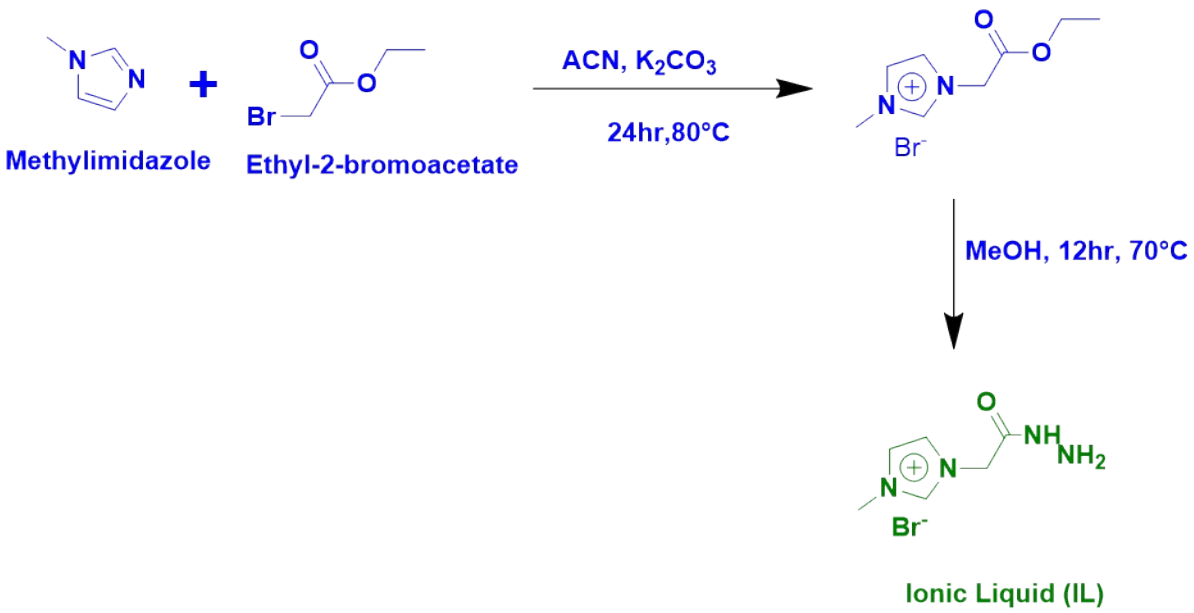
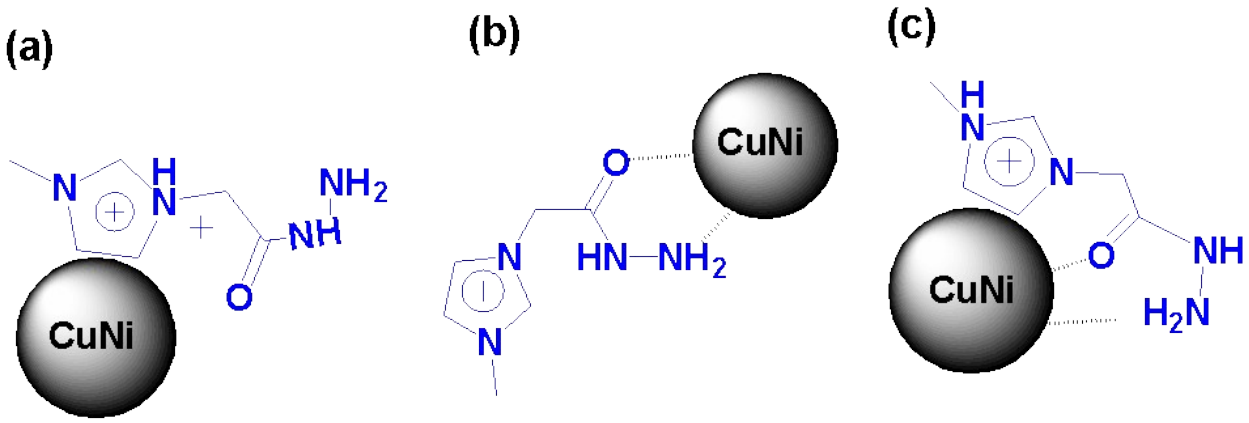
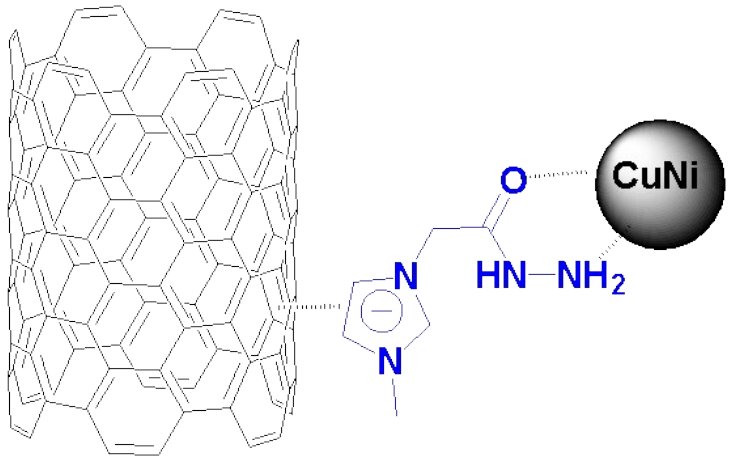
Scheme S1: Schematic Diagram showing synthesis of IL.



Scheme-2:Three possible stabilization modes of Ionic liquid with alloy nanoparticles



Interaction of CuNi alloy NPs with MWCNTs by an IL linker

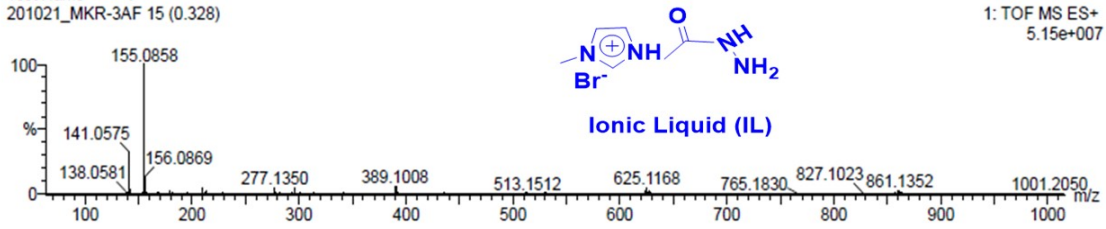


Elemental Composition Report **Page 1**

Single Mass Analysis
Tolerance = 300.0 PPM / DBE: min = -1.5, max = 50.0
Element prediction: Off
Number of isotope peaks used for i-FIT = 5

Monoisotopic Mass, Even Electron Ions
8 formula(e) evaluated with 1 results within limits (all results (up to 1000) for each mass)
Elements Used:
C: 6-6 H: 0-300 N: 1-4 O: 0-1

Sample Name : 201021_MKR-3AF IITRPR XEVO G2-XS QTOF
Test Name :
201021_MKR-3AF 15 (0.328) 1: TOF MS ES+
5.15e+007



Ionic Liquid (IL)

Minimum:				-1.5				
Maximum:		2.0	300.0	50.0				
Mass	Calc. Mass	mDa	PPM	DBE	i-FIT	Norm	Conf(%)	Formula
155.0858	155.0933	-7.5	-48.4	3.5	1914.6	n/a	n/a	C6 H11 N4 O

Figure S1: HRMS spectrum of Ionic liquid (IL)

Calculated mass (M^+) = 155.0927) and Observed Mass (M^+) = 155.0858

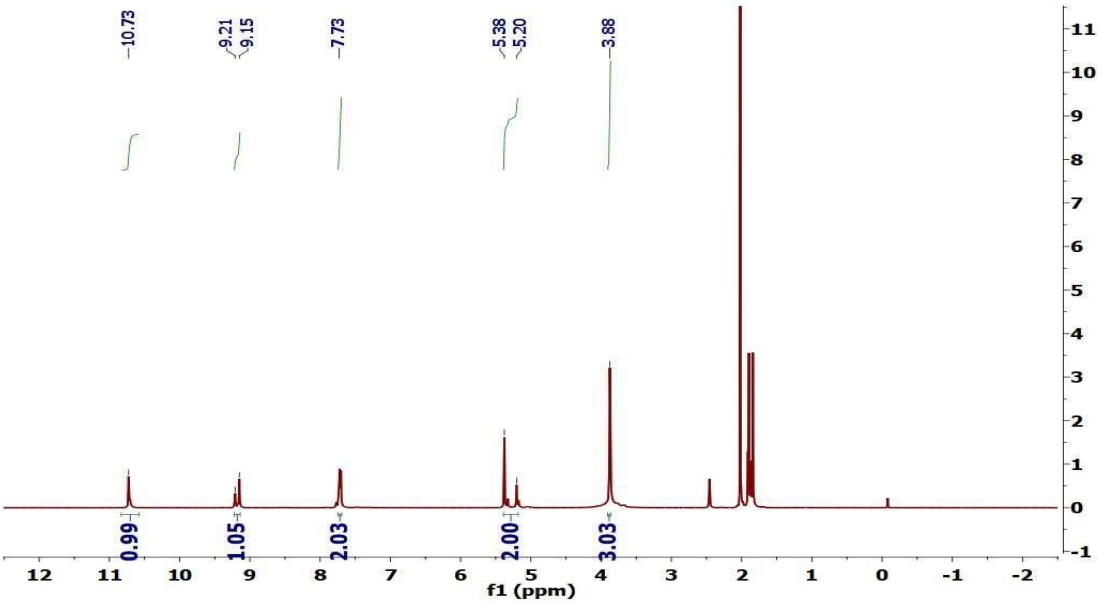


Figure S2: ^{1}H-NMR spectrum of Ionic liquid (IL); 1H NMR (400MHz, DMSO-d6) – δ 10.73 (s, 1H, NH), 9.21-9.15 (s, 1H, C2H-Im), 7.33,7.70 (d, 2H, C4H, C5H-Im), 5.38-5.20 (s, 2H, CH2CO), 3.88 (s, 3H, CH3-N).

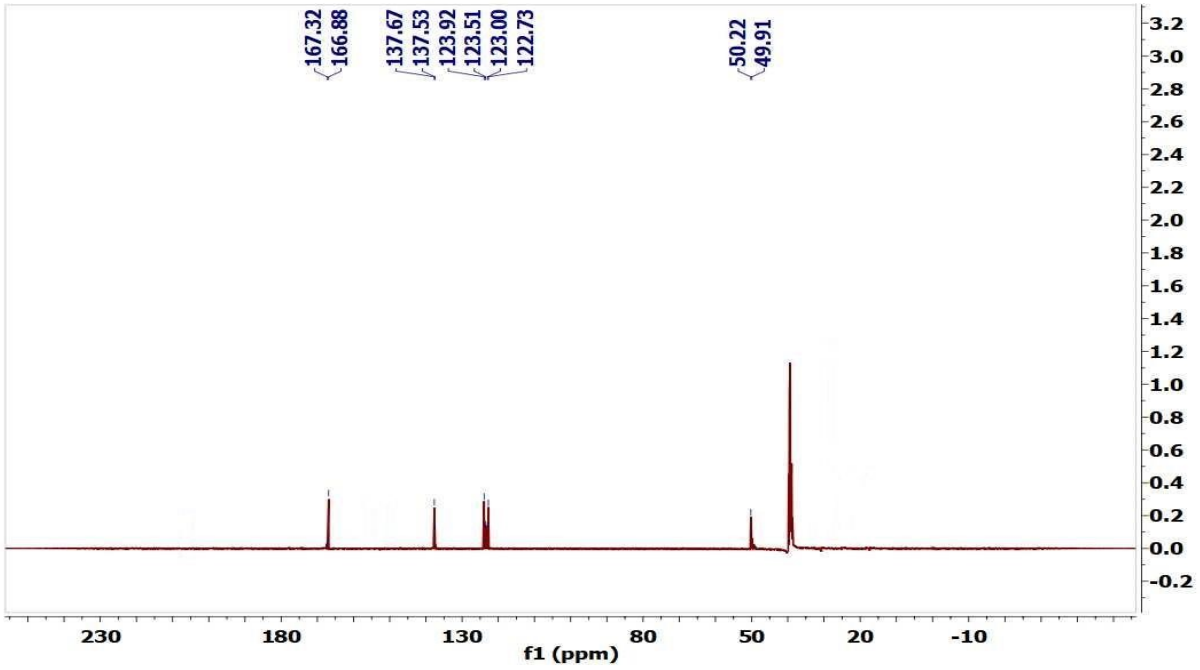


Figure S3: ^{13}C-NMR spectrum of Ionic liquid (IL);

^{13}C NMR (100MHz, DMSO-d_6)- δ 167.32, 166.88, 137.67, 137.53, 123.92, 123.51, 123.00, 122.73, 50.22, 49.91.

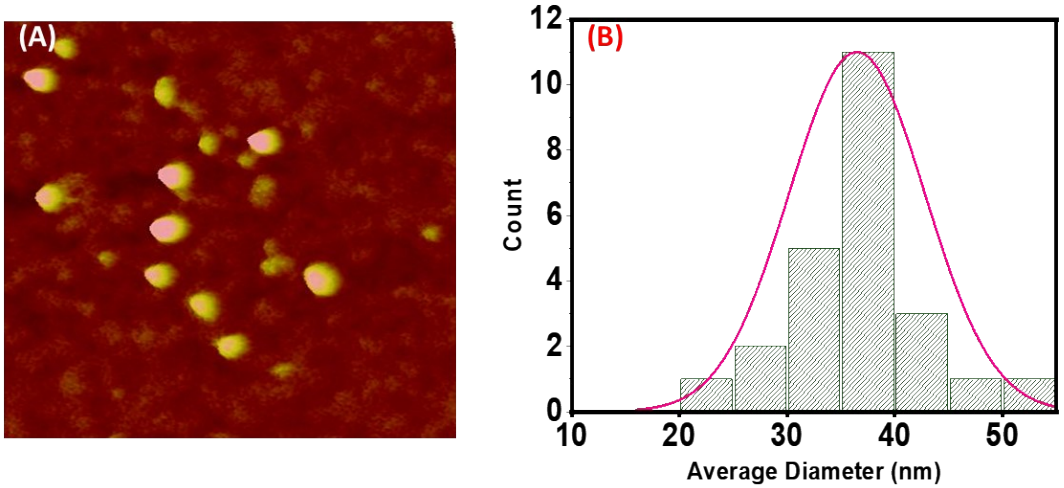


Figure S4(A): Atomic Force Microscopic image showing the morphology of CuNi/IL alloy nanoparticles and (B) histogram of average size of CuNi/IL alloy nanoparticles calculated using Gwydion software.

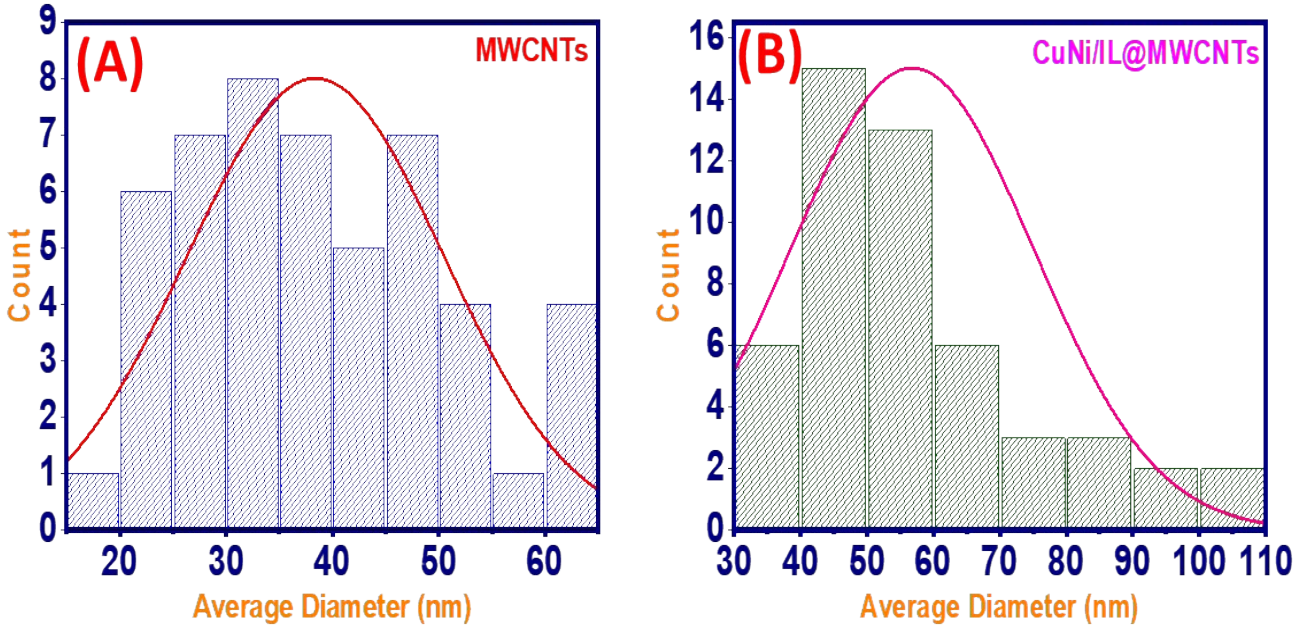


Figure S5: (A) Histogram of average size of MWCNTs and (B) CuNi/IL@MWCNTs nanocomposite calculated using Gwydion software from AFM images.

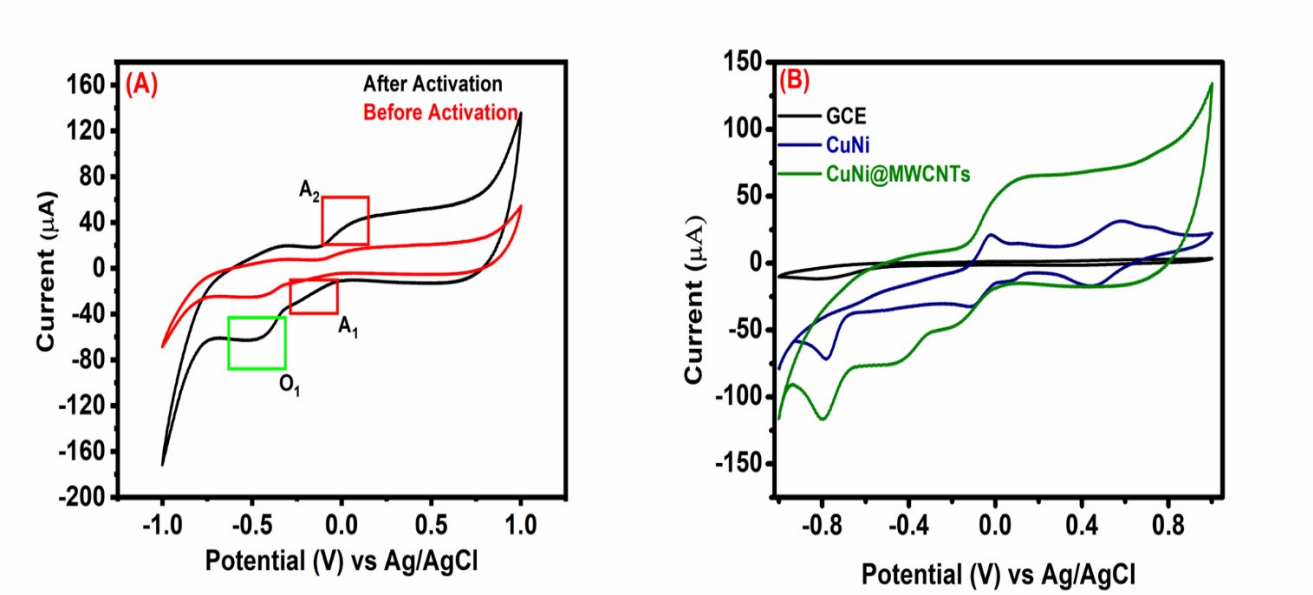


Figure S6: (A) Cyclic voltammetry response of CuNi/IL@MWCNTs before and after activation for 60 cycles in 0.1M PBS at 100mVs^{-1} scan rate. (B) CV response of GCE, CuNi/IL, CuNi/IL@MWCNTs towards IMD sensing in 0.1M PBS at 100mVs^{-1} scan rate.

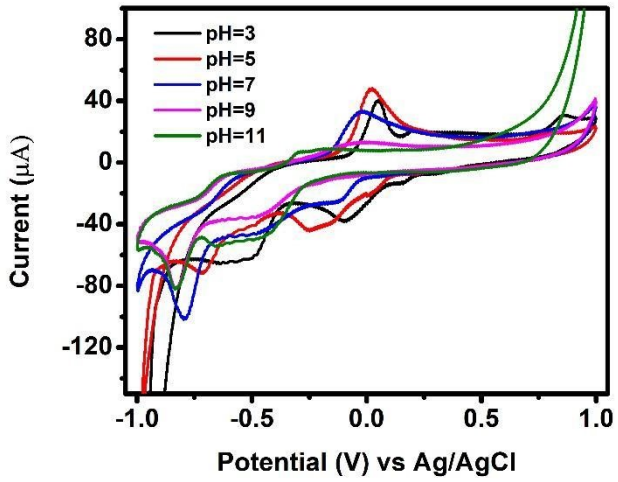


Figure S7: Cyclic voltammetry response of CuNi/IL@MWCNTs towards IMD sensing in different pH (3to11) in 0.1M PBS at 100mVs^{-1} scan rate.

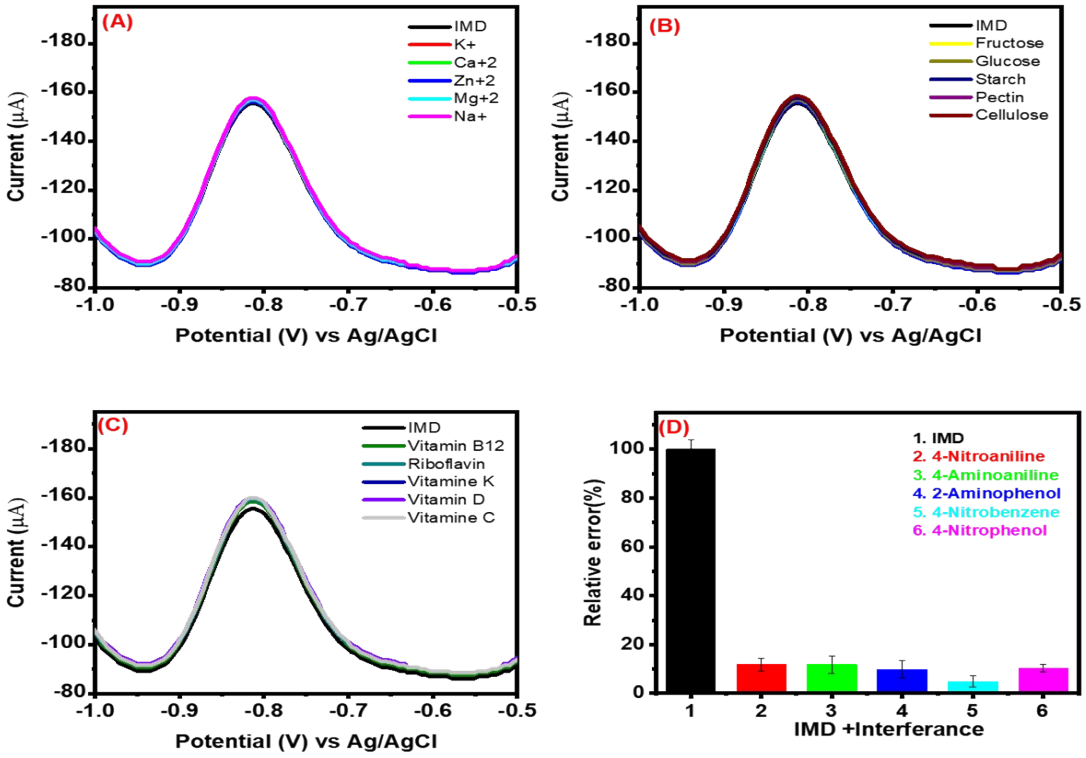


Figure S8: DPV response of CuNi/IL@MWCNTs (A) anions; (B) polysaccharides; (C) Vitamins; (D) Bar graph showing change in current response of CuNi/IL@MWCNTs towards IMD in presence of nitroaromatic compounds.

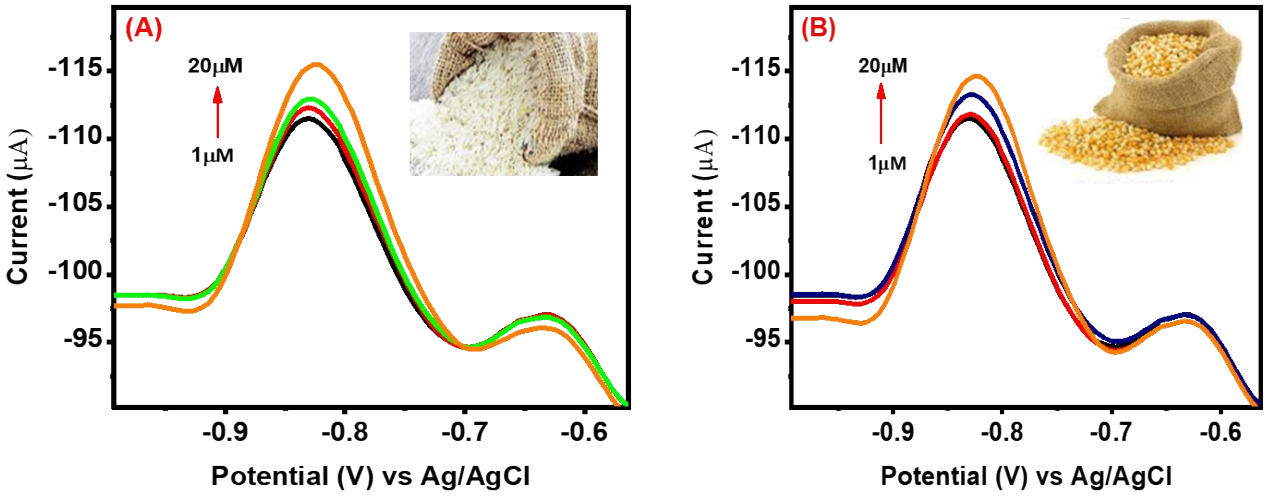
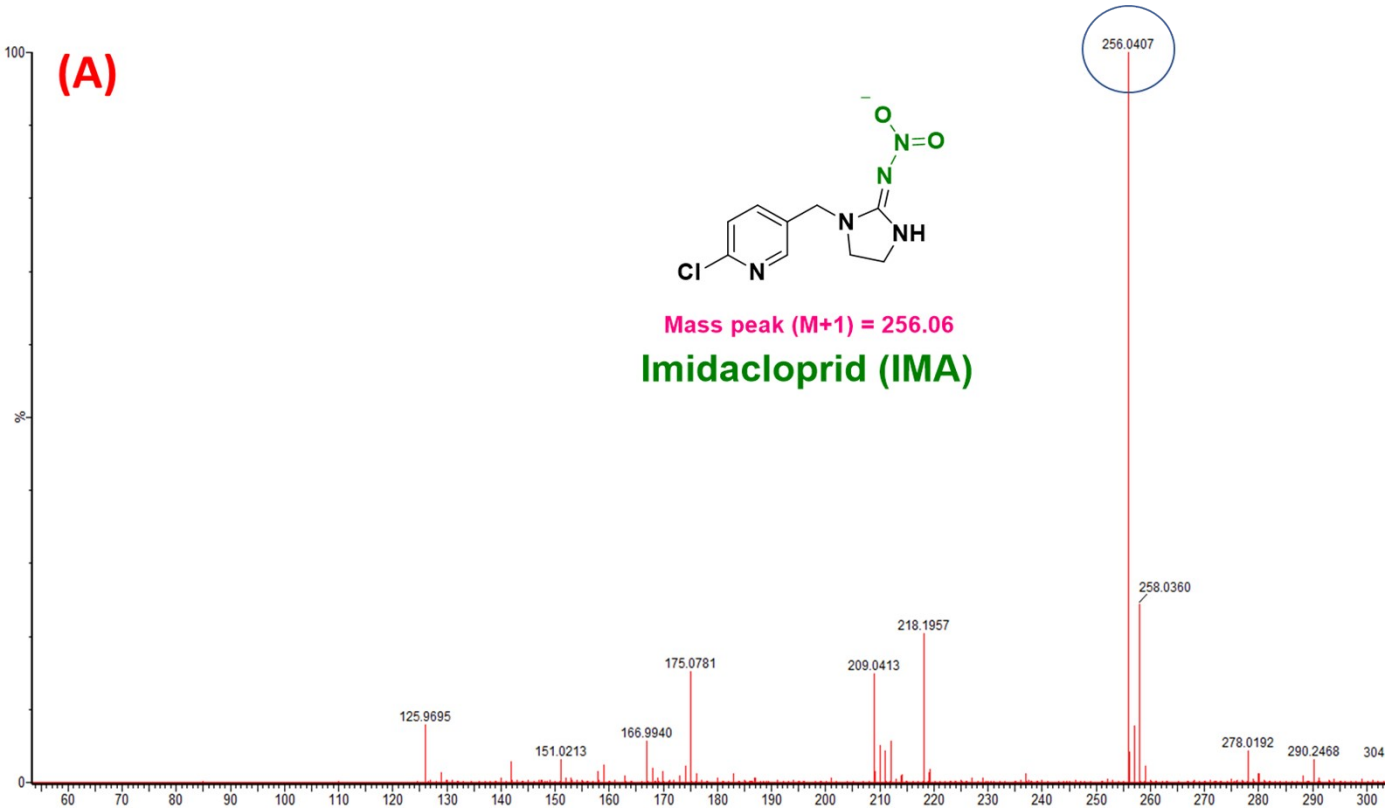


Figure S9: DPV response of CuNi/IL@MWCNTs towards IMD sensing (A) in rice samples; (B) in corn samples.



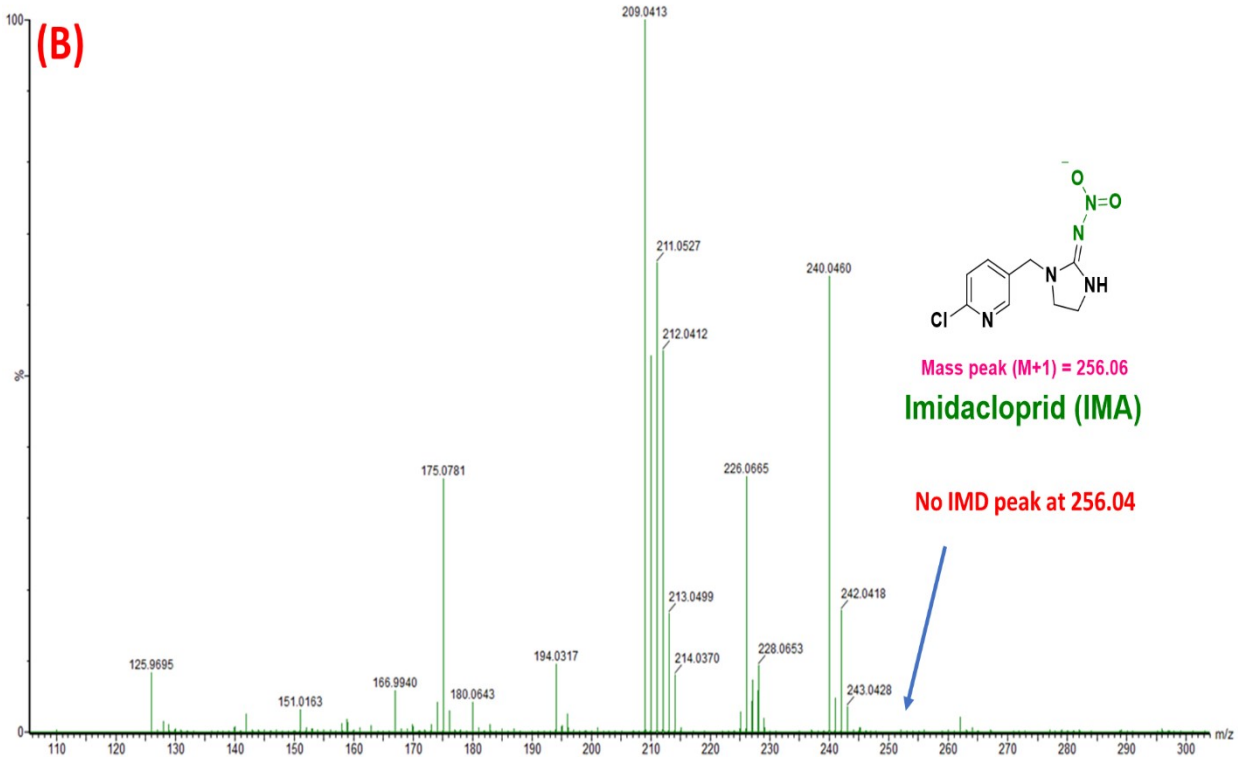


Figure S10: MS data of IMD in presence of (A) $NaBH_4$ (B) CuNi/IL@MWCNTs with $NaBH_4$.

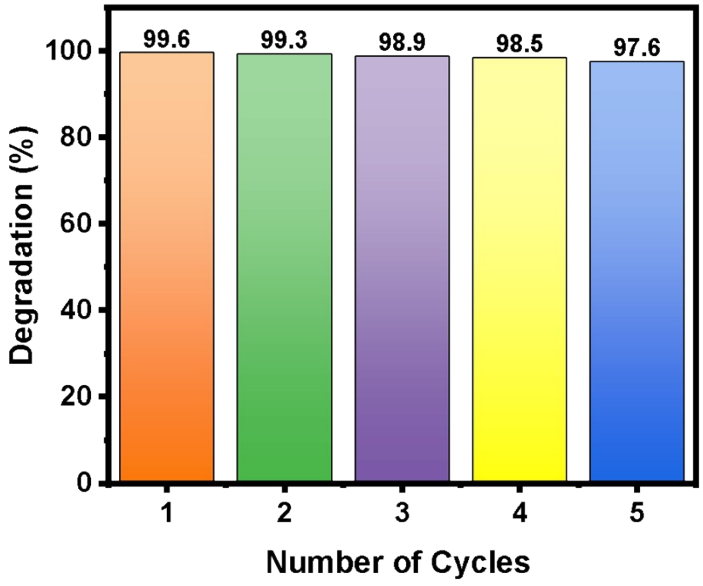


Figure S11: Reusability of CuNi/IL@MWCNTs for degradation of IMD after 5 cycles.

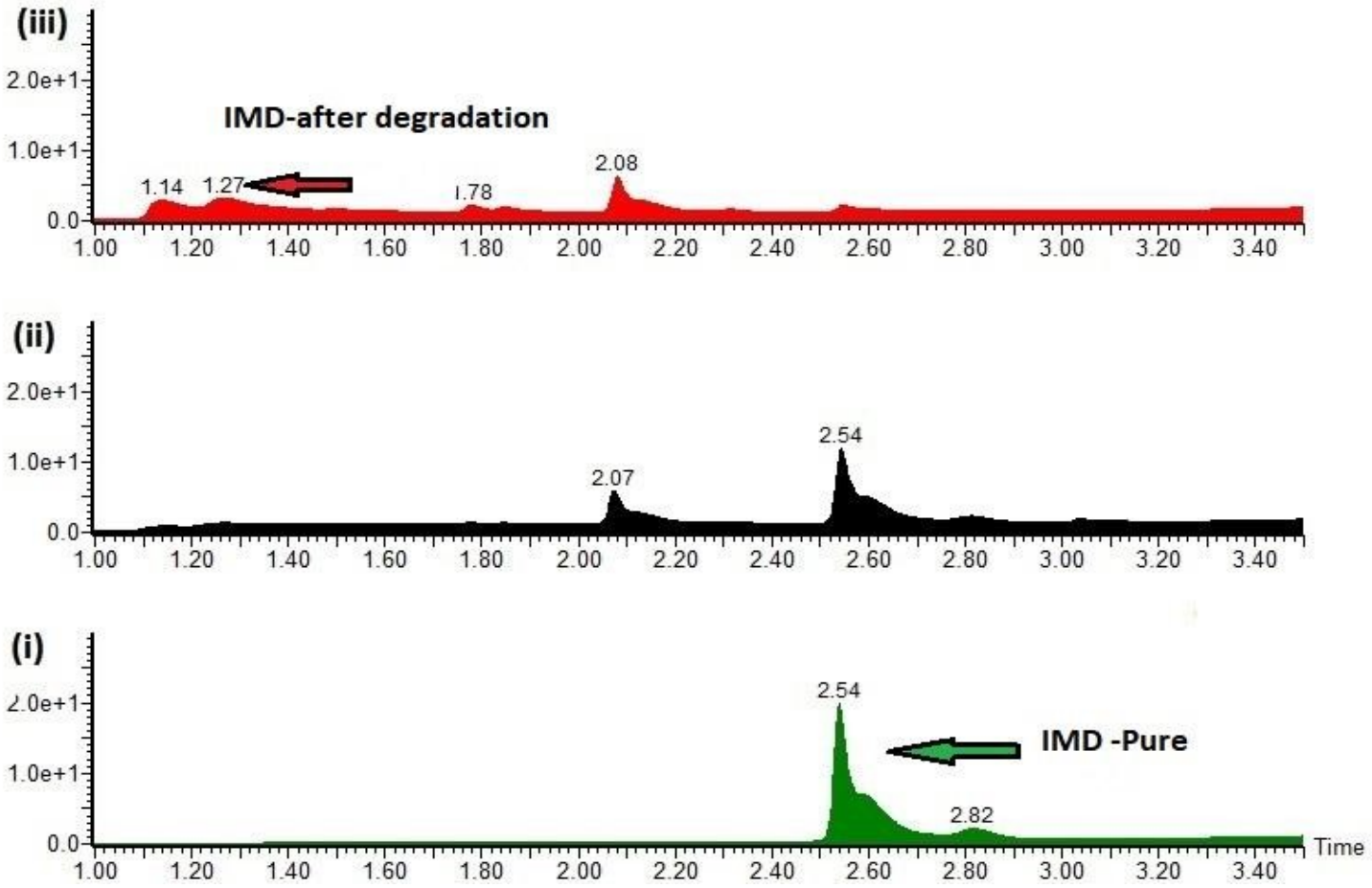
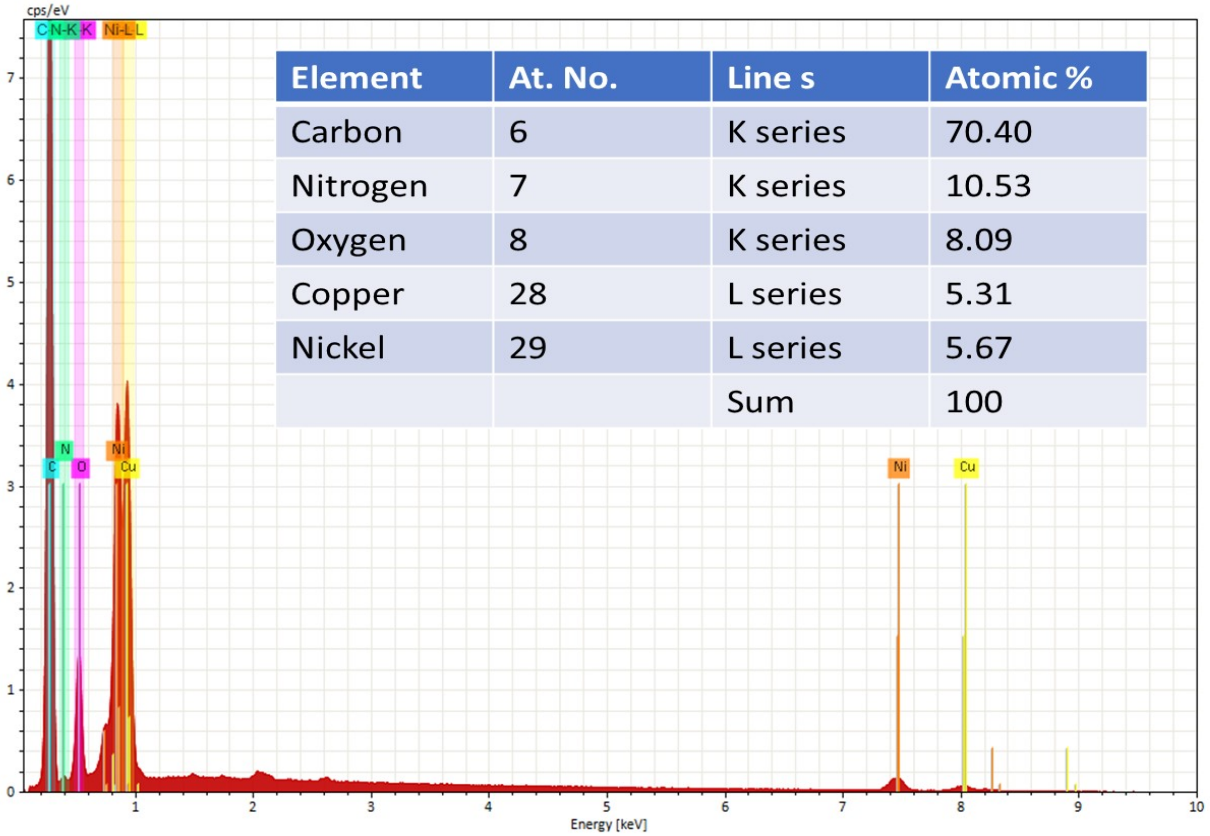


Figure S-12: LC-MS chromatograms: (i) pure IMD, (ii) Intermediate during reduction, (iii) after complete reduction;



Element	At. No.	Line s	Atomic %
Carbon	6	K series	70.40
Nitrogen	7	K series	10.53
Oxygen	8	K series	8.09
Copper	28	L series	5.31
Nickel	29	L series	5.67
		Sum	100

Figure S-13: EDS spectrum of CuNi/IL@MWCNTs nanocomposite.

Table S1: Comparison of the merits of methods for detection and degradation of Imidacloprid.

S. No.	Material Used	Method	Quantification and Degradation	cathodic peak current.	Linear range	LOD and degradation %age	Type of Real Sample	Ref.
1.	h-MoO_3 HRs/GCE	Electrochemical (Differential pulse voltammetry)	Quantification	Ipc =4.8 µA	38.7–132 µM	5.99µM	Tomato, Potato	[1]
2.	fMWCNT–Nafion®0.5%/GCE	Electrochemical (Square-wave voltammetric)	Quantification	Ipc = −1.21 µA	0.2-1.7 µM	37.4nM	Tap water, melon, and shrimp	[2]
3.	Ni/carbon	Electrochemical impedance spectroscopy	Degradation		NA	87.8%	NA	[3]
4.	poly(carbazole)/chemically reduced graphene oxide	Electrochemical (Differential pulse voltammetry)	Quantification	Ipc= -1.31µA	3 µM to 10 µM	0.44 mM	NA	[4]
5.	N/Cu-HPC/GCE	Electrochemical (Cyclic Voltammetry	Quantification	Ipc= -69.1µA	0.5µM to 60 µM	0.026 mM	Rice	[5]
6.	Graphene quantum dot/Au	Colorimetric	Quantification	NA	0.01–1 ppm	0.007 ppm.	Cucumber	[6]
7.	Iron Activated Sodium persulfate	PS oxidation	Degradation	NA	NA	80% in 30 mins	Water samples	[7]
8.	Chlorine doped Bi–BiO2−x	Photocatalysis	Degradation	NA	NA	90% in 12 hr	Water	[8]
9.	Ag-Deposited Titanate Nanotubes	Photocatalysis	Degradation	NA	NA	$t_{1/2}$ = 31 mins	NA	[9]
10.	3D–MoO2–PBC	Electro–Fenton System	Degradation	NA	NA	100% in 90mins	NA	[10]
11.	**CuNi/IL@MWCN**	**Electrochemic**	**Quantificatio**	**118.5**	**0.012**	**11nM**	**Corn and**	**This**

	Ts	**al Quantification (DPV) and catalytic degradation**	**n and Degradation**	**4 μA**	**5 -240 μM**	**And 99.6% in 100s**	**Rice**	**Wor k**

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