Enhanced Non-enzymatic Electrochemical Sensor Based on Bi_2S_3-TiO_2 Nanocomposite with HNT's for the individual and simultaneous Detection of 4-Nitrophenol and Nitrofurantoin in environmental samples.

Srujan Basavapura Ravikumar[a], Trishul Alanahalli Mallu[b], Sirisha Subbareddy[c], Santhosh Arehalli Shivamurthy[d]*, Varun Donnakatte Neelalochana[e], Karthik Chimatahalli Shantakumar[a], Jothi Ramalingam Rajabathar[f], Narges Ataollahi[e], Sandeep Shadakshari[a]*

[a]Department of Chemistry, SJCE, JSS Science and Technology University, Mysuru, Karnataka 570006, India.
[b]Department of Environmental Engineering, SJCE, JSS Science and Technology University, Mysuru, Karnataka 570006, India.
[c]Department of studies in Physics, University of Mysore, Mysuru, Karnataka, 570006, India
[d]Department of of Chemistry (U.G.), N.M.K.R.V. College for Women, Jayanagara 3rd block, Bengaluru, Karnataka 560011, India.
[e]Department of Civil, Environmental, and Mechanical Engineering, University of Trento, 38123 Trento, Italy.
[f]Department of Chemistry, College of Science, King Saud University, P.O. Box. 2455, Riyadh, 11451, Saudi Arabia.

Corresponding authors : Dr. Sandeep S, E-mail id: sandeep12chem@gmail.com
Dr. Santhosh A S, E-mail id : santhu41100@gmail.com

Supplementary data

S1 Formation mechanism of the Bi_2S_3-TiO_2/HNTs nanocomposite:

Firstly, the hydrolysis of Ti $(OBu)_4$ occurs upon the addition of water. Ti $(OBu)_4$ undergoes hydrolysis to form titanium hydroxide (Ti $(OH)_4$) and butanol (C_4H_9OH). During the condensation phase, the Ti $(OH)_4$ molecules undergo condensation reactions to form a network structure of Ti—O—Ti bridges. After multiple condensation events, large polymeric structures are formed [1].

Secondly, bismuth nitrate (Bi $(NO_3)_3$) dissolves in the ethanol-water mixture, releasing Bi^{3+} ions. Thiourea $((NH_2)_2CS)$ decomposes in the presence of water and ammonia, releasing S^{2-} ions. The Bi^{3+} ions react with S^{2-} ions to form bismuth sulfide (Bi2S3) through precipitation. The Bi2S3 and TiO2 particles then integrate during the sol-gel process, forming a nanocomposite material with both Bi2S3 and TiO2 phases. The calcination step at 500°C promotes the crystallization of TiO_2 and further stabilizes the Bi2S3-TiO_2 nanocomposite.

Thirdly, the formation of the composite between Bi2S3-TiO_2 and HNTs is achieved through a simple sonication method. Here, the Bi_2S_3-TiO_2 and HNTs are mixed in equal proportions and sonicated, which creates a force of attraction between the two nanomaterials.

Table S2. Emphasizes the Comparison of Electrochemical Performance of various reported electrodes with Bi_2S_3-TiO_2/HNT's

Material	Limit of detection		Linear range		References
	NFT (nM)	4-NP (nM)	NFT (µM)	4-NP(µM)	
NiFe/*f*-MWCNT	30	-	0.1–352.4	-	2
$MgFe_2O_4$	33	7	0–342.6	0–342.6	3
M-MWCNTs	167	165	0.56	0.55	4
NiO/BCN	10.0	-	0.05–230.0	-	5
SVG-2/GCE	8.7	-	0.035–672.3	-	6
BDDFE	8.2	-	0.497–5.66	-	7
AuNP/RGO	-	10	-	0.05–2.0	8
GO/GCE	-	20	-	0.1-120	9

rGO–HNT–AgNP/SPCE	-	48	-	0.1–363.9	10
Nb_2CTX/ Zn-Co-NC	-	70	-	1– 500	11
Bi_2S_3-TiO_2/HNT's	3.2	3.5	0 -260	0-260	This work

Table S3: Simultaneous determination of NFT and 4-NP in pond water samples using the Bi_2S_3-TiO_2/HNT's sensor

Sample	Added (µM)	Found (µM)	HPLC Method	Recovery (%)	RSD (%)
Pond water	50	49.0	49.5	**96.5**	**2.12**
	100	98.5	99.2	**98.4**	**3.23**
	150	149.2	149.3	**98.2**	**3.12**
Tap Water	50	48.6	49.8	**97.6**	**2.62**
	100	99.4	98.9	**99.5**	**3.55**
	150	149.5	148.9	**99.6**	**3.58**

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