Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

A designed miniature sensor for the trace level detection and degradation studies of a toxic dye Rhodamine B

Mazhar Hayat[a], Afzal Shah[a,*], Muhammad Kamran Hakeem[a], Muhammad Irfan[a], Abdul Haleem[a,*], Sher Bahadar Khan[b], and Iltaf Shah[c]

[a]Department of Chemistry, Quaid-i-Azam University, Islamabad 45320, Pakistan

[b]Department of Chemistry, King Abdulaziz University, P.O. Box 80203, Jeddah 21589, Saudi Arabia

[c]Department of Chemistry, College of Science, United Arab Emirates University, Al Ain P.O. Box 15551, United Arab Emirates

*The correspondent authors: Afzal Shah & Abdul Haleem

E-mail: afzals_qau@yahoo.com & haleem0300@gmail.com

Table S1. Calculated surface areas of working electrodes

Working Electrode	**Surface Area (cm^2)**
Bare GCE	0.02
MWCNTs/GCE	0.05
NH_2-*f*MWCNTs/GCE	0.09
HOOC-*f*MWCNTs/NH_2-*f*MWCNTs/GCE	0.11

Table S2. Parameters obtained from EIS

Working Electrode	**R_e (Ohm)**	**R_{ct} (Ohm)**	**CPE (µF)**
Bare GCE	169.08	5493.7	67.7
MWCNTs/GCE	166.35	3070.5	43.6
NH_2-*f*MWCNTs/GCE	172.9	178	3.6
HOOC-*f*MWCNTs/NH_2-*f*MWCNTs/GCE	154.4	159	2.9

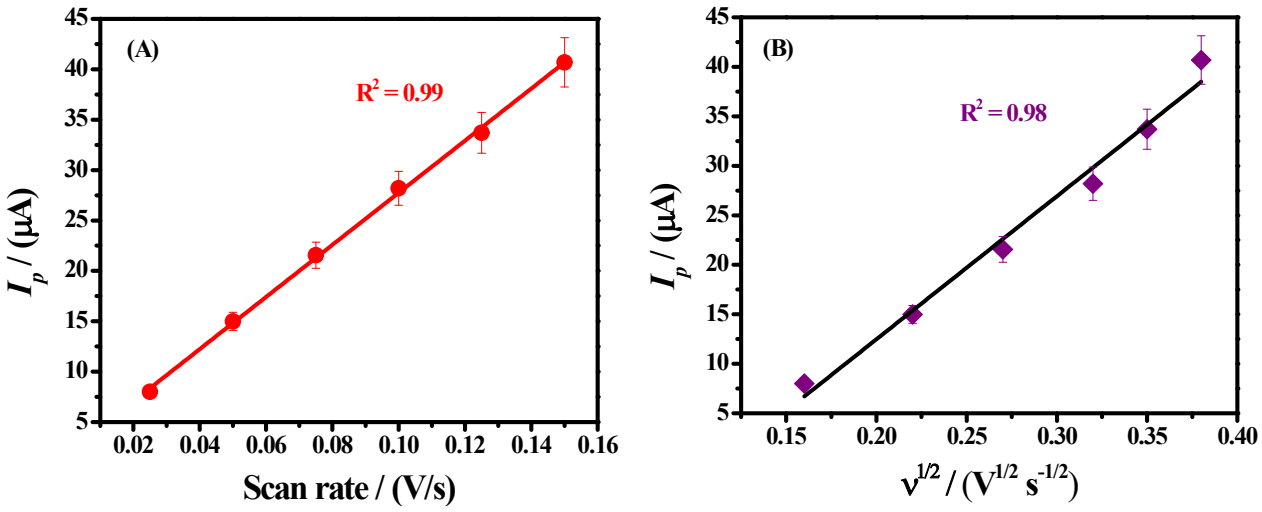

Figure S1. (A) plot of oxidation peak current *vs.* scan rate. **(B)** plot of oxidation peak current *vs.* square root of scan rate by using HOOC-*f*MWCNTs/NH_2-*f*MWCNTs/GCE as a designed sensor in 0.1 M phosphate buffer.

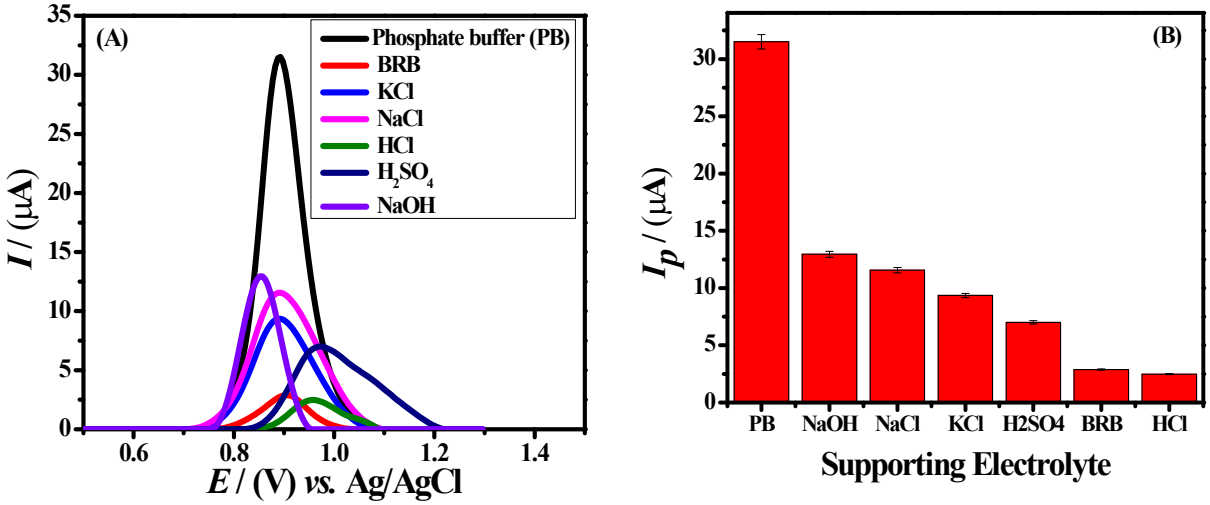

Figure S2. (A) SWVs recorded for 20 μM RhB in different supporting media using HOOC-*f*MWCNTs/NH_2-*f*MWCNTs/GCE as a modified working electrode. **(B)** The bar chart of peak current of 20 μM of Rhodamine B *vs.* supporting electrolyte

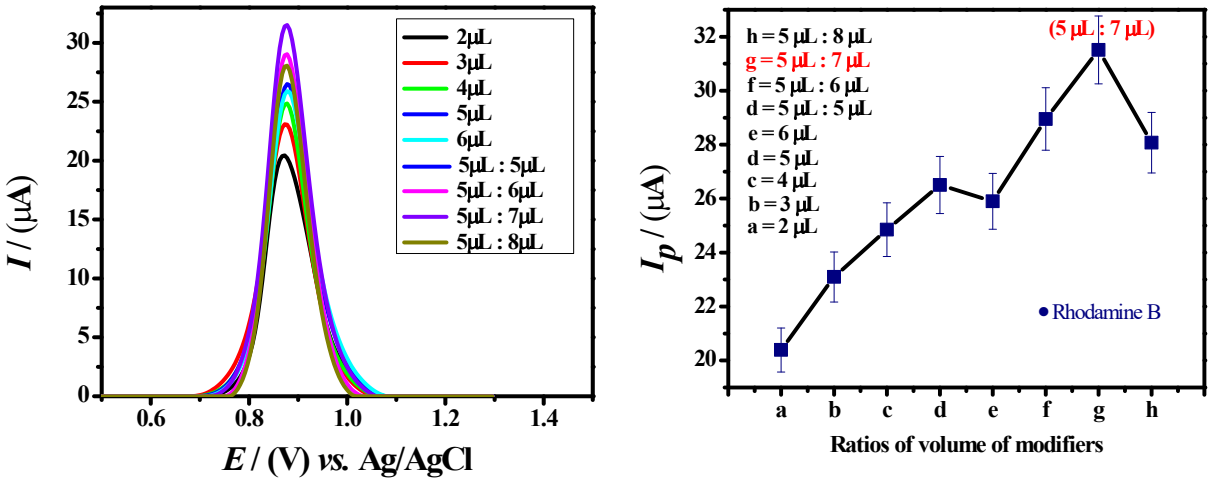

Figure S3. (A) The effect of different volume of modifiers on oxidation peak current of 20 μM Rhodamine B. **(B)** Plot between peak current *vs*. ratios of volume of modifiers in 0.1 M phosphate buffer electrolyte.

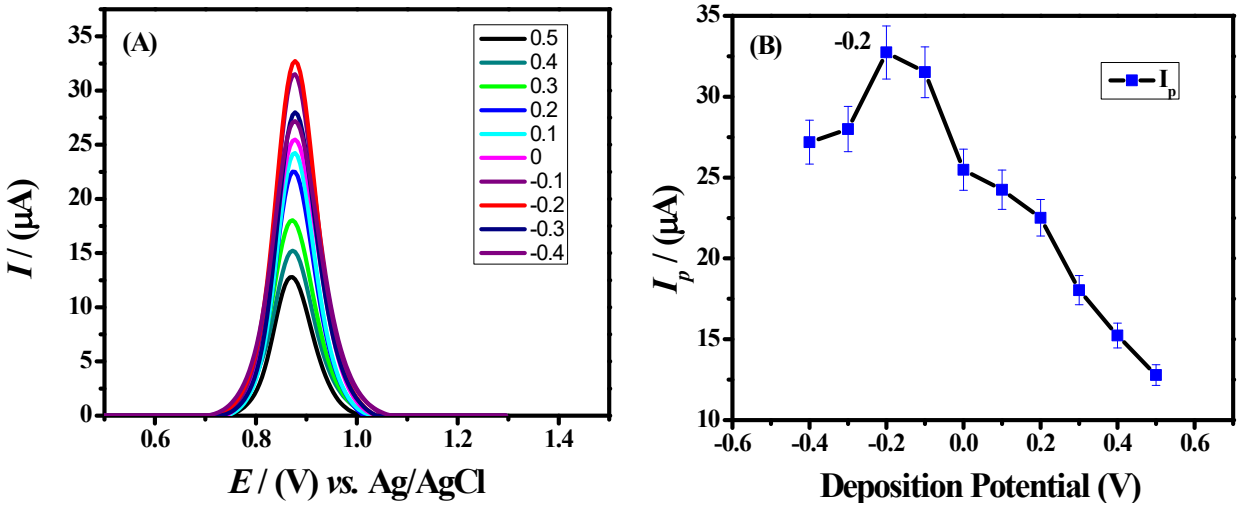

Figure S4. Selection of optimum deposition potential for the sensing of 20 μM RhB. **(A)** Square wave voltammograms of 20μM RhB. **(B)** Plot of Ip versus accumulation potential using HOOC-*f*MWCNTs/NH_2-*f*MWCNTs/GCE in PBS of pH=7.0.

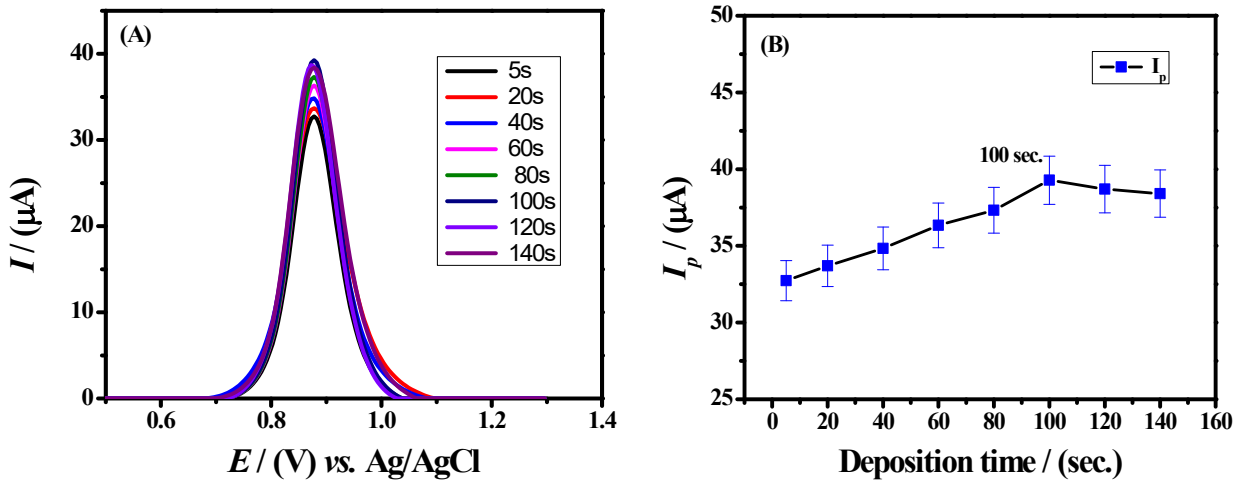

Figure S5. Selection of optimal accumulation time for sensing RhB using HOOC-*f*MWCNTs/NH_2-*f*MWCNTs/GCE in PBS at pH=7.0. **(A)** Square wave voltammograms of 20 µM RhB. **(B)** Plot of Ip versus accumulation time.

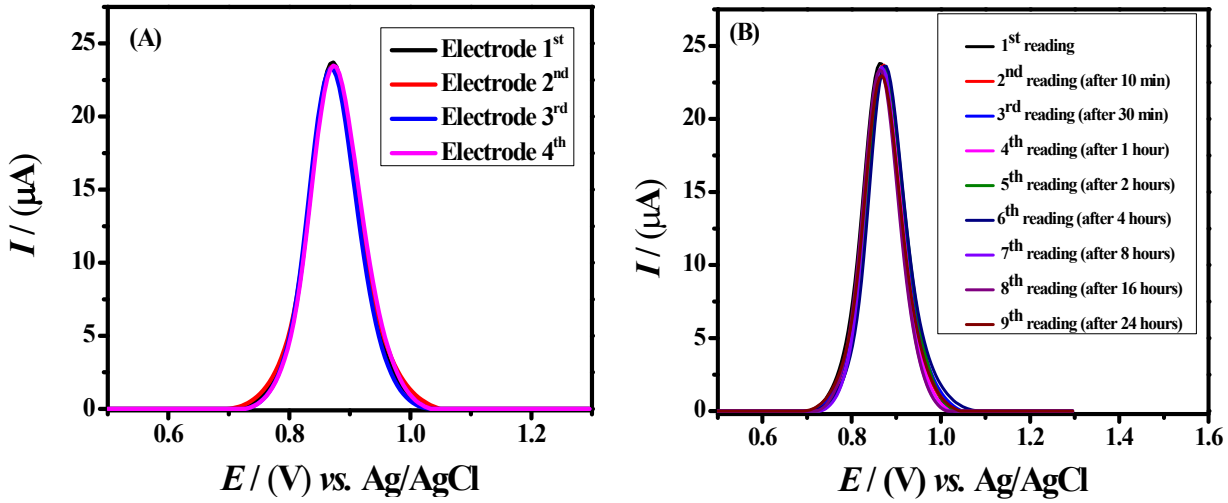

Figure S6. (A)SW voltammograms of 4 µM RhB showing the reproducibility **(B)** Square wave voltammograms of 4 µM RhB showing repeatability of the developed sensor in phosphate buffer of pH 7.0.

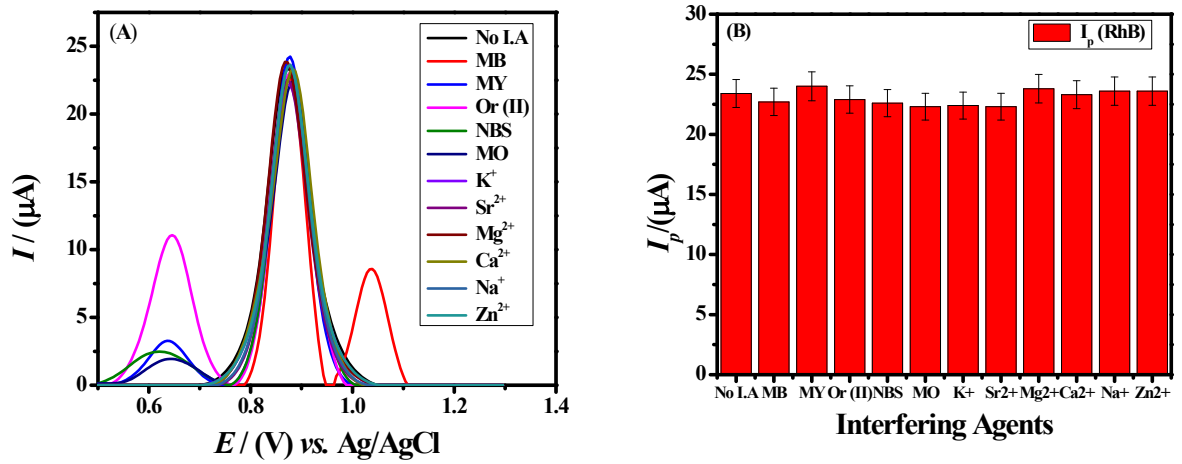

Figure S7. SWVs recorded on a surface of HOOC-*f*MWCNTs/NH_2-*f*MWCNTs/GCE in 0.1 M phosphate buffer solution of pH 7.0 in the presence of RhB and interfering agents. **(B)** plotted bar chart between peak current of RhB and interfering agents.

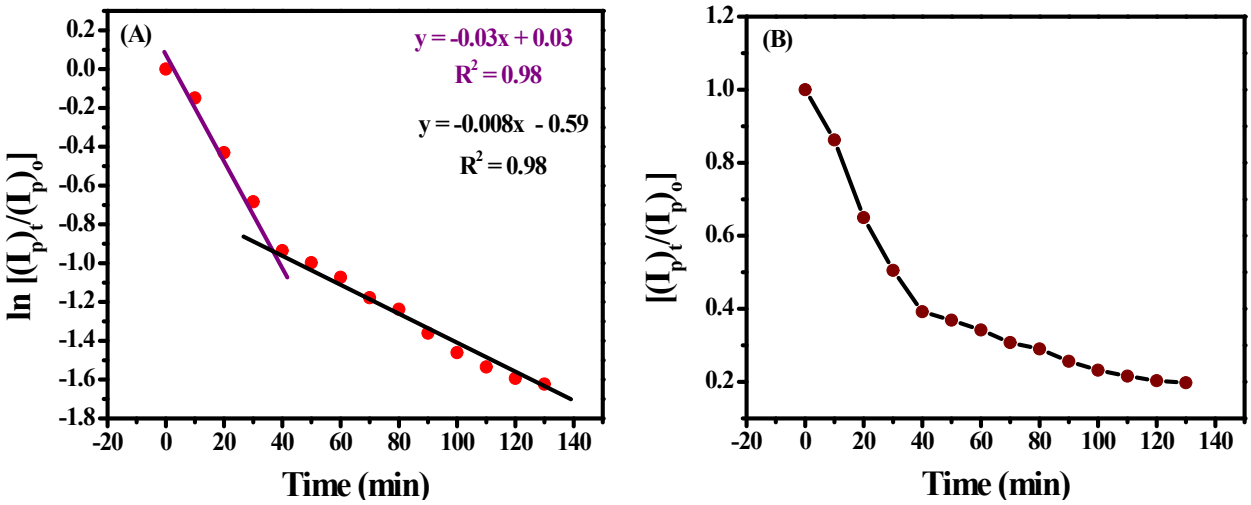

Figure S8. (A) Plot of ln $[(I_p)_t / (I_p)_o]$ versus time kinetic study using electrochemical data of the degradation of Rhodamine B. **(B)** Plot for the estimation of the extent of reduction of Rhodamine B *vs.* time.

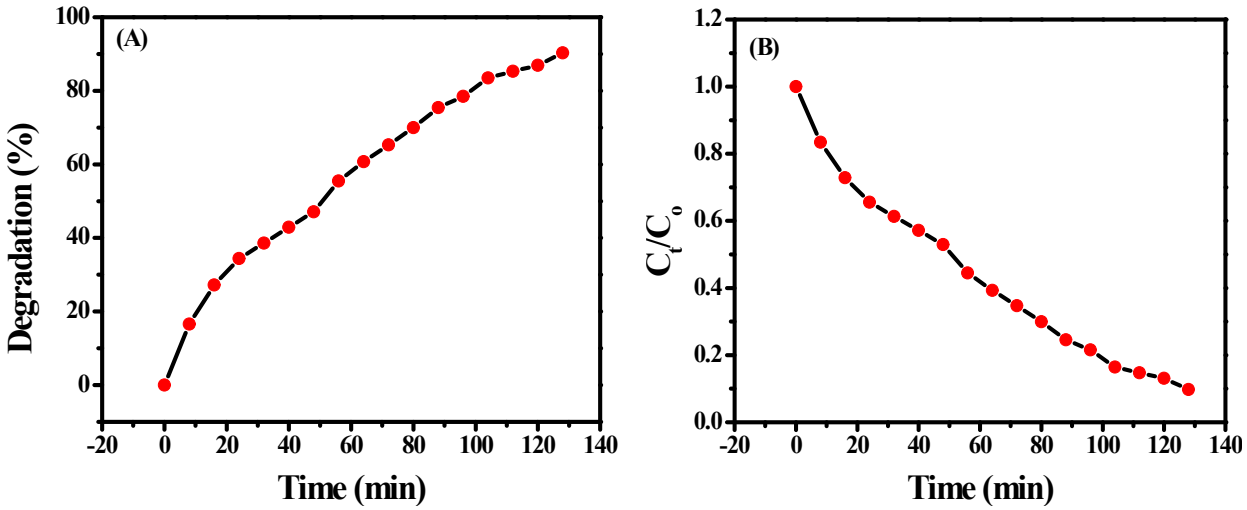

Figure S9. (A) Plot between % degradation and time. **(B)** Plot for the estimation of the extent of reduction of Rhodamine B *vs.* time.