Supporting Information

In-situ meat spoilage monitoring using label-free recognition of ethylenediamine by flexible paper based electrochemical sensor

Rokhsareh Ebrahimi [a], Houman Kholafazad kordasht [b], Mohammad Hasanzadeh [c,*], Nasrin Shadjou [d]

[a] Asian Nano-ink (ANI) Company, Tabriz University of Medical Sciences, Tabriz, Iran.

[b] Nutrition Research Center, Tabriz University of Medical Sciences, Tabriz, Iran.

[c] Pharmaceutical Analysis Research Center, Tabriz University of Medical Sciences, Tabriz, Iran.

[c] Department of Nanotechnology, Faculty of Chemistry, Urmia University, Urmia, Iran.

* Corresponding Authors:
Mohammad Hasanzadeh
Pharmaceutical Analysis Research Center, Tabriz University of Medical Sciences, Tabriz, Iran.
(*) hasanzadehm@tbzmed.ac.ir

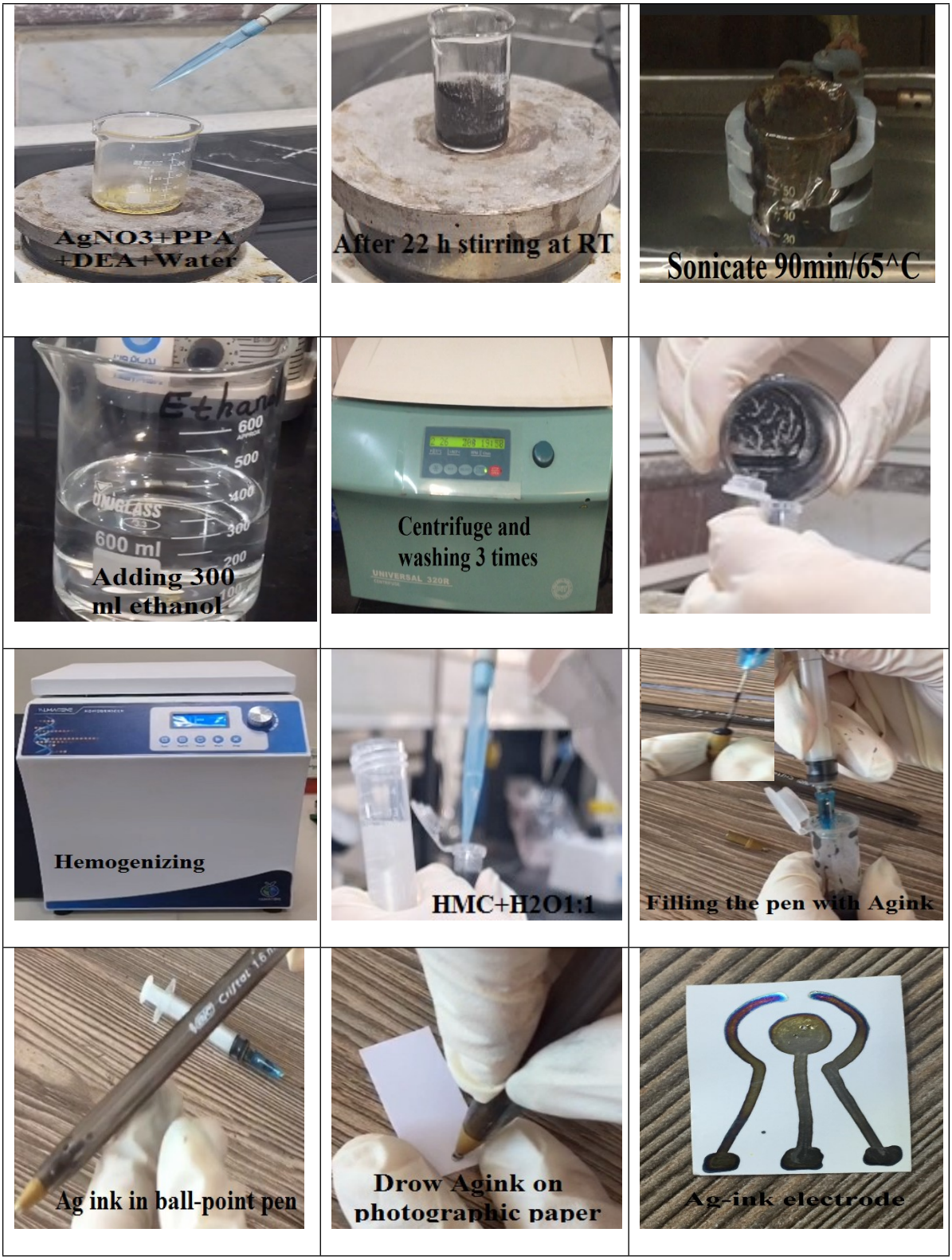

Figure S1. Photographic images of Ag nano-ink preparation procedure.

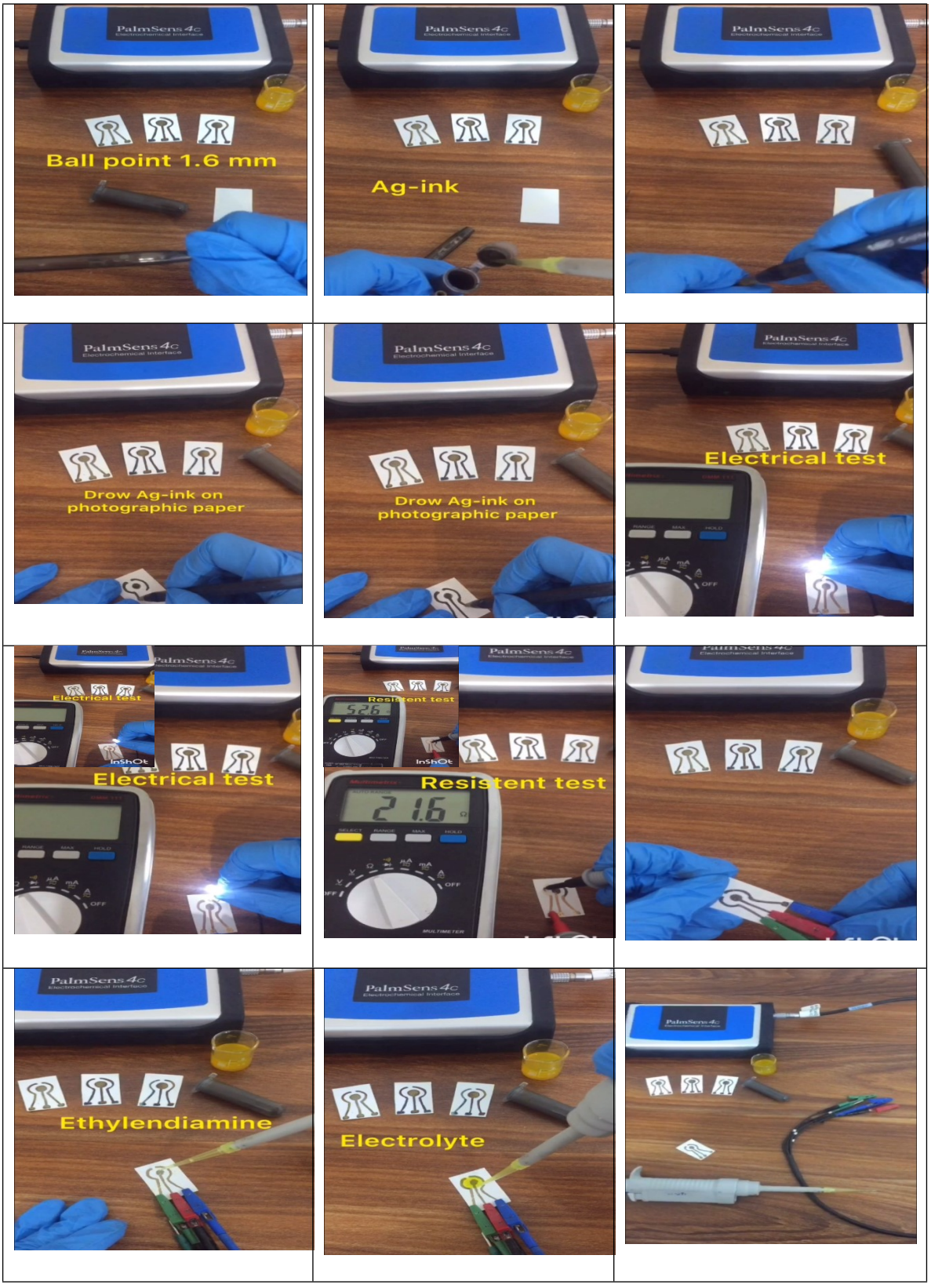

Figure S2. EDA analysis using photographic paper-based sensor.

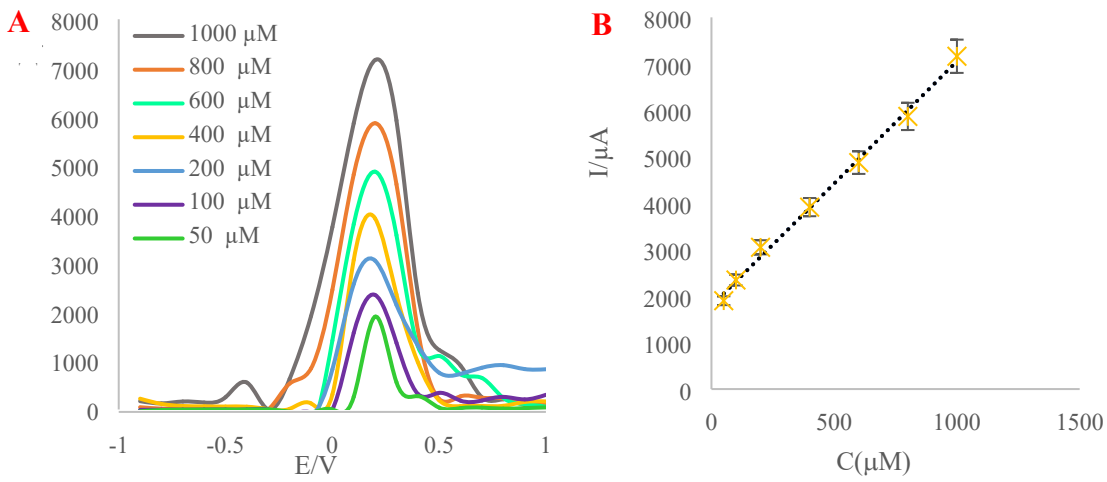

Figure S3. (A) SWVs of the developed electrochemica sensor in different concentrations of EDA (50, 100, 200, 400, 600, 800 and 1000 µM). **(B) C**alibration curves.

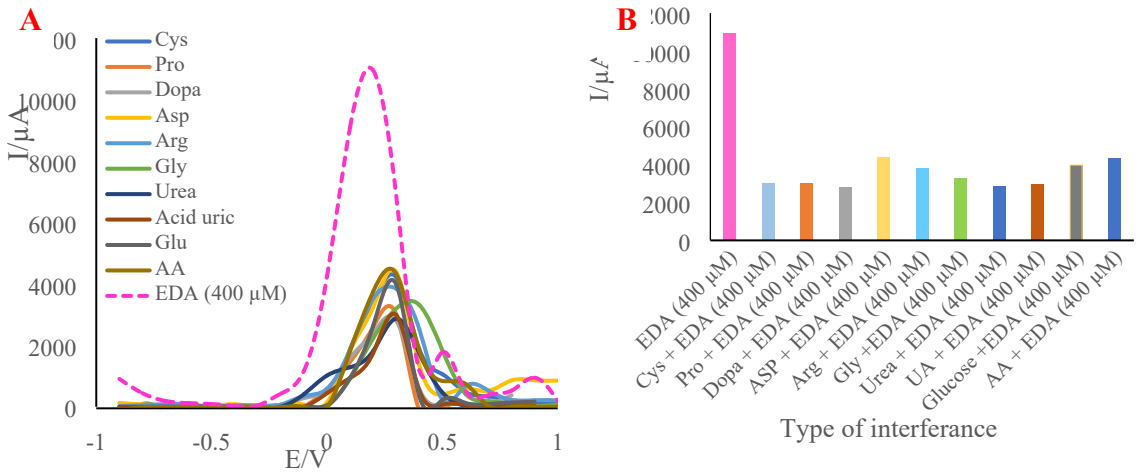

Figure S4. (A) SWVs of the prepared paper-based electrochemical sensor in the presence of different interferences (Glucose, Cys, AA, DA, UA, Pro, Asp, Arg, Gly and Urea). **(B)** Histogram of peak currents *versus* type of interferes agent.

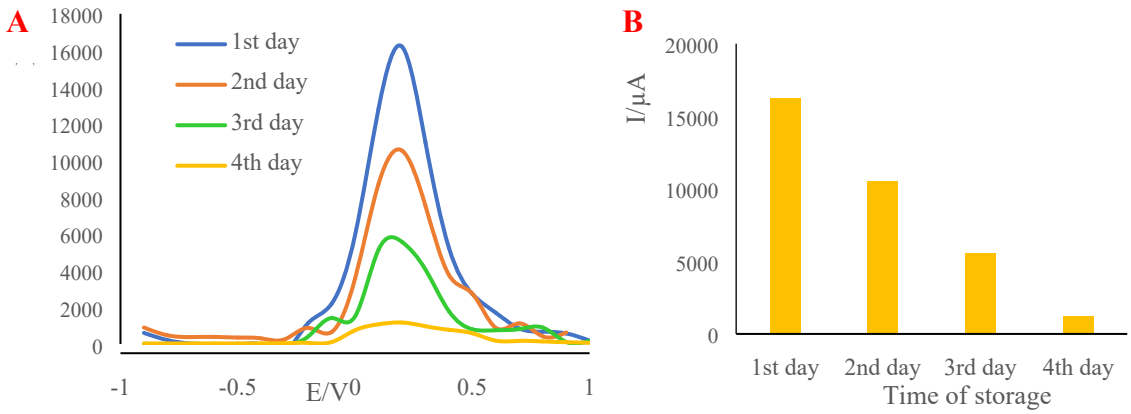

Figure S5. **(A)** SWVs of paper-based electrochemical sensor over four days. **(B)** Histogram of peak current *versus* time of sensor incubation in dark place.

Table S1. Comparison of peak current and potential of different interventions.

Type of Technique	Ag nano-ink		Ag Ink/EDA	
	I/μA	E/V	I/μA	E/V
CV	852	0. 35	9724	0.33
SWV	10128.11	0.2	22252.57	0.2
DPV	44.56	0.1	75.69	0.1

Table S2. Comparison of peak current and potential of different interventions.

Type of species	E/V	I/μA
EDA (400 μM)	0.2	10949.48
Cys + EDA (400 μM)	0.3	3005.485
Pro + EDA (400 μM)		3005.485
DA + EDA (400 μM)		2804.046
ASP + EDA (400 μM)		4384.908
Arg + EDA (400 μM)		3842.747
Gly +EDA (400 μM)	0.4	3314.263
Urea + EDA (400 μM)	0.3	2869.172
UA + EDA (400 μM)		2984.347
Glucose +EDA (400 μM)		3978.43
AA + EDA (400 μM)		4323.652

Table S3. Comparison of current intensity and RSD of three microsensors in three different concentrations.

No. of test	Concentration of EDA			
	100 µM	**400 µM**	**1000 µM**	
	I/ µA			
1st	11537.1	14413.79	23916.03	
2nd	4132.597	4537.099	16991.71	
3rd	212.4389	781.6105	1939.09	
RSD%	7.33	7.89	4.45	6.56 (**Average**)

Table S4. Comparison of current intensity and RSD of three paper-based electrochemical sensors in three different concentrations.

No. of test	**Concentration of** EDA			
	100 µM	**400 µM**	**1000 µM**	
	I/ µA			
1st	11537.1	14413.79	25828.84	
2nd	10275.33	16165.17	23916.03	
3rd	11043.45	16815.92	22175.78	
RSD%	4.13	3.82	3.64	3.86 (**Average**)