Electronic Supplementary Material (ESI) for RSC Advances.

Supporting information

Reliable discrimination of histamine and ethylenediamine in meat samples using colorimetric affordable test strip (CATS): Introducing a novel lab-on paper strategy for low-cost ensuring food safety by rapid and accurate monitoring of biogenic amines

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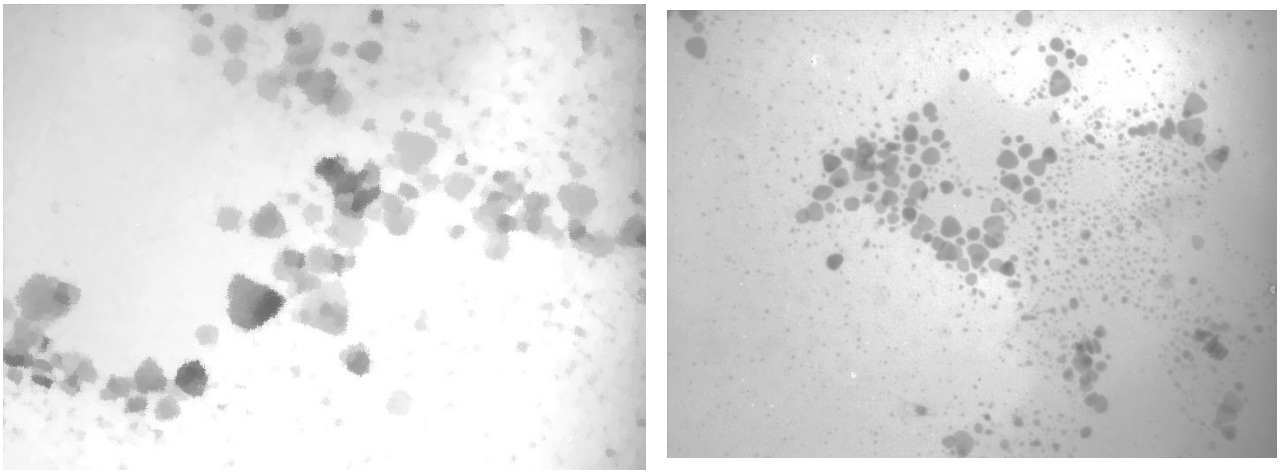


Fig. S1. A) TEM images of AgNPrs in two magnifications (included with permission [32]).

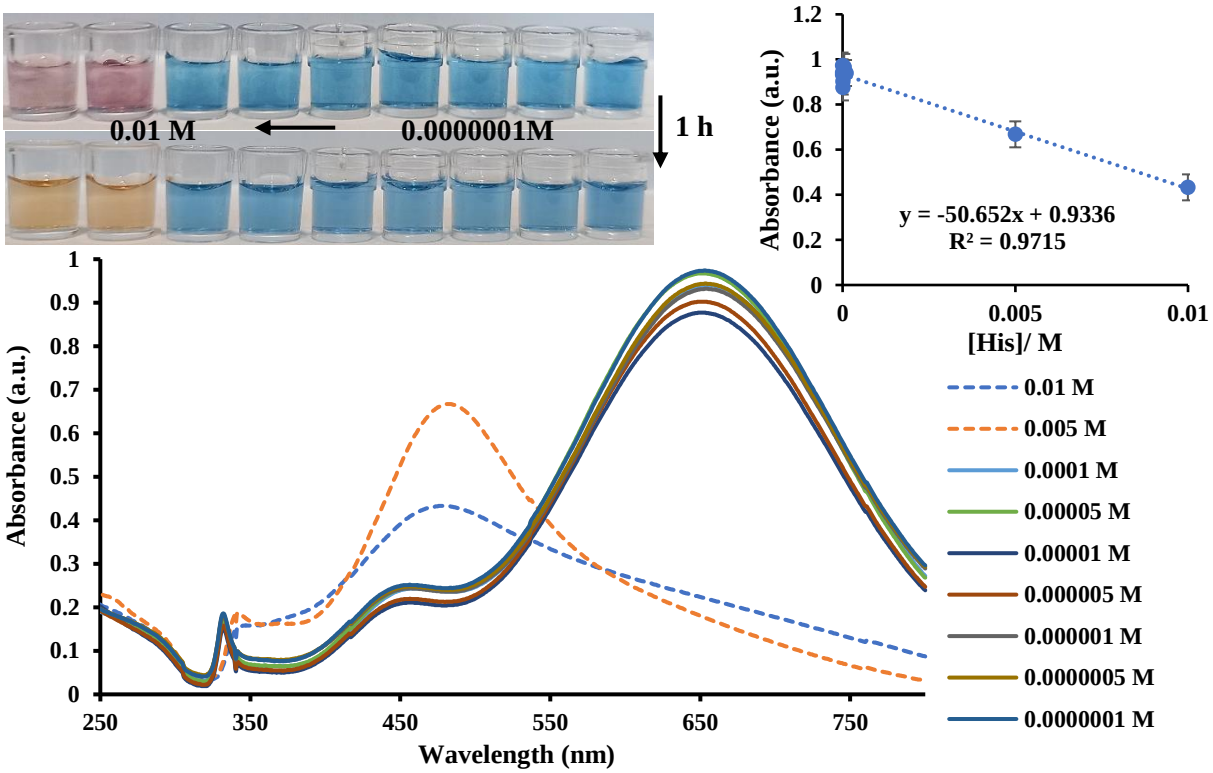


Figure S2. A) The UV-Vis spectra of AgNPrs in the presence of various concentration of HIS. **Inset**; Calibration curve.

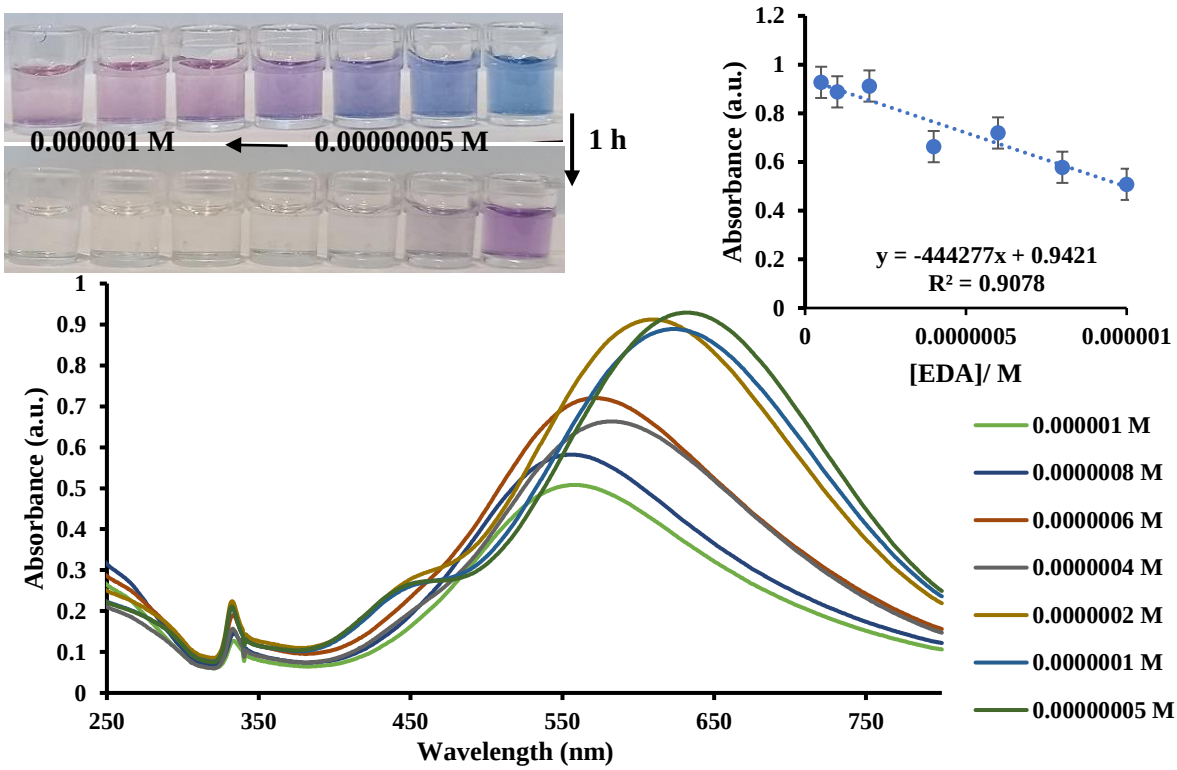
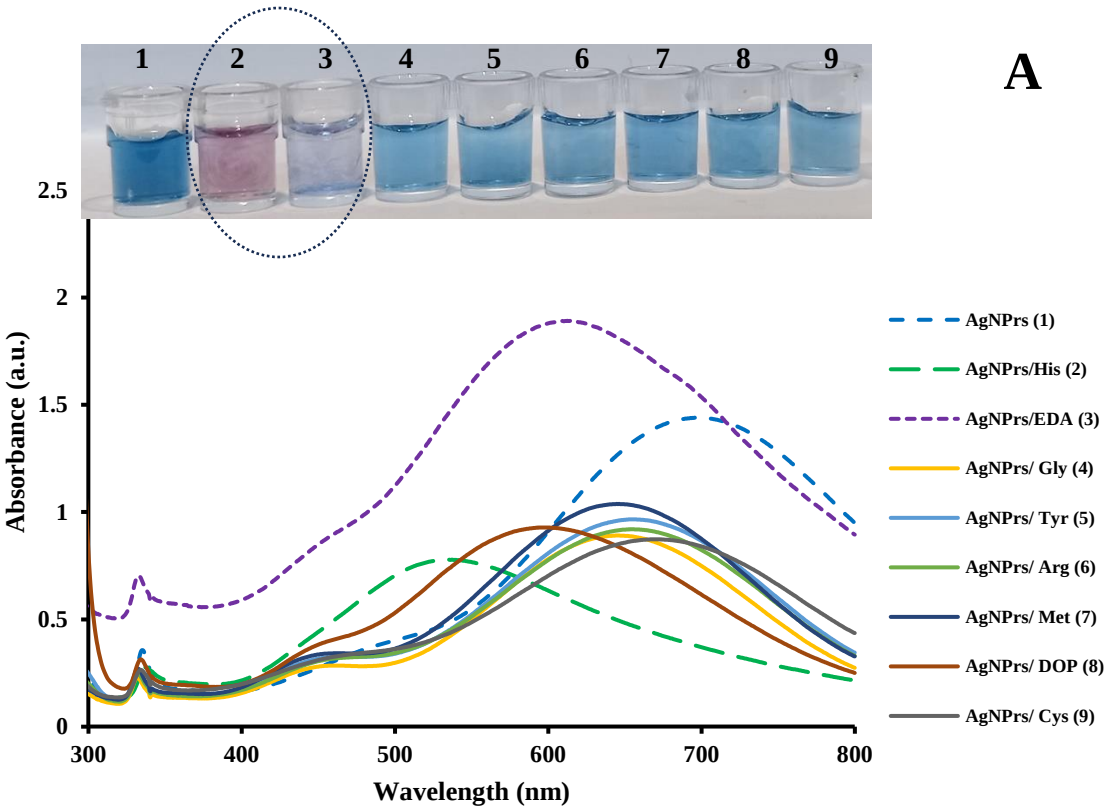
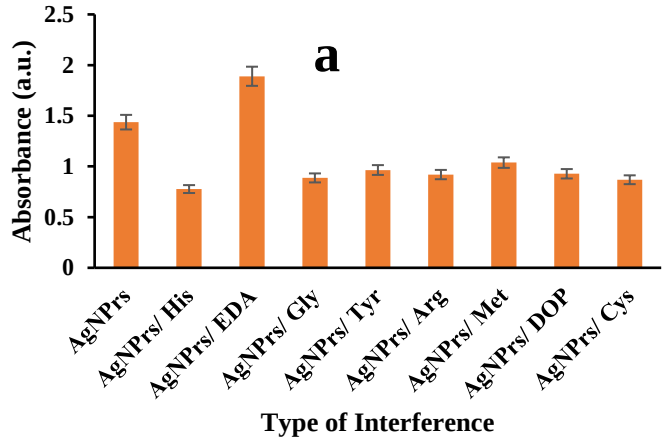
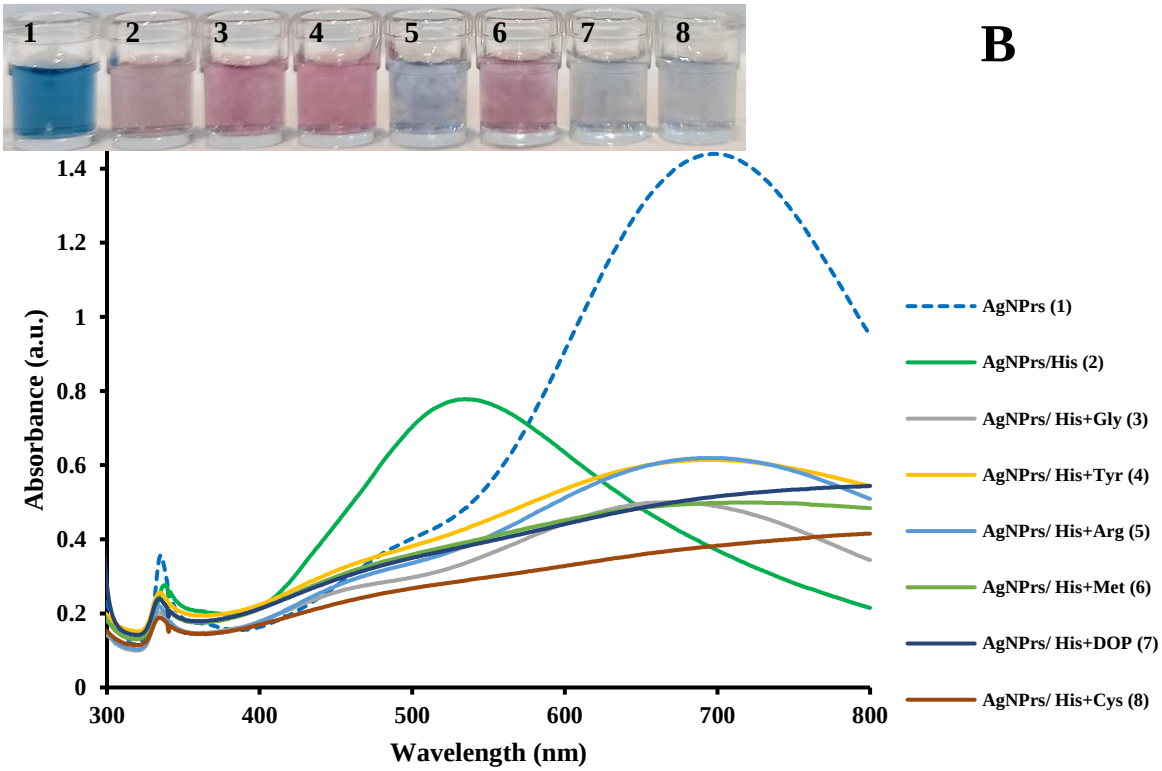
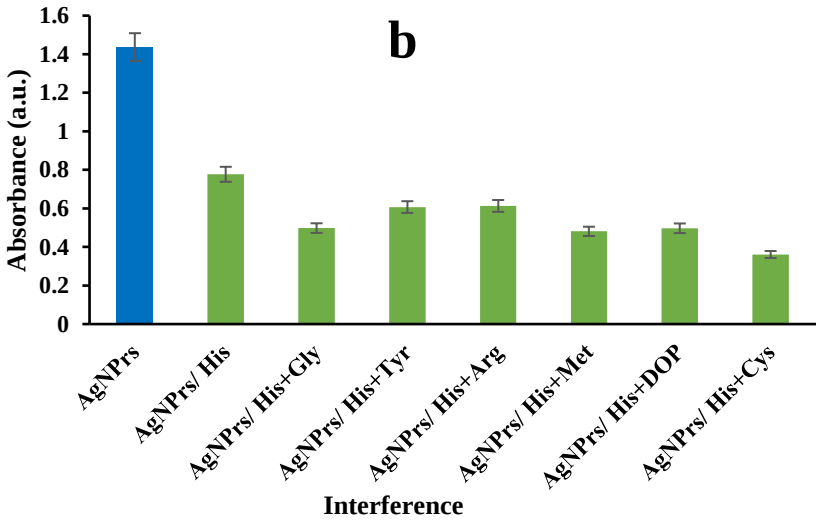


Figure S3. A) The UV-Vis spectra of AgNPrs in the presence of various concentration of EDA. **Inset**; Calibration curve.


A
1
2
3
4
5
6
7
8
9
Absorbance (a.u.)
Wavelength (nm)
AgNPrs (1)
AgNPrs/His (2)
AgNPrs/EDA (3)
AgNPrs/ Gly (4)
AgNPrs/ Tyr (5)
AgNPrs/ Arg (6)
AgNPrs/ Met (7)
AgNPrs/ DOP (8)
AgNPrs/ Cys (9)


a
Absorbance (a.u.)
AgNPrs
AgNPrs/ His
AgNPrs/ EDA
AgNPrs/ Gly
AgNPrs/ Tyr
AgNPrs/ Arg
AgNPrs/ Met
AgNPrs/ DOP
AgNPrs/ Cys
Type of Interference


B
1
2
3
4
5
6
7
8
Absorbance (a.u.)
Wavelength (nm)
AgNPrs (1)
AgNPrs/His (2)
AgNPrs/ His+Gly (3)
AgNPrs/ His+Tyr (4)
AgNPrs/ His+Arg (5)
AgNPrs/ His+Met (6)
AgNPrs/ His+DOP (7)
AgNPrs/ His+Cys (8)


b
Absorbance (a.u.)
AgNPrs
AgNPrs/ His
AgNPrs/ His+Gly
AgNPrs/ His+Tyr
AgNPrs/ His+Arg
AgNPrs/ His+Met
AgNPrs/ His+DOP
AgNPrs/ His+Cys
Interference

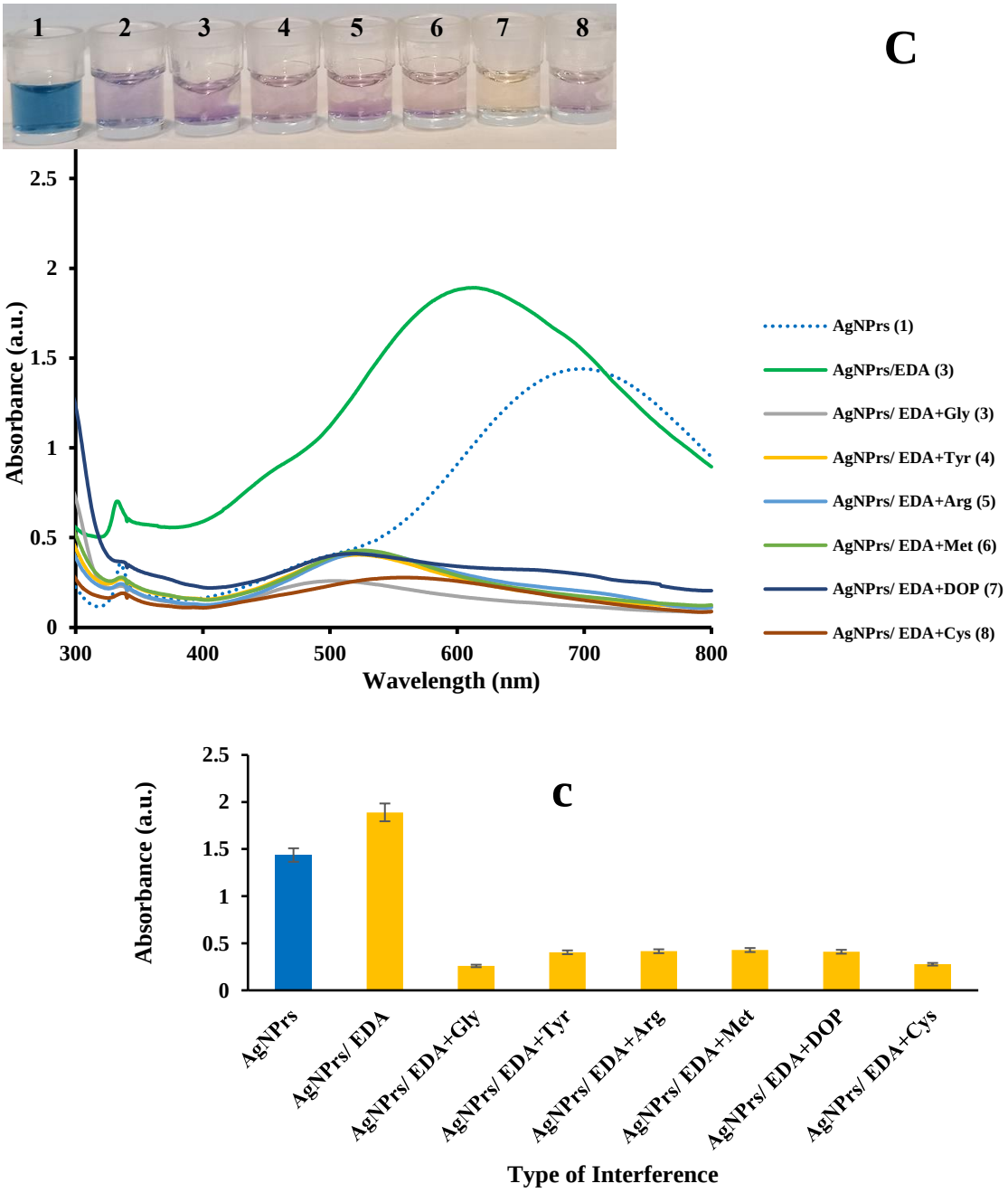
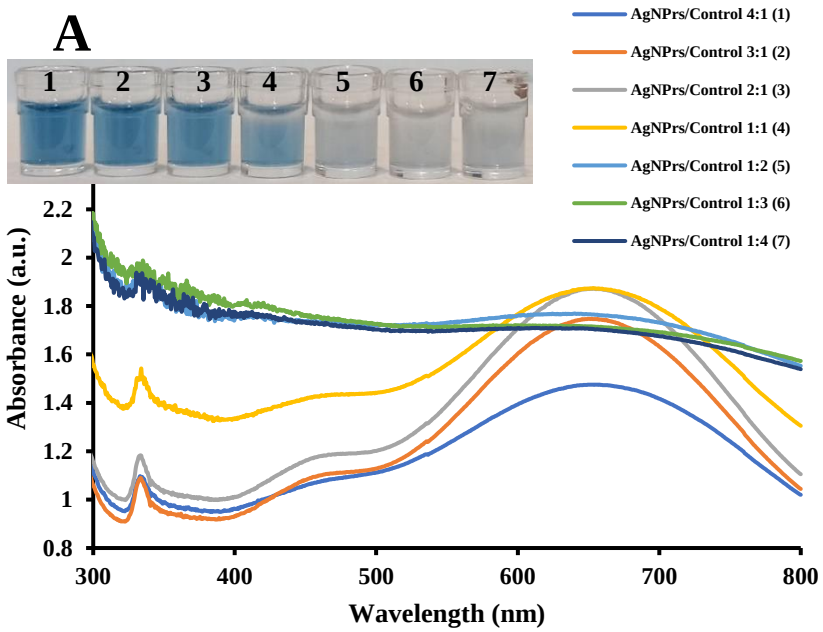
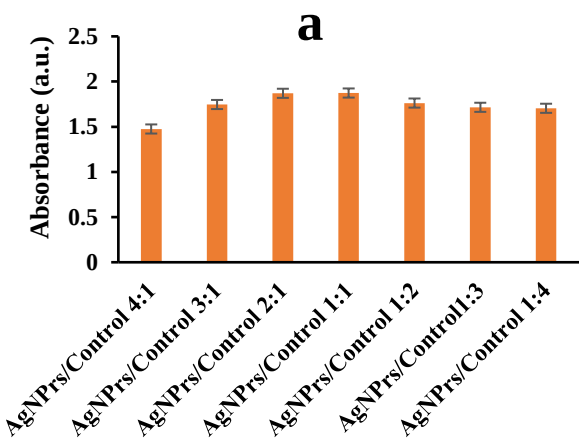
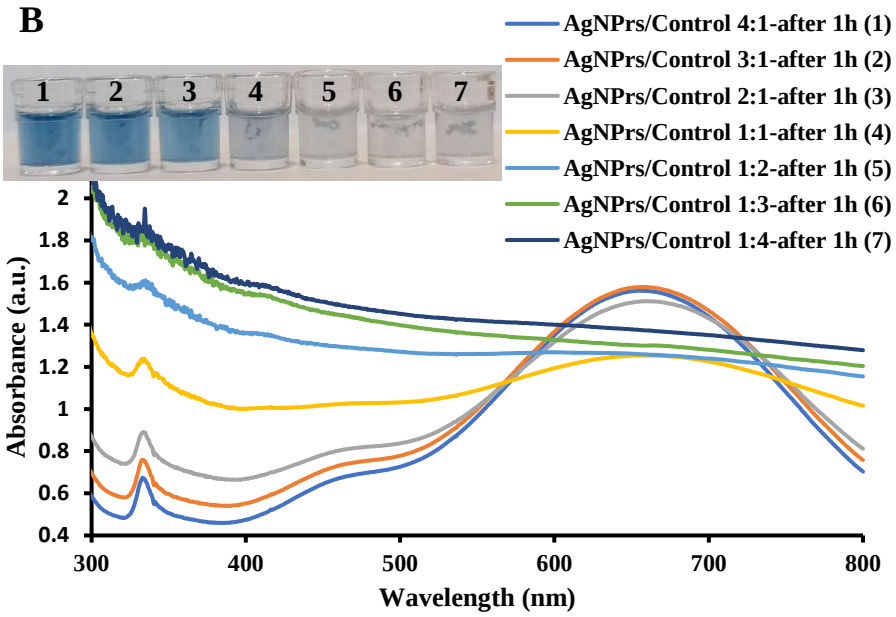
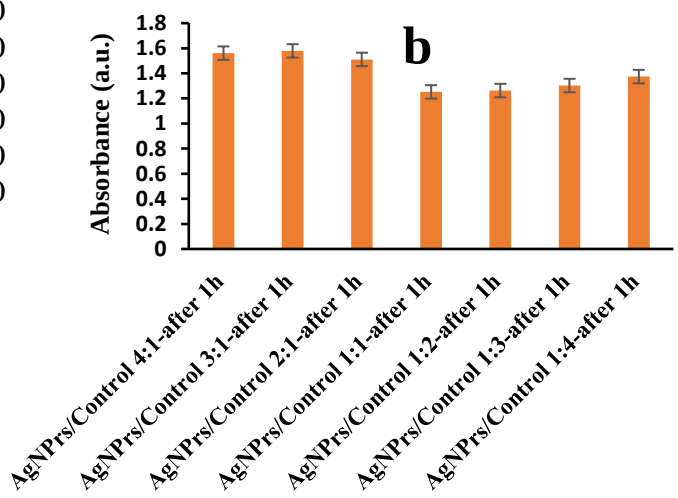


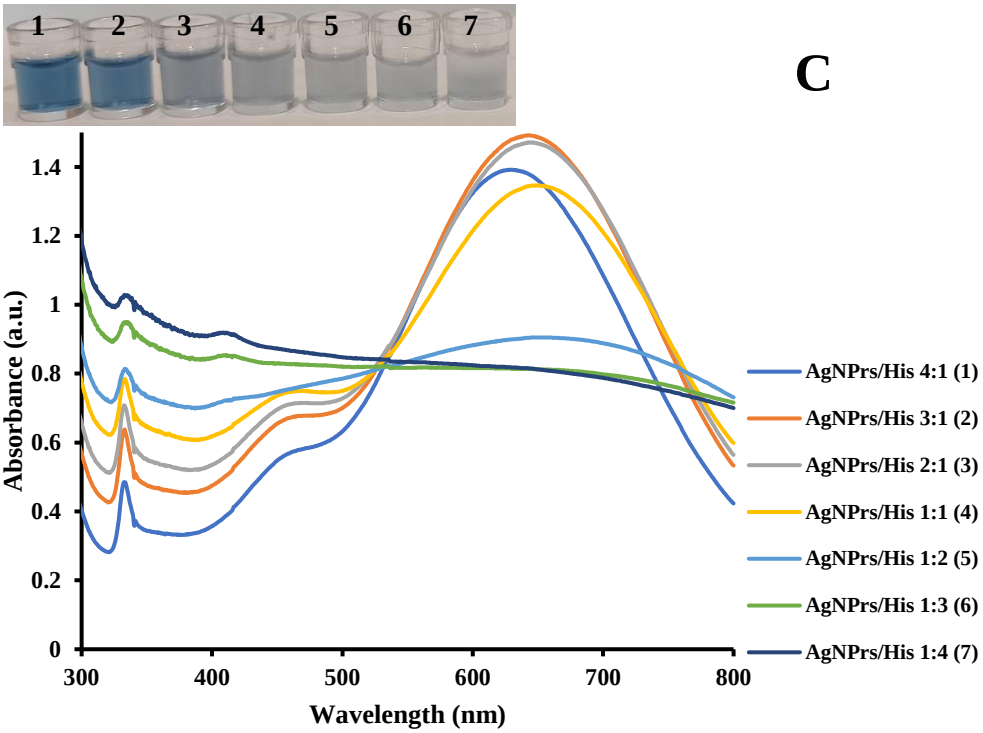
Figure S4. Selectivity of optical chemosensor to detection of EDA and HIS in the presence of various interferences **(A)**, His in the presence of interferences **(B)**, EDA in the presences of EDA **(C)**.

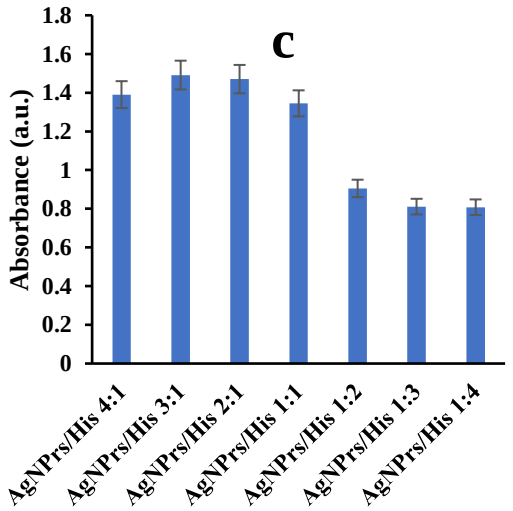

A
1
2
3
4
5
6
7
AgNPrs/Control 4:1 (1)
AgNPrs/Control 3:1 (2)
AgNPrs/Control 2:1 (3)
AgNPrs/Control 1:1 (4)
AgNPrs/Control 1:2 (5)
AgNPrs/Control 1:3 (6)
AgNPrs/Control 1:4 (7)
Absorbance (a.u.)
Wavelength (nm)

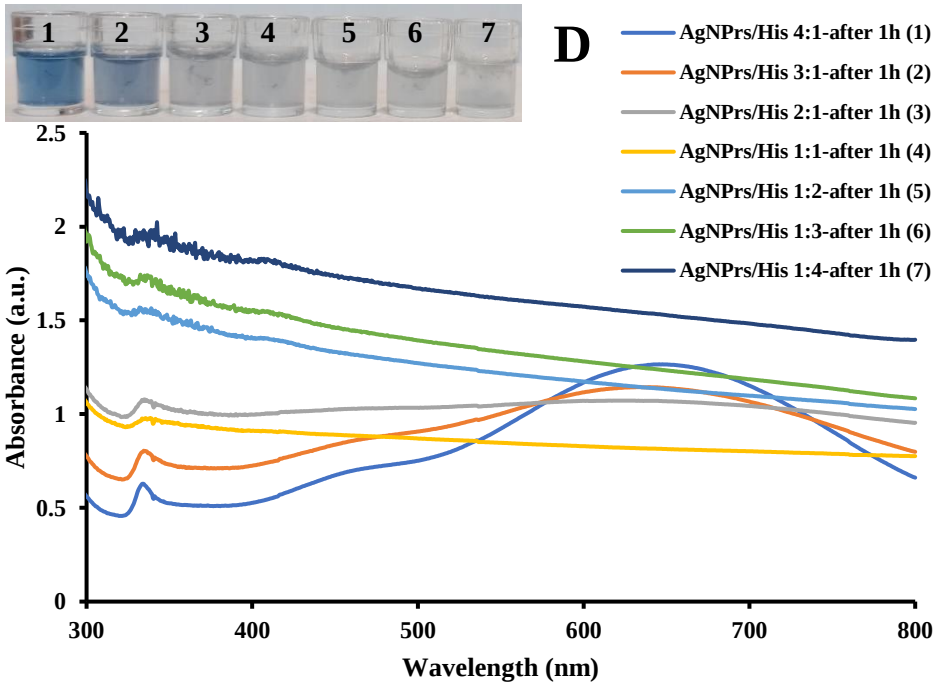

a
Absorbance (a.u.)
AgNPrs/Control 4:1
AgNPrs/Control 3:1
AgNPrs/Control 2:1
AgNPrs/Control 1:1
AgNPrs/Control 1:2
AgNPrs/Control1:3
AgNPrs/Control 1:4

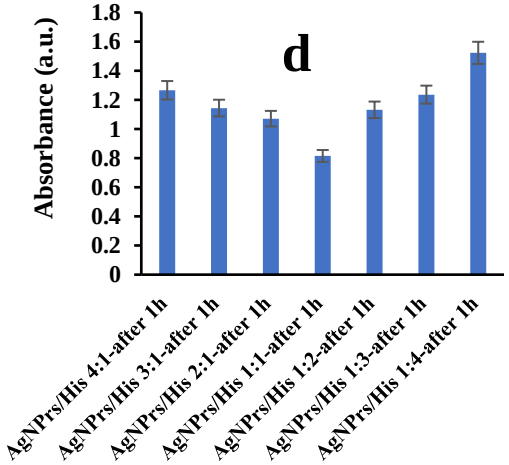

B
1
2
3
4
5
6
7
AgNPrs/Control 4:1-after 1h (1)
AgNPrs/Control 3:1-after 1h (2)
AgNPrs/Control 2:1-after 1h (3)
AgNPrs/Control 1:1-after 1h (4)
AgNPrs/Control 1:2-after 1h (5)
AgNPrs/Control 1:3-after 1h (6)
AgNPrs/Control 1:4-after 1h (7)
Absorbance (a.u.)
Wavelength (nm)


b
Absorbance (a.u.)
AgNPrs/Control 4:1-after 1h
AgNPrs/Control 3:1-after 1h
AgNPrs/Control 2:1-after 1h
AgNPrs/Control 1:1-after 1h
AgNPrs/Control 1:2-after 1h
AgNPrs/Control 1:3-after 1h
AgNPrs/Control 1:4-after 1h


1
2
3
4
5
6
7
C
Absorbance (a.u.)
Wavelength (nm)
AgNPrs/His 4:1 (1)
AgNPrs/His 3:1 (2)
AgNPrs/His 2:1 (3)
AgNPrs/His 1:1 (4)
AgNPrs/His 1:2 (5)
AgNPrs/His 1:3 (6)
AgNPrs/His 1:4 (7)


c
Absorbance (a.u.)
AgNPrs/His 4:1
AgNPrs/His 3:1
AgNPrs/His 2:1
AgNPrs/His 1:1
AgNPrs/His 1:2
AgNPrs/His 1:3
AgNPrs/His 1:4


1
2
3
4
5
6
7
D
Absorbance (a.u.)
Wavelength (nm)
AgNPrs/His 4:1-after 1h (1)
AgNPrs/His 3:1-after 1h (2)
AgNPrs/His 2:1-after 1h (3)
AgNPrs/His 1:1-after 1h (4)
AgNPrs/His 1:2-after 1h (5)
AgNPrs/His 1:3-after 1h (6)
AgNPrs/His 1:4-after 1h (7)


d
Absorbance (a.u.)
AgNPrs/His 4:1-after 1h
AgNPrs/His 3:1-after 1h
AgNPrs/His 2:1-after 1h
AgNPrs/His 1:1-after 1h
AgNPrs/His 1:2-after 1h
AgNPrs/His 1:3-after 1h
AgNPrs/His 1:4-after 1h

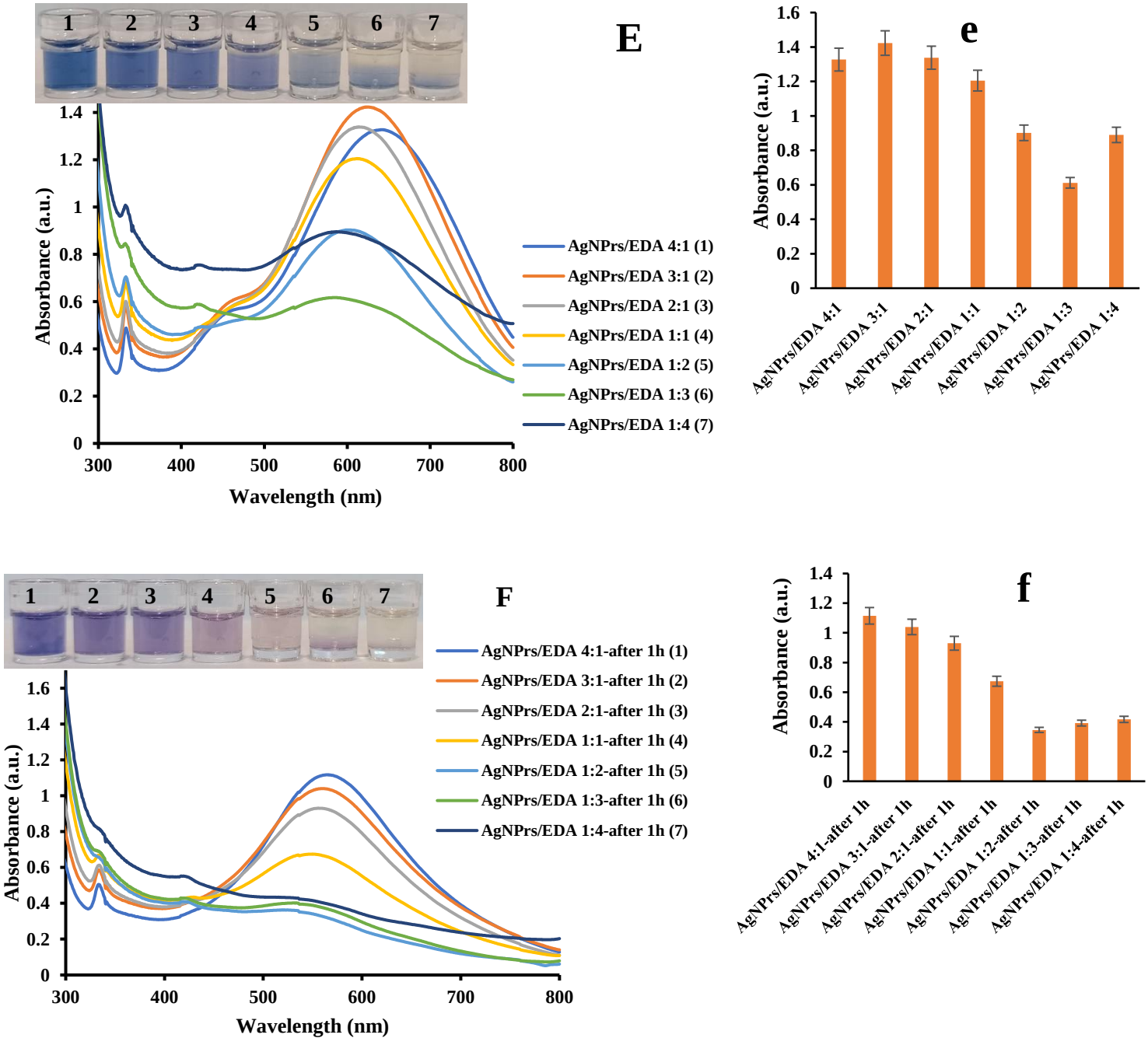
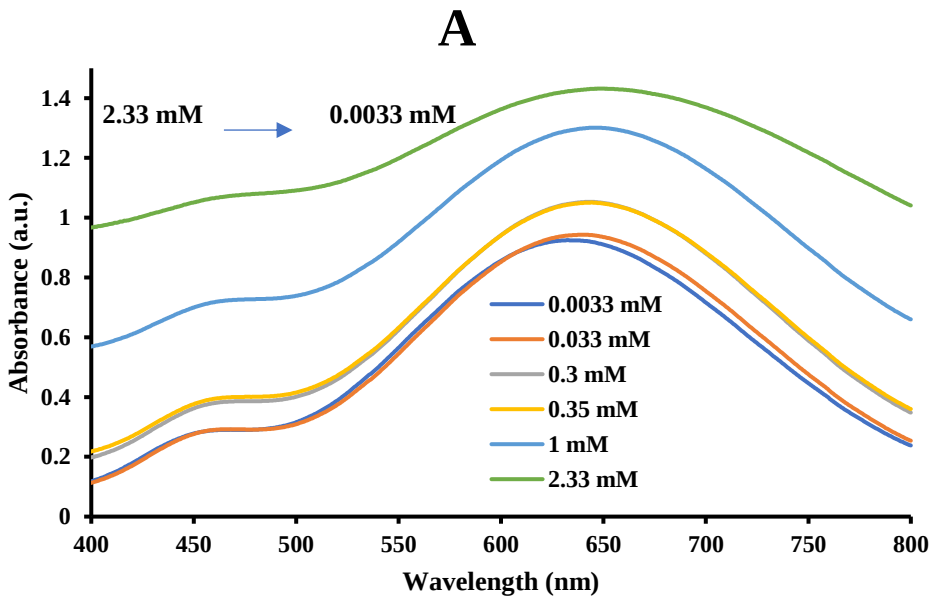
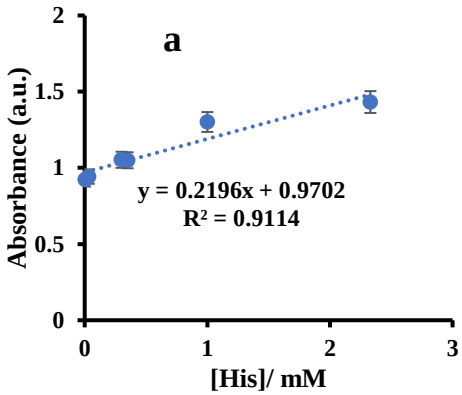


Figure S5. Optimization of additive-probe volume ratio, **A)** control, **B)** control after 1h; **C)** His, **D)** His after 1h; and **E)** EDA, **F)** EDA after 1h. (a-f) Histogram of Abs (a.u) *versus* additive-probe volume ratio.


After 1 h


A
2.33 mM
0.0033 mM
Absorbance (a.u.)
Wavelength (nm)
0.0033 mM
0.033 mM
0.3 mM
0.35 mM
1 mM
2.33 mM


a
Absorbance (a.u.)
[His]/ mM
y = 0.2196x + 0.9702
R² = 0.9114

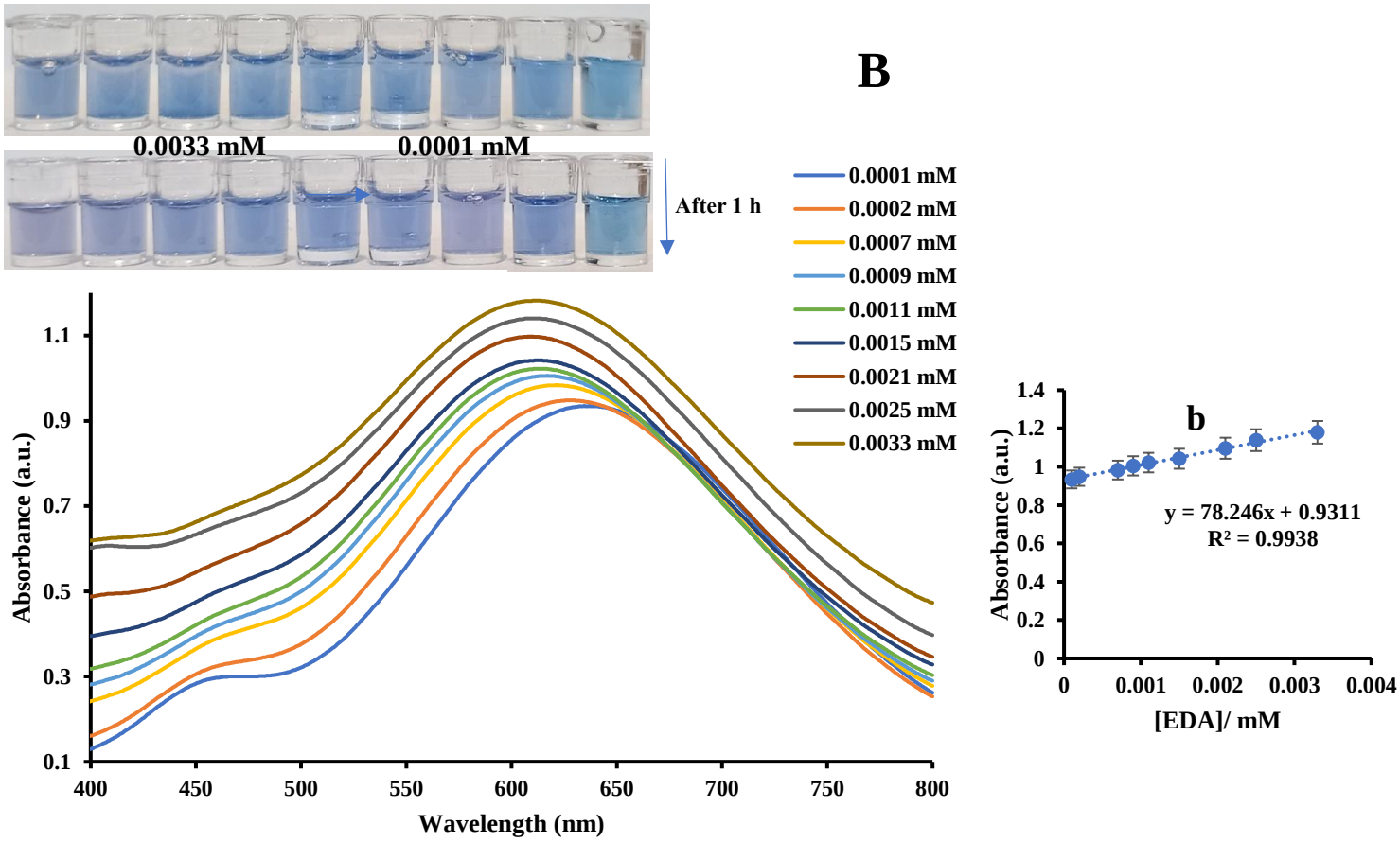
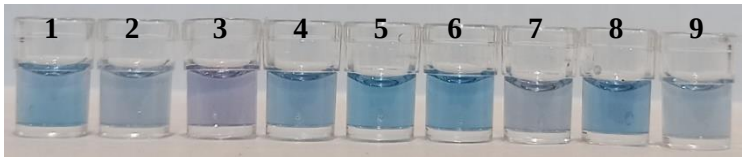
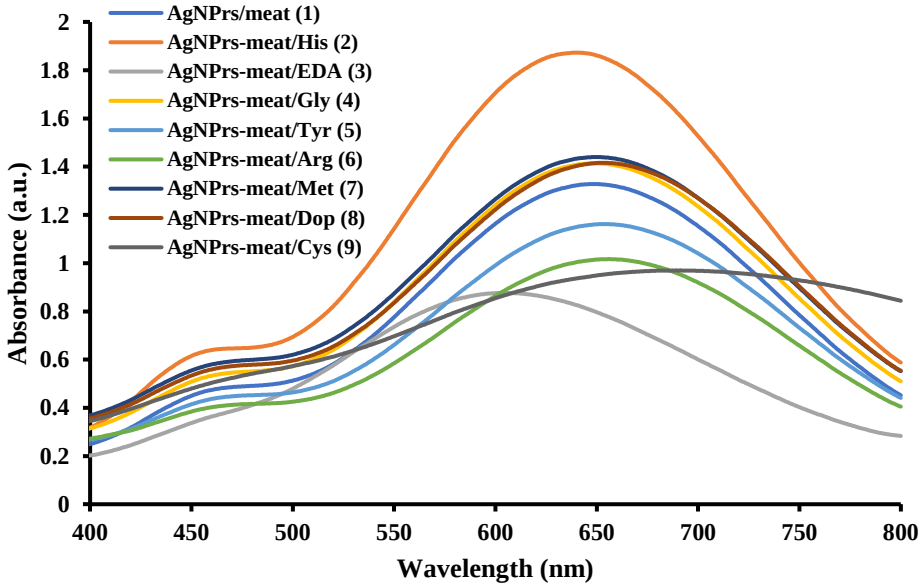
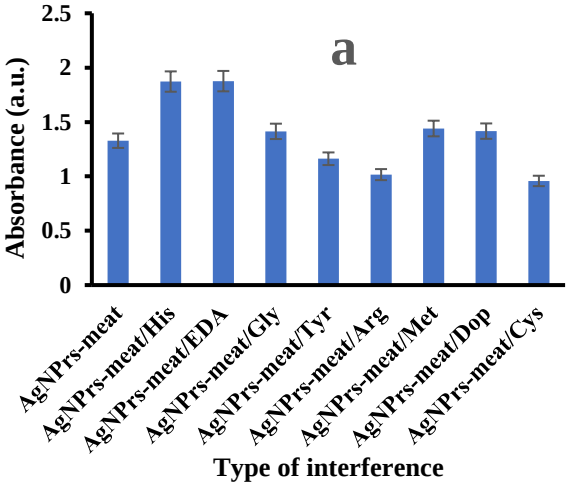


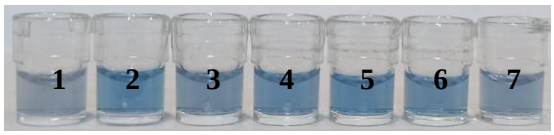
Figure S6. The UV-Vis spectra of AgNPrs in the presence of different concentration of **(A)** HIS **(B)** EDA at the spoiled meat.


1
2
3
4
5
6
7
8
9

A

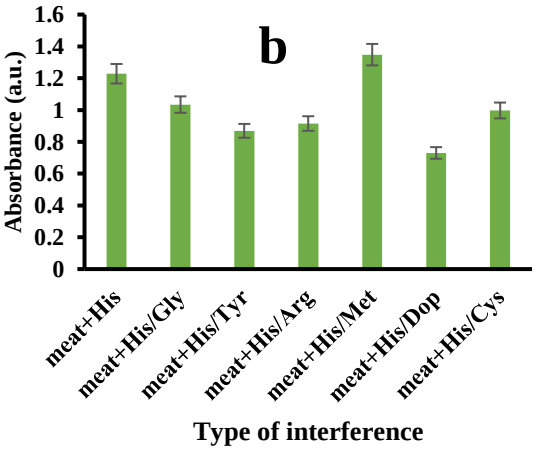

AgNPrs/meat (1)
AgNPrs-meat/His (2)
AgNPrs-meat/EDA (3)
AgNPrs-meat/Gly (4)
AgNPrs-meat/Tyr (5)
AgNPrs-meat/Arg (6)
AgNPrs-meat/Met (7)
AgNPrs-meat/Dop (8)
AgNPrs-meat/Cys (9)
Absorbance (a.u.)
Wavelength (nm)


a
Absorbance (a.u.)
AgNPrs-meat
AgNPrs-meat/His
AgNPrs-meat/EDA
AgNPrs-meat/Gly
AgNPrs-meat/Tyr
AgNPrs-meat/Arg
AgNPrs-meat/Met
AgNPrs-meat/Dop
AgNPrs-meat/Cys
Type of interference


1
2
3
4
5
6
7

B

AgNPrs/meat+His (1)
AgNPrs/meat+His/Gly (2)
AgNPrs/meat+His/Tyr (3)
AgNPrs/meat+His/Arg (4)
AgNPrs/meat+His/Met (5)
AgNPrs/meat+His/Dop (6)
AgNPrs/meat+His/Cys (7)
Absorbance (a.u.)
Wavelength (nm)


b
Absorbance (a.u.)
meat+His
meat+His/Gly
meat+His/Tyr
meat+His/Arg
meat+His/Met
meat+His/Dop
meat+His/Cys
Type of interference

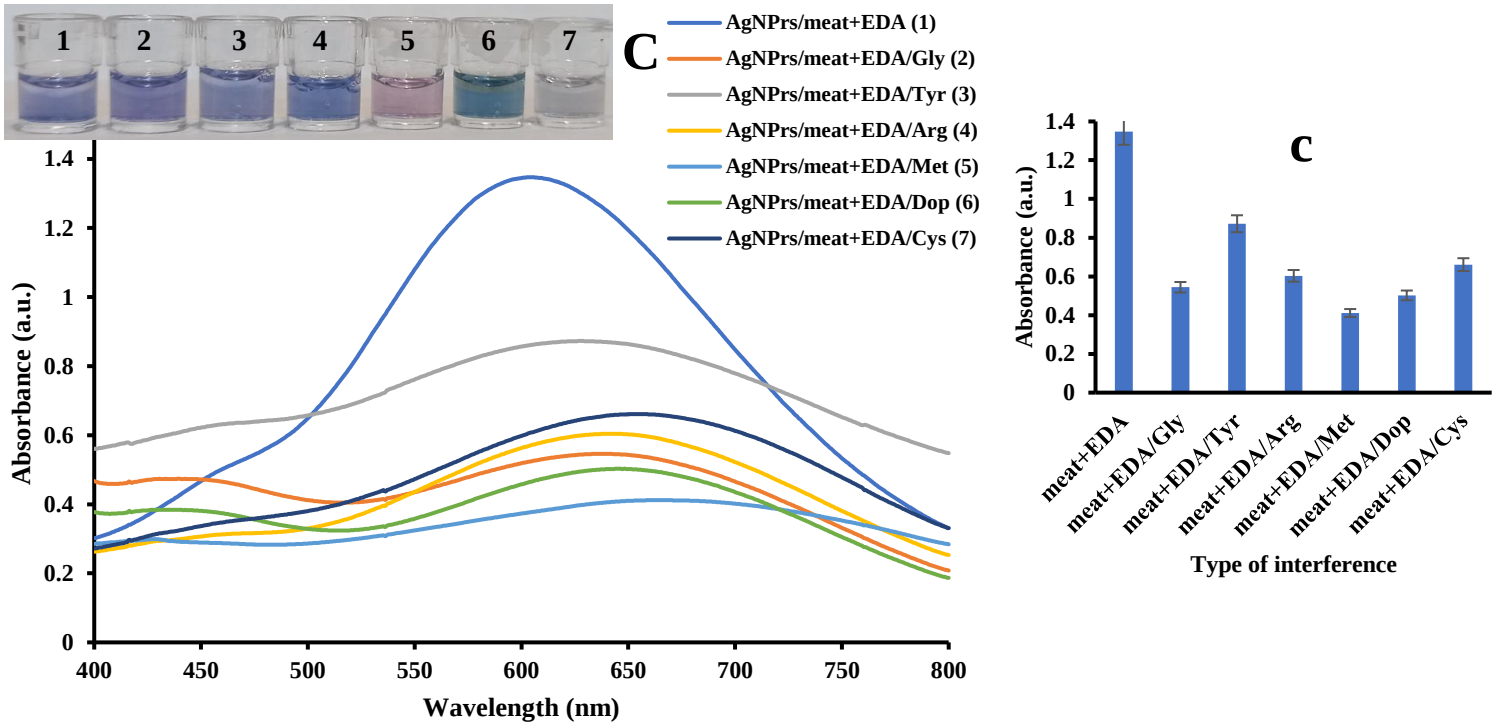
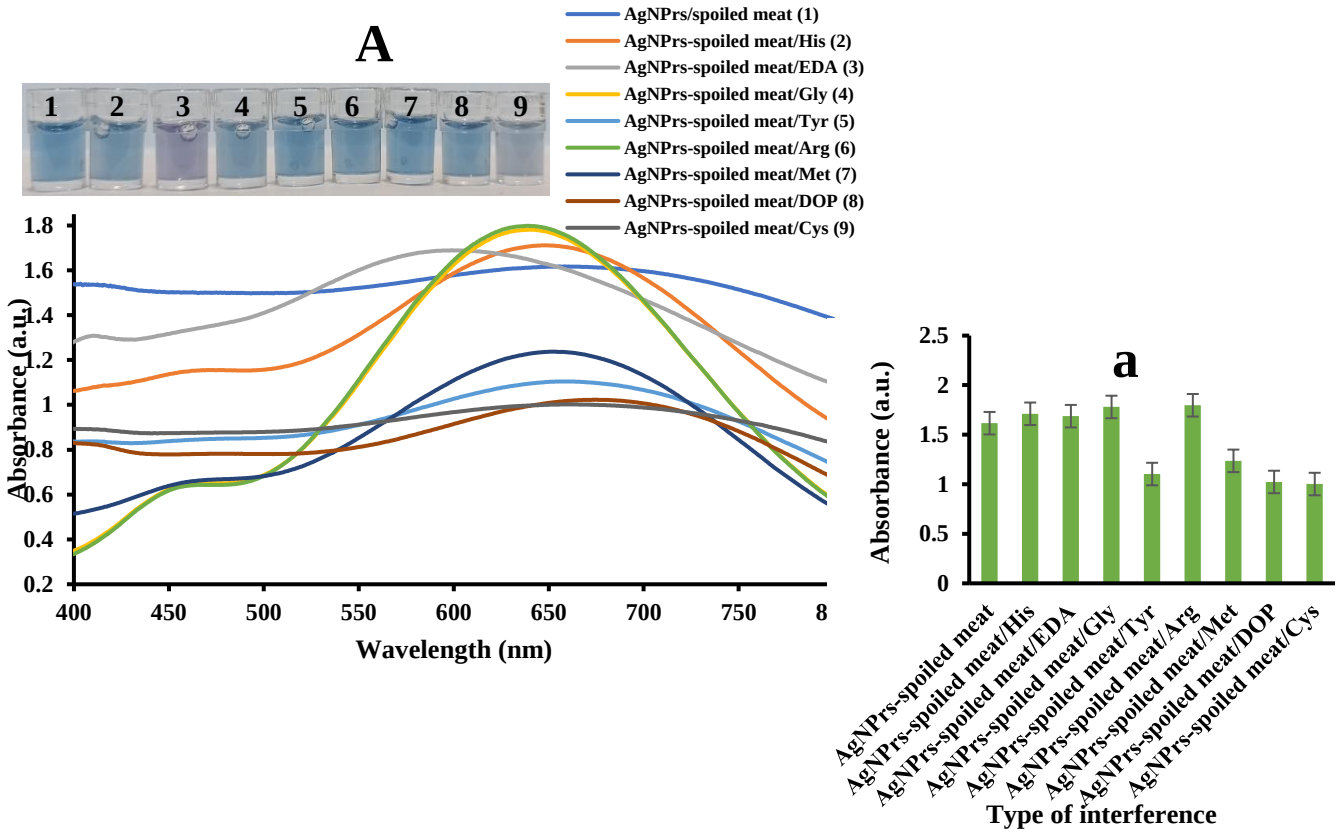
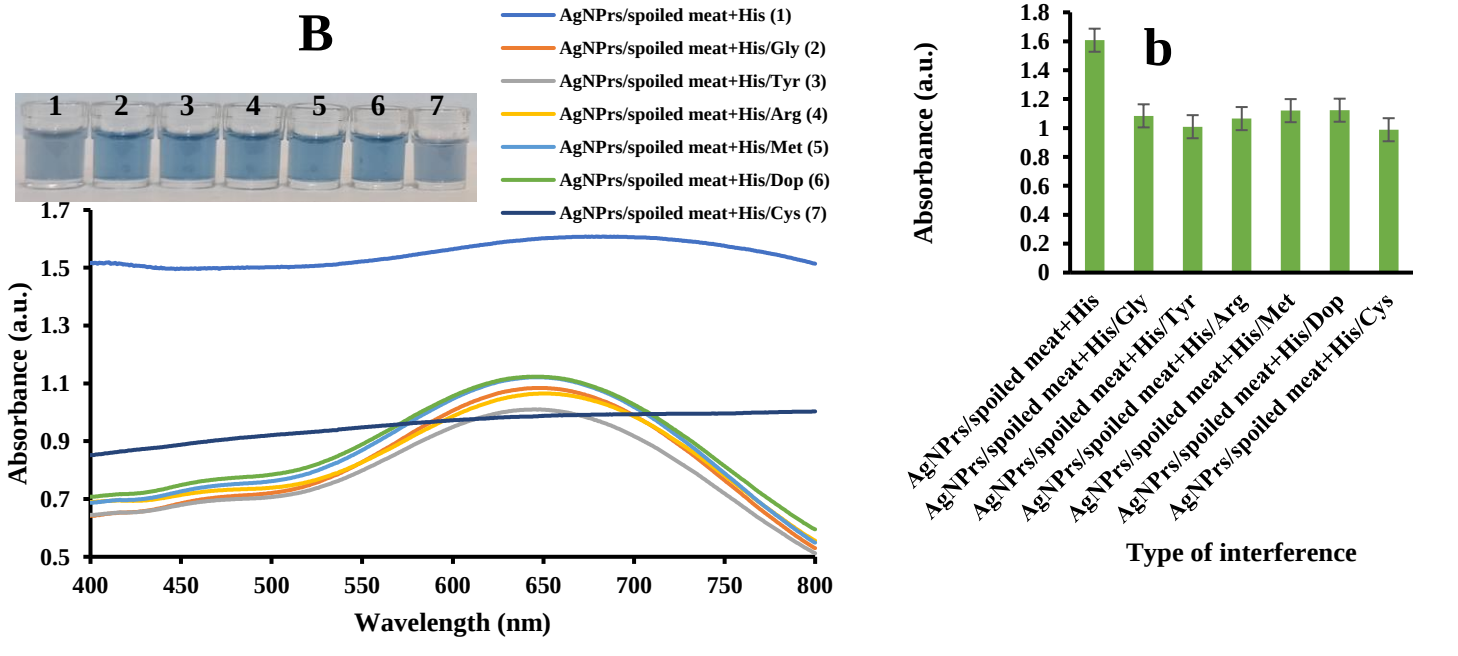


Figure S7. The UV-Vis spectra of AgNPrs in the presence of different interferences **(A)**, different interferences in the presence of HIS **(B),** and various interferences in the presence of EDA **(C)** at the fresh meat.


A
AgNPrs/spoiled meat (1)
AgNPrs-spoiled meat/His (2)
AgNPrs-spoiled meat/EDA (3)
AgNPrs-spoiled meat/Gly (4)
AgNPrs-spoiled meat/Tyr (5)
AgNPrs-spoiled meat/Arg (6)
AgNPrs-spoiled meat/Met (7)
AgNPrs-spoiled meat/DOP (8)
AgNPrs-spoiled meat/Cys (9)
1 2 3 4 5 6 7 8 9
Absorbance (a.u.)
Wavelength (nm)
a
Absorbance (a.u.)
AgNPrs-spoiled meat
AgNPrs-spoiled meat/His
AgNPrs-spoiled meat/EDA
AgNPrs-spoiled meat/Gly
AgNPrs-spoiled meat/Tyr
AgNPrs-spoiled meat/Arg
AgNPrs-spoiled meat/Met
AgNPrs-spoiled meat/DOP
AgNPrs-spoiled meat/Cys
Type of interference


B
AgNPrs/spoiled meat+His (1)
AgNPrs/spoiled meat+His/Gly (2)
AgNPrs/spoiled meat+His/Tyr (3)
AgNPrs/spoiled meat+His/Arg (4)
AgNPrs/spoiled meat+His/Met (5)
AgNPrs/spoiled meat+His/Dop (6)
AgNPrs/spoiled meat+His/Cys (7)
1 2 3 4 5 6 7
Absorbance (a.u.)
Wavelength (nm)
b
Absorbance (a.u.)
AgNPrs/spoiled meat+His
AgNPrs/spoiled meat+His/Gly
AgNPrs/spoiled meat+His/Tyr
AgNPrs/spoiled meat+His/Arg
AgNPrs/spoiled meat+His/Met
AgNPrs/spoiled meat+His/Dop
AgNPrs/spoiled meat+His/Cys
Type of interference

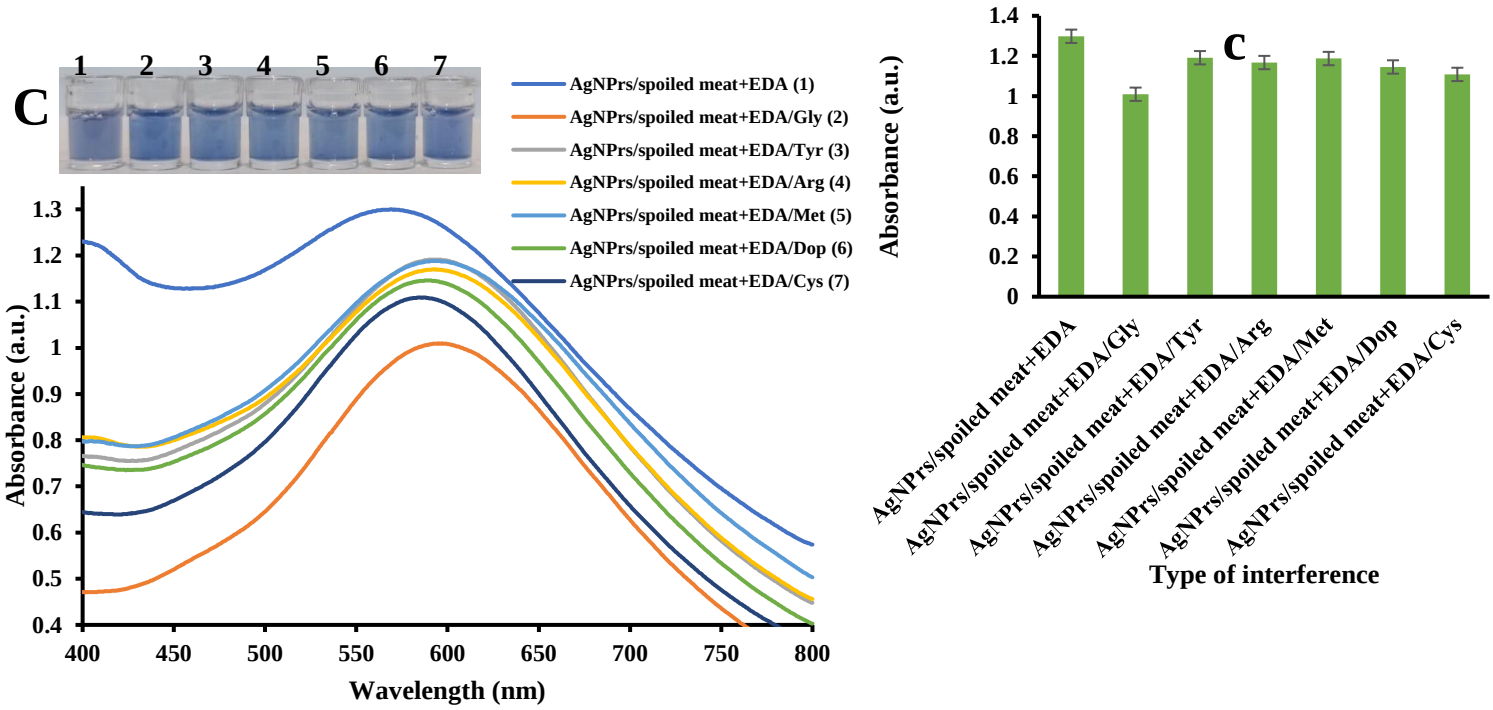


Figure S8. The UV-Vis spectra of AgNPrs in the presence of different interferences **(A)**, various interferences in the presence of HIS **(B),** and diverse interferences in the presence of EDA **(C)** at the spoiled meat.

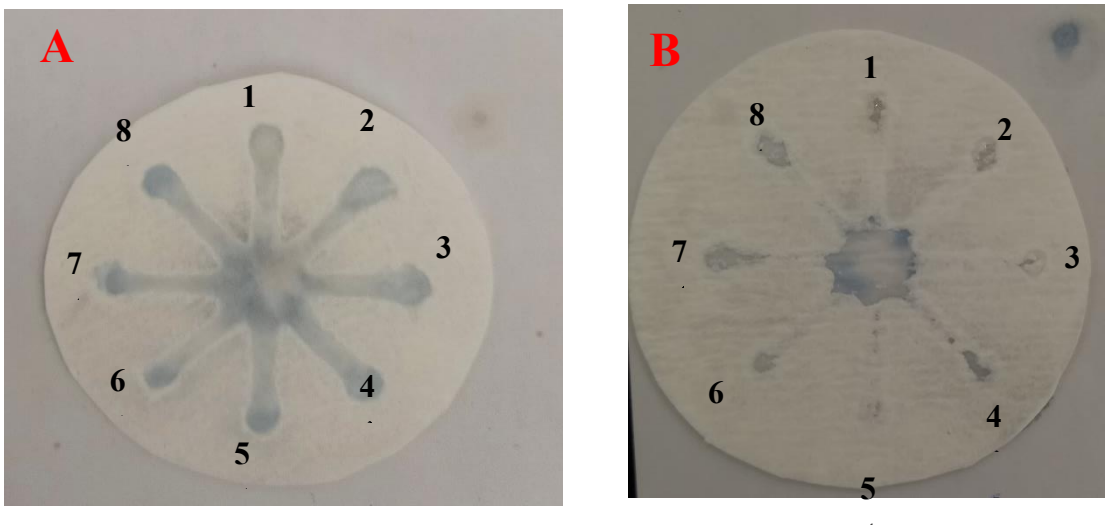


Figure S9. Photographic images of CATS modified by AgNPrs for detection of different concentration of **(A)** His (zones 1 to 8 corresponding to the concentrations of 0.001, 0.0033, 0.01, 0.033, 0.35, 1.35, 2.33, and 3.33 mM, respectively) and **(B)** EDA (zones 1 to 8 corresponding to the concentrations of 0.0001, 0.0002, 0.0004, 0.0009, 0.0015, 0.0021, 0.0025, and 0.0033 mM, respectively) in meat.