Supplementary Information

Machine-Learning Assisted Multiplex Detection of Catecholamine Neurotransmitters with a Colorimetric Sensor Array

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Synthesis of AuNPs with different capping agents

Synthesis of citrate-capped AuNPs (Cit-AuNPs)

Generally, 50 mL of 1mM $HAuCl_4$ solution was prepared and boiled under reflux. While boiling, 5mL of trisodium citrate (38.8 mM) was added to the as-prepared solution under vigorous stirring. The heating and stirring were continued under reflux for a further 30 min. AuNPs formation was revealed by appearing wine red color in the solution.

Synthesis of borohydride-capped AuNPs (BH_4-AuNPs)

First, solution 1 containing $HAuCl_4$ (50.0 mM) and HCl (50.0 mM) was prepared. Then, 400µL of the solution consisting of $NaBH_4$ (50.0 mM and NaOH (50.0 mM) was added to 100µL of solution 1. The resulting solution was stirred at room temperature for 15 minutes after adding 9.6 ml of DI water.

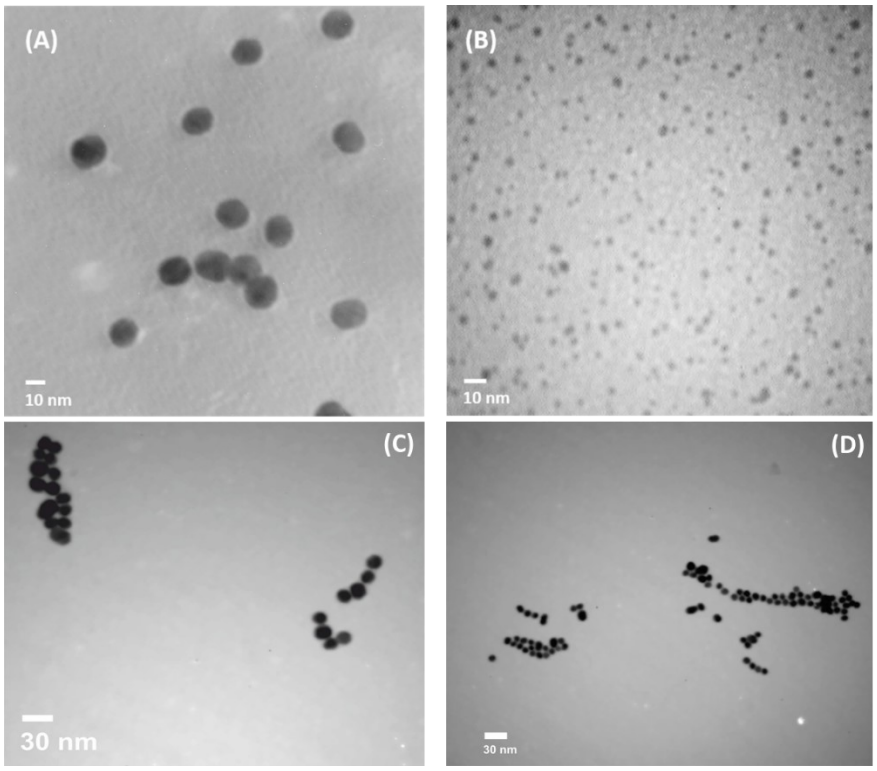

Fig. S1. TEM images of Citrate-capped (Cit-) AuNPs in absence **(A)** and presence **(C)** of DA. TEM images of Borohydride-capped (BH_4-) AuNPs in absence **(B)** and presence **(D)** of DA

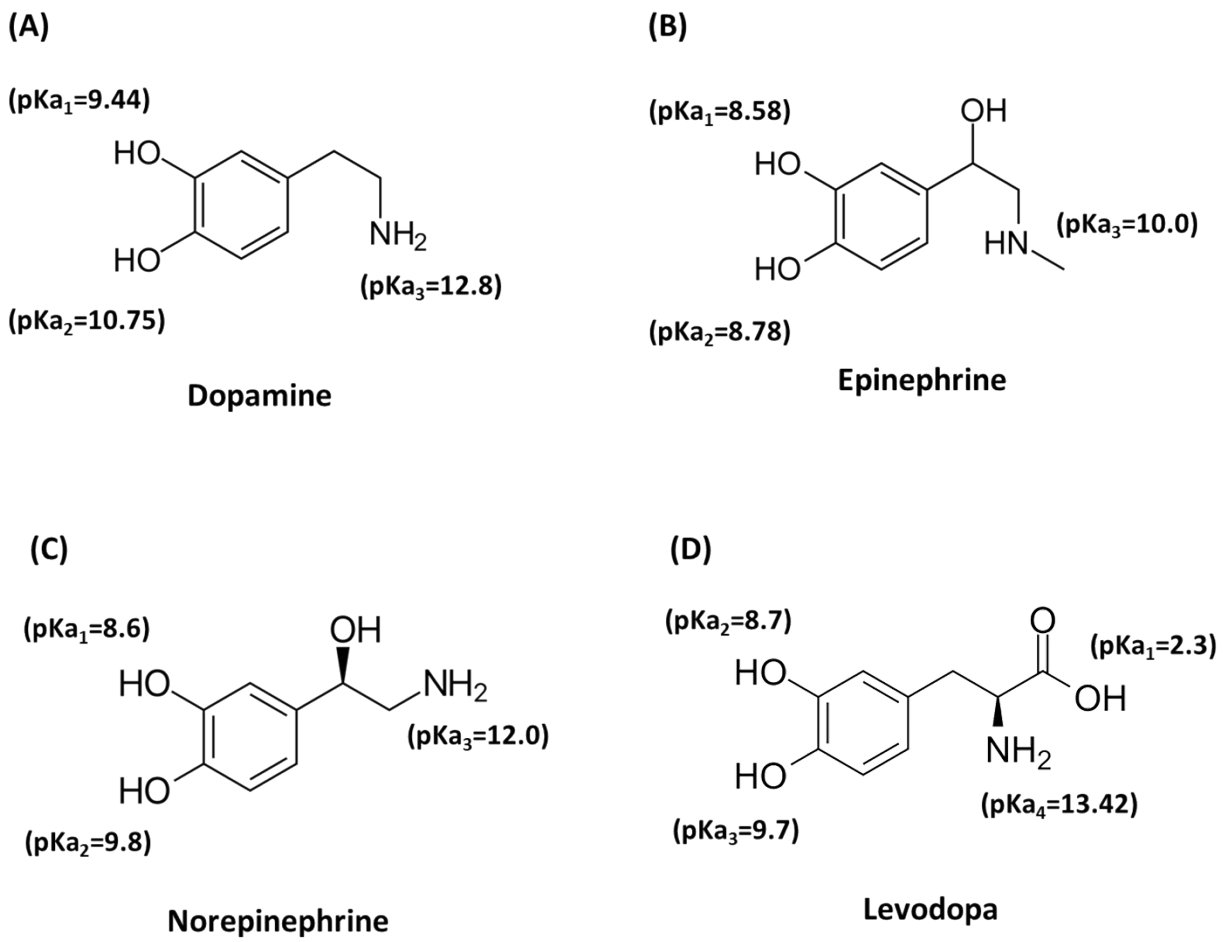

Fig. S2. Chemical structure and pK_a values of **(A)** DA, **(B)** EP, **(C)** NEP, and **(D)** LD.

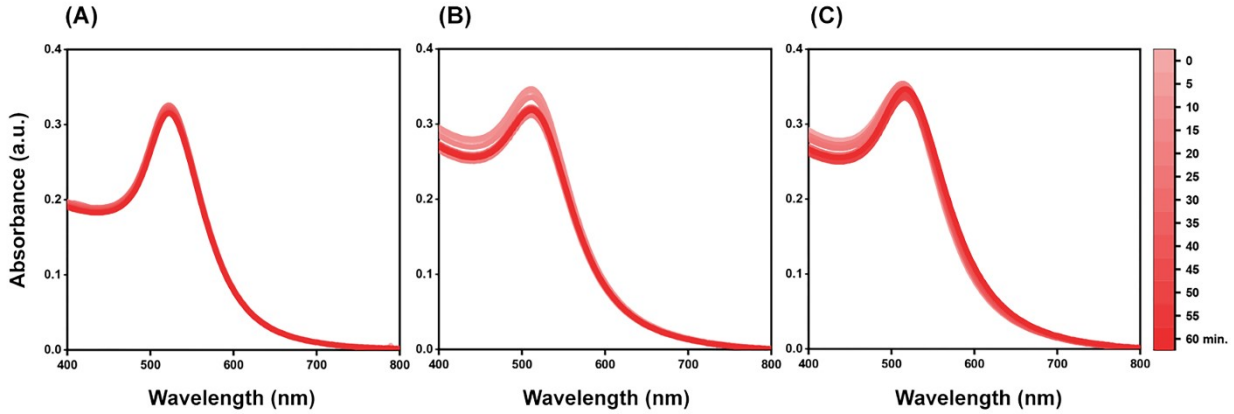

Fig. S3. The stability of **(A)** SE1 (Cit-AuNPs in Phosphate Buffer pH 7.0), **(B)** SE2 (BH_4-AuNPs in Citrate Buffer pH 4.5), and **(C)** SE3 (BH_4-AuNPs in Phosphate Buffer pH 7.0) in the 5-minute time intervals.

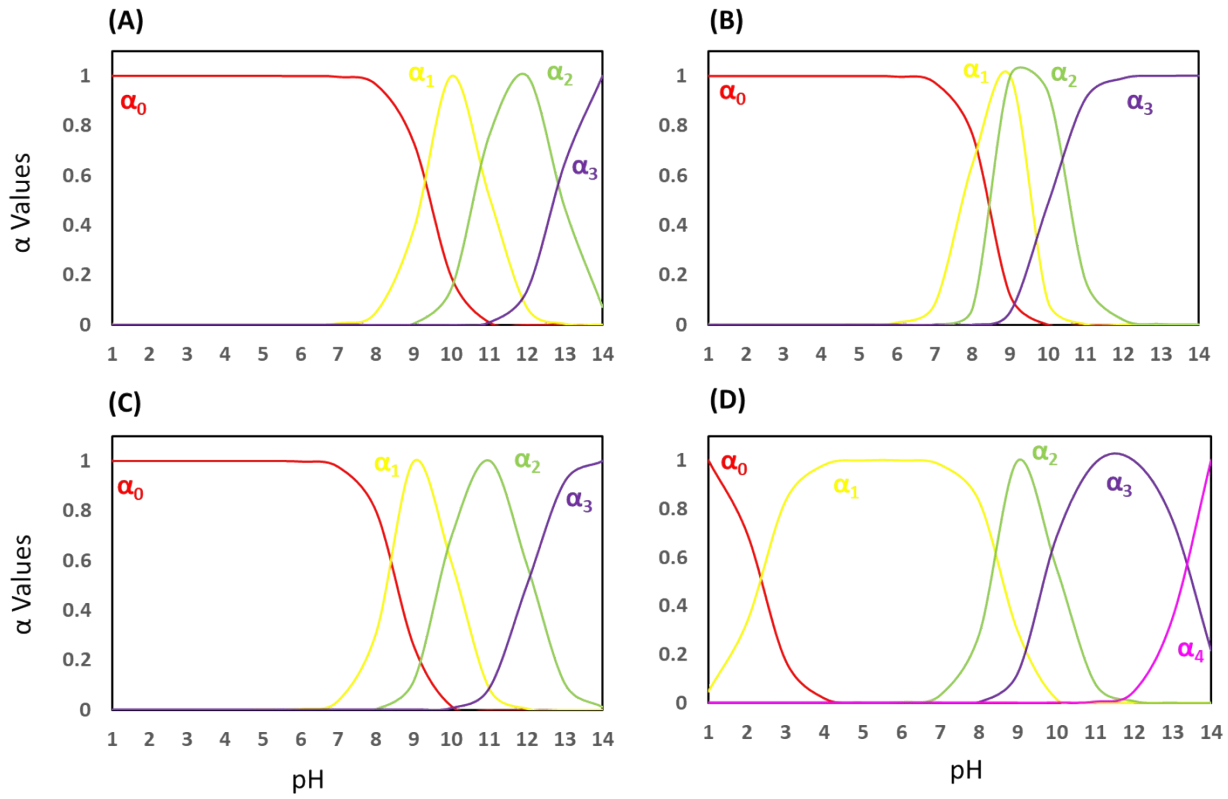

Fig. S4. The predominant forms of **(A)** DA, **(B)** EP, **(C)** NEP, and **(D)** LD at different pH values.

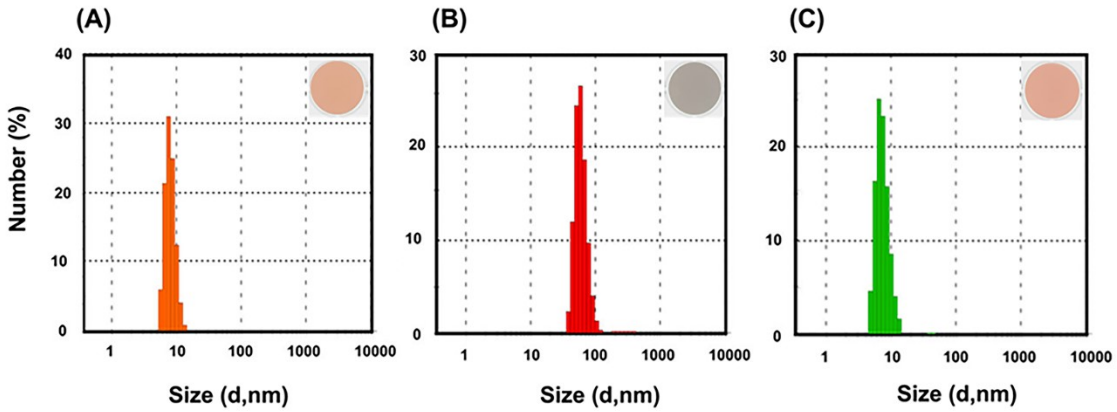

Fig. S5. DLS measurements of SE2 (BH_4-AuNPs pH 4.5) in the absence **(A)** and in the presence of 5 µM of **(B)** DA and **(C)** LD after 20 min. The colorful spots show the corresponding images taken from the solutions.

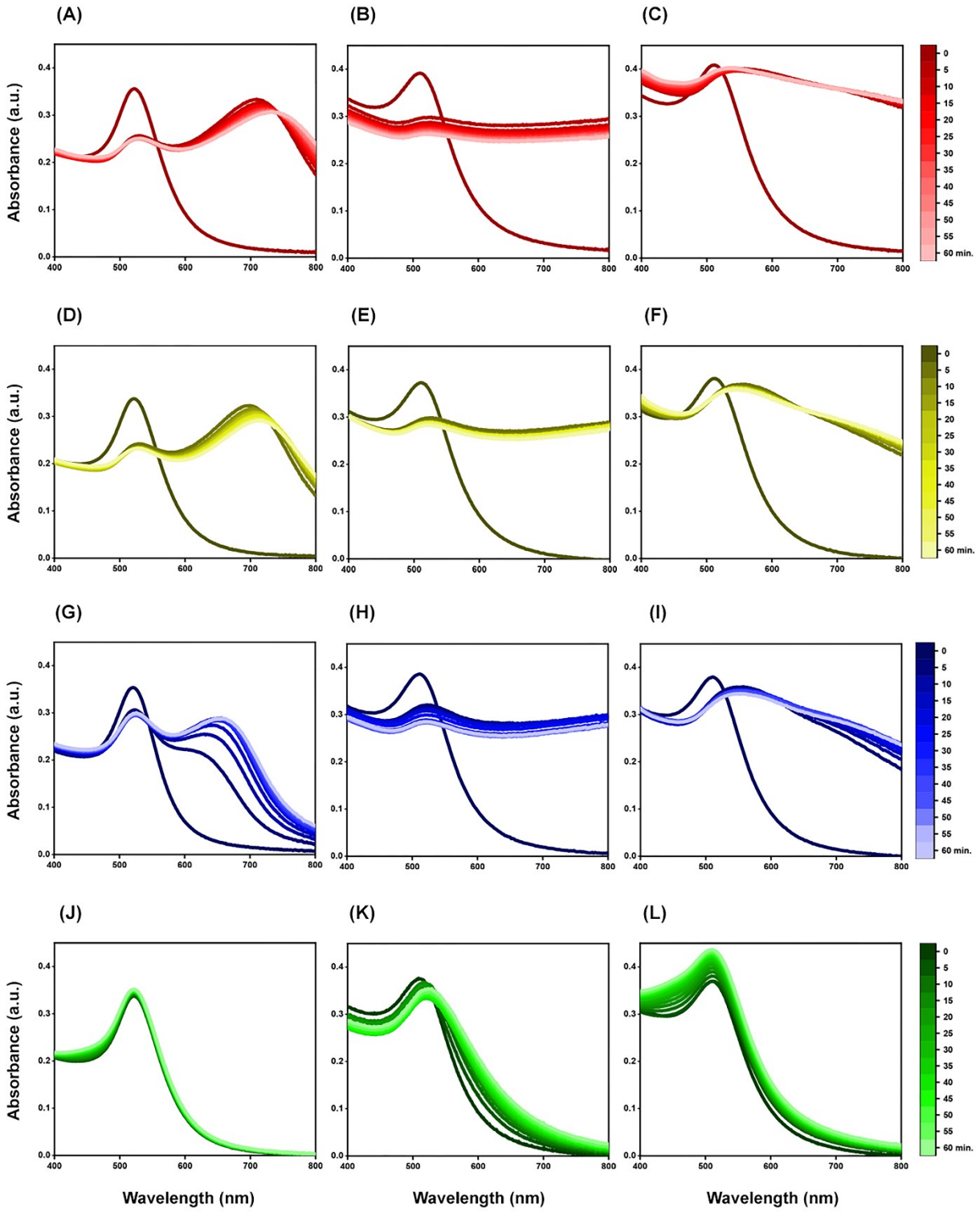

Fig. S6. The variation of time-cyclic UV-Vis spectra of SE1, SE2, and SE3 (in order from left to right) upon the addition of **(A-C)** DA, **(D-F)** EP, **(G-I)** NEP, and **(J-L)** LD at a concentration of 50 µM.

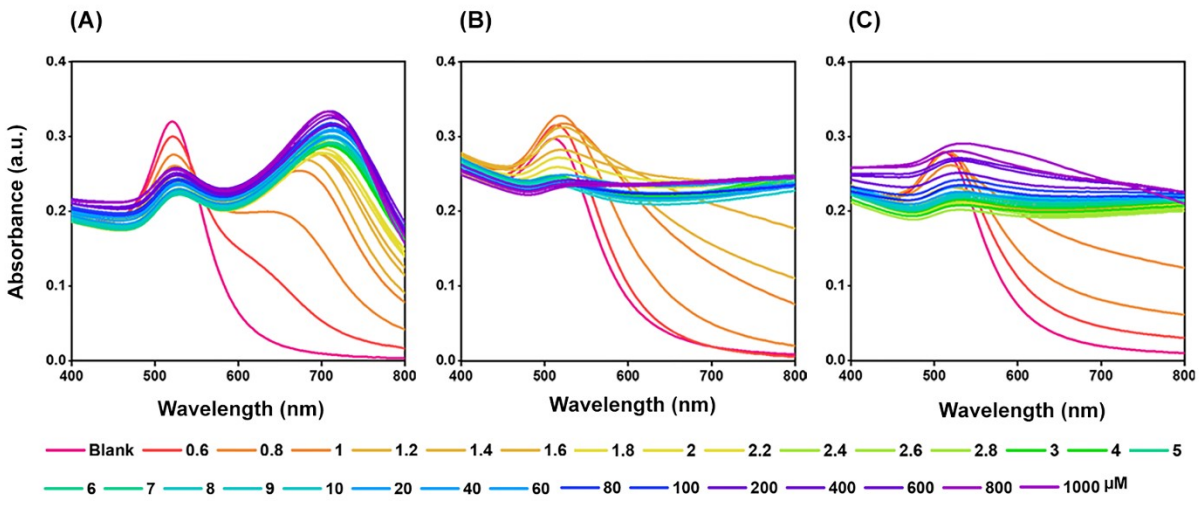

Fig. S7. UV-Vis spectra of **(A)** SE1 **(B)** SE2, and **(C)** SE3 in the presence of dopamine in the concentration range of 0 – 1000 µM after 20min.

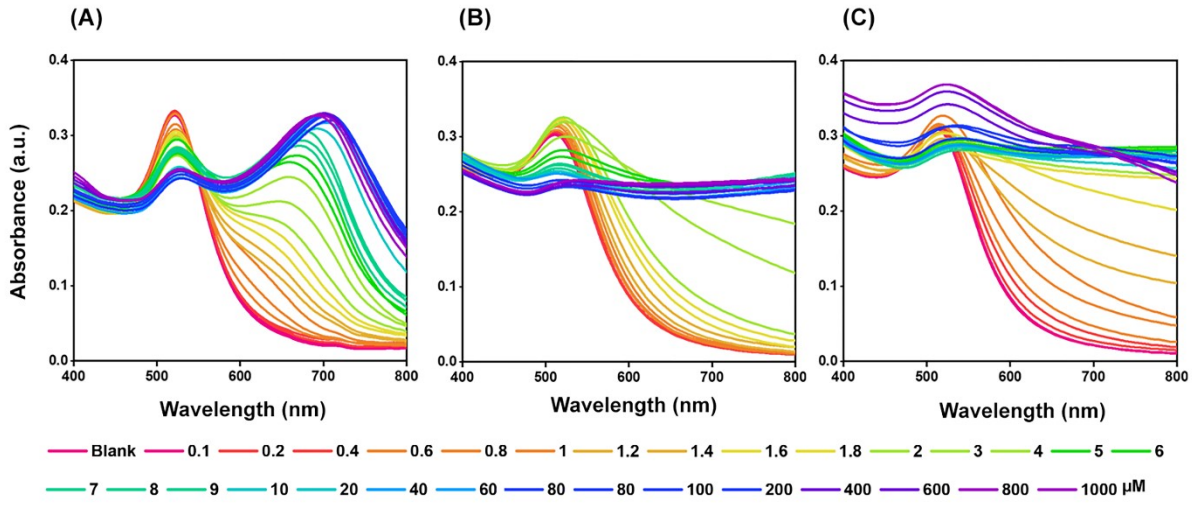

Fig. S8. UV-Vis spectra of **(A)** SE1 **(B)** SE2, and **(C)** SE3 in the presence of epinephrine in the concentration range of 0 – 1000 μM after 20min.

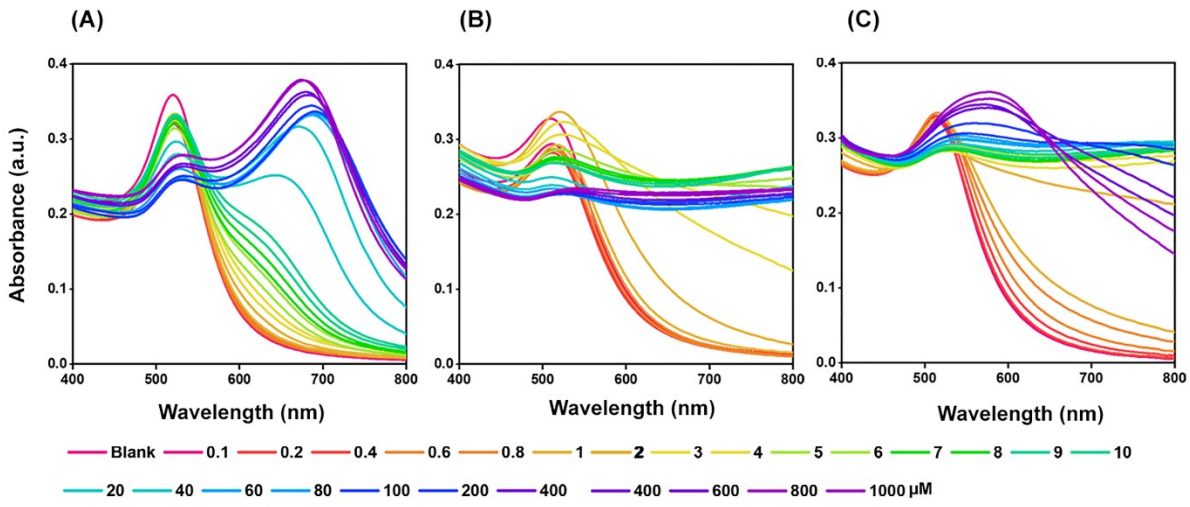

Fig. S9. UV-Vis spectra of **(A)** SE1 **(B)** SE2, and **(C)** SE3 in the presence of norepinephrine in the concentration range of 0 – 1000 µM after 20min.

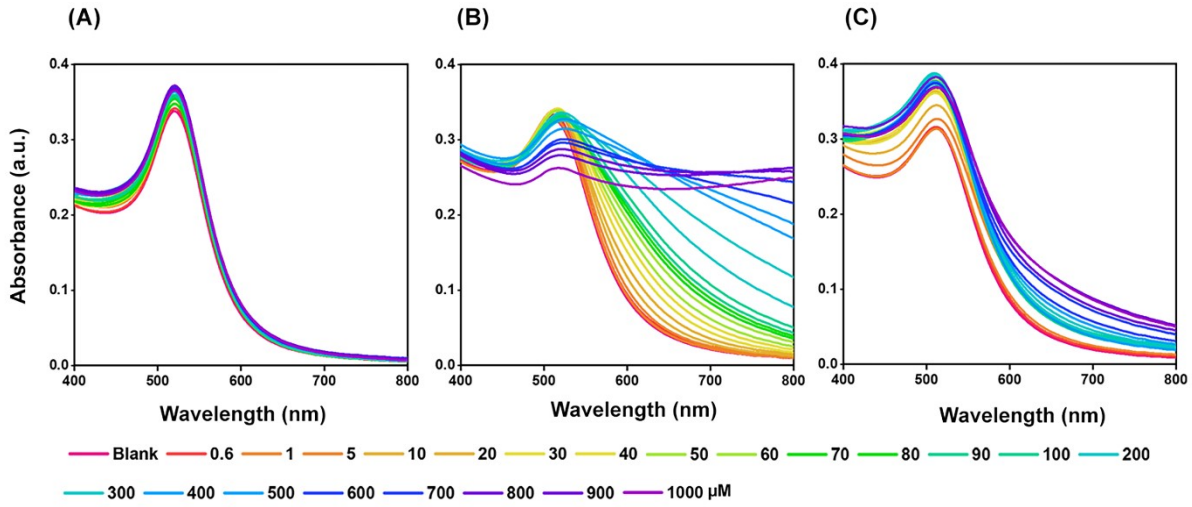

Fig. S10. UV-Vis spectra of **(A)** SE1 **(B)** SE2, and **(C)** SE3 in the presence of levodopa in the concentration range of 0 – 1000 µM after 20min.

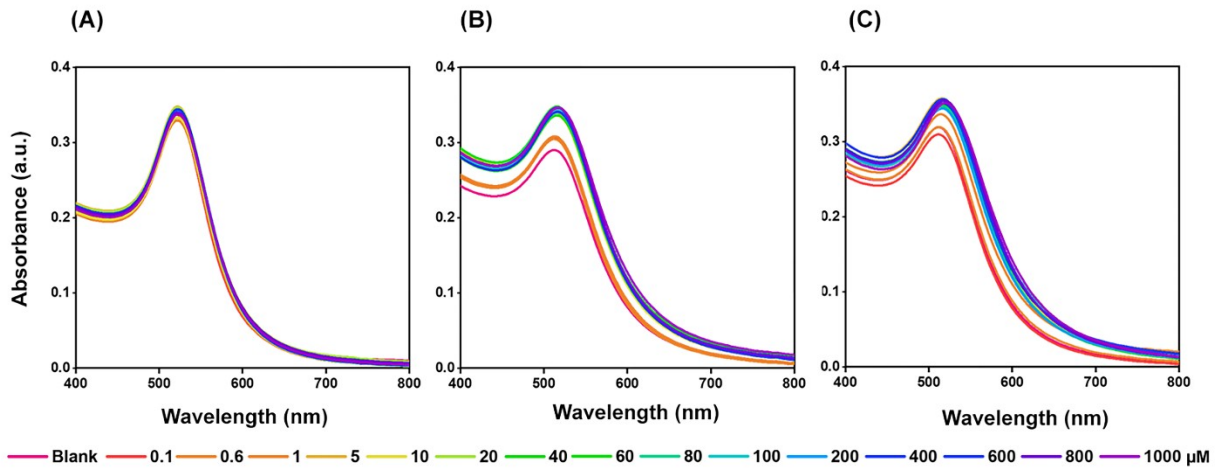

Fig. S11. UV-Vis spectra of **(A)** SE1 **(B)** SE2, and **(C)** SE3 in the presence of uric acid in the concentration range of 0 – 1000 µM after 20min.

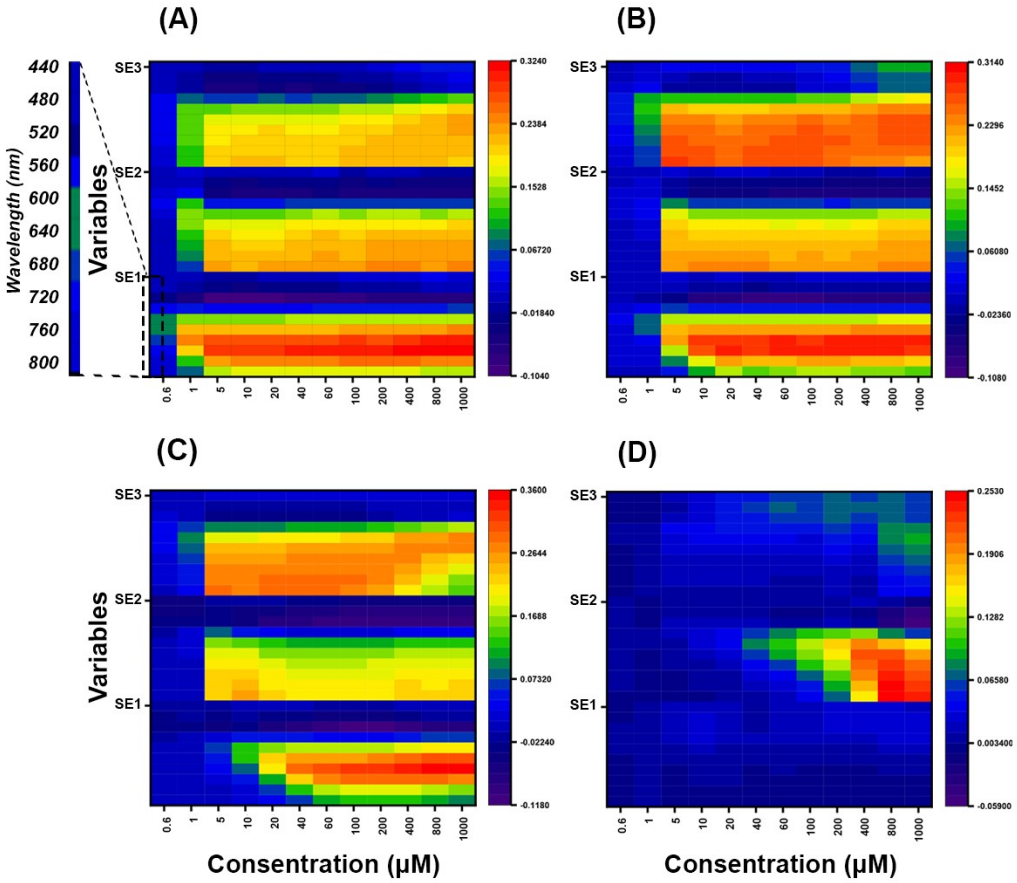

Fig. S12. Heatmap showing cross-reactivity in the arrays' response. Visual encoding of the arrays' response at different concentrations for **(A)** DA, **(B)** EP, **(C)** NEP, and **(D)** LD.

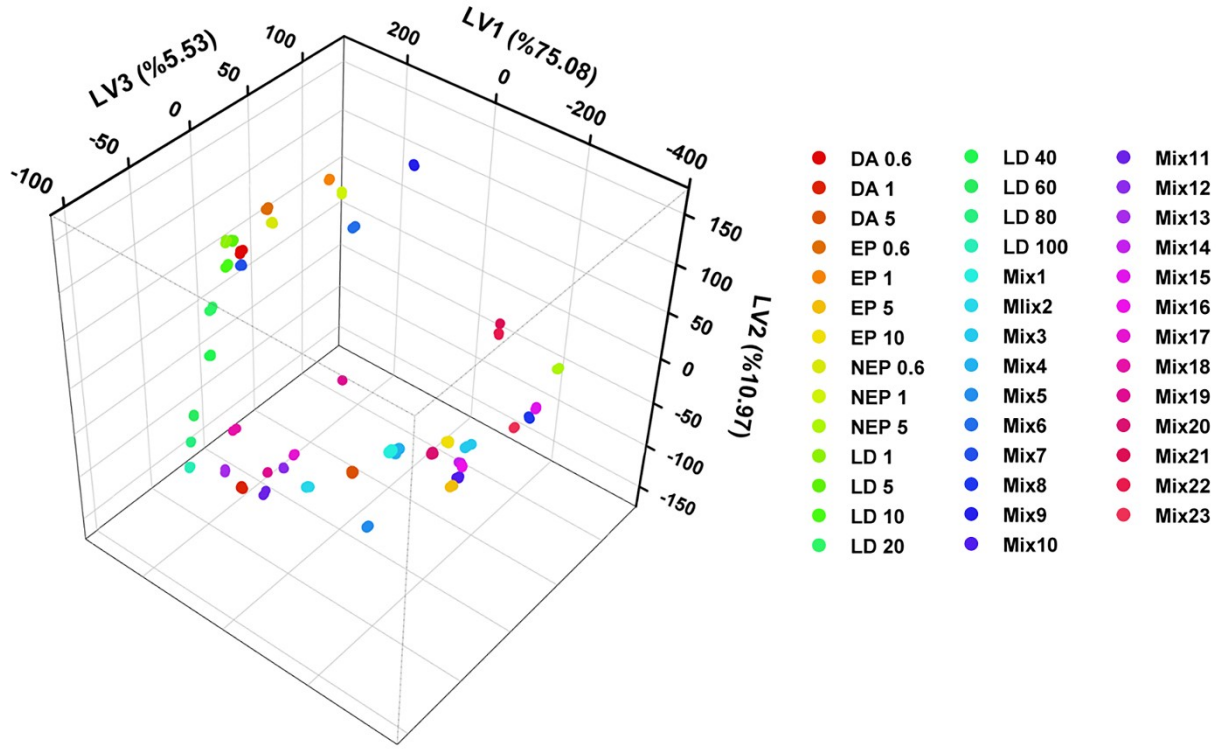

Fig. S13. 3D LDA score plot showing the discrimination between pure and mixture forms of the CNs (**Mix1** DA5:EP5; **Mix2** DA1:EP5; **Mix3** DA1:NEP5; **Mix4** DA5:NEP1; **Mix5** DA1:NEP0.6; **Mix6** DA0.6:NEP0.6; **Mix7** DA0.6:EP0.6; **Mix8** EP5:NEP5; **Mix9** EP0.6:NEP1; **Mix10** EP10:NEP1; **Mix11** DA1:LD100; **Mix12** EP5:LD60; **Mix13** NEP1:LD80; **Mix14** DA1:EP1:NEP1; **Mix15** DA0.6:EP1:NEP5; **Mix16** DA1:EP0.6:NEP1; **Mix17** DA1:EP0.6:LD20; **Mix18** EP0.6:NEP0.6:LD40; **Mix19** DA0.6:NEP1:LD80; **Mix20** DA5:EP5:NEP5:LD5; **Mix21** DA1:EP1:NEP1:LD10; **Mix22** DA0.6:EP0.6:NEP1:LD5; **Mix23** DA1:EP0.6:NEP1:LD1). Concentrations are given in µM.

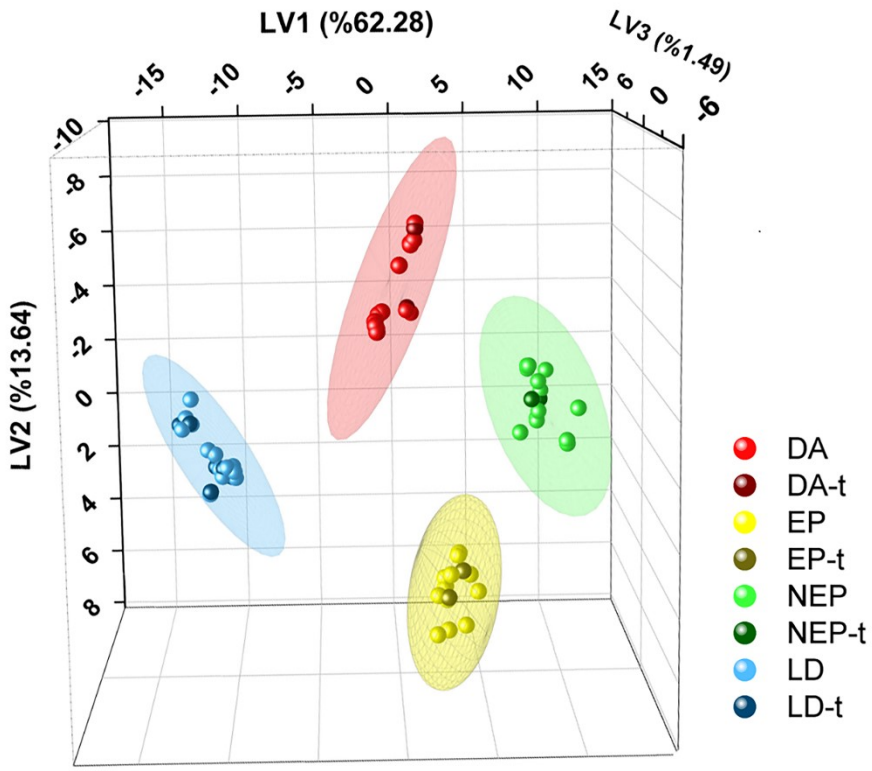

Fig. S14. 3D LDA score plot showing the discrimination between the analytes in their concentration ranges: **DA** (1 - 12); **EP** (3.6 - 9); **NEP** (3 - 12); and **LD** (10 - 70) in the human urine sample. Concentrations are given in µM. Samples with the symbol -**t** were introduced into the LDA analysis in the form of a test set matrix.

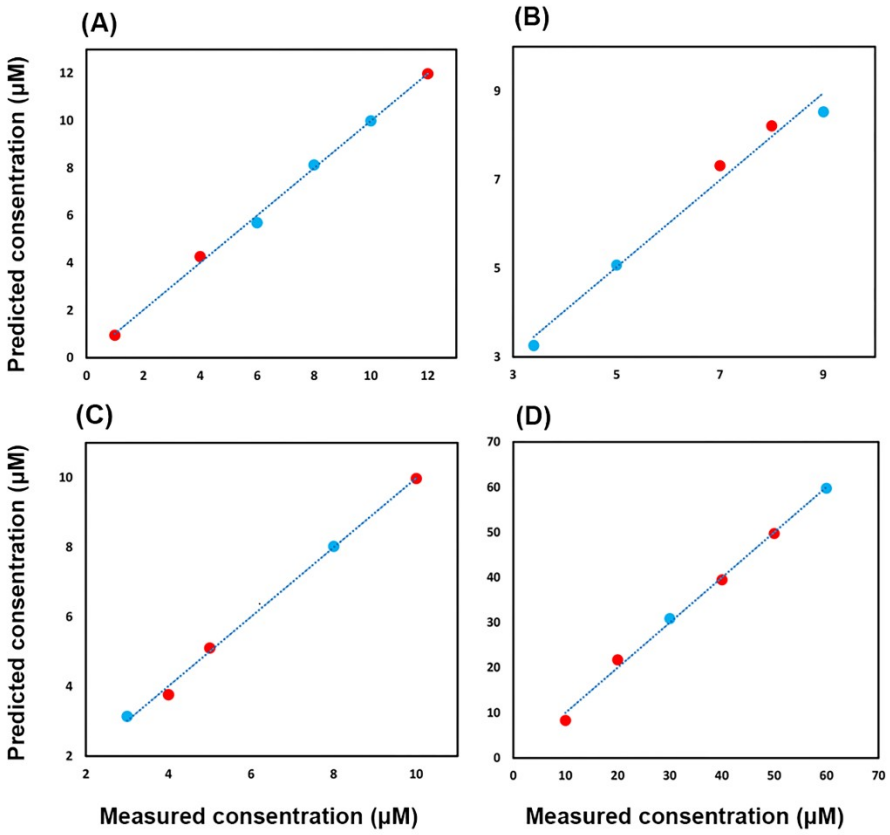

Fig. S15. Multivariate calibration of catecholamine neurotransmitters in the human urine sample with PLSR. The predicted versus measured concentrations for **(A)** DA, **(B)** EP, **(C)** NEP, and **(D)** LD. The data was randomly split into 80% calibration (red spots) and 20% prediction (blue spots) sets.

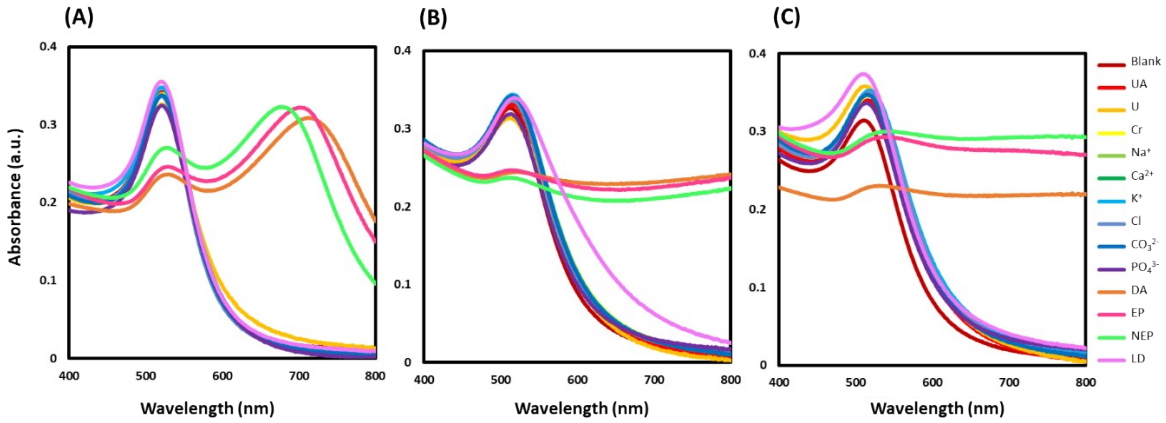

Fig. S16. UV-Vis spectra of (A) SE1 (B) SE2, and (C) SE3 in the presence of 50 µM uric acid(UA, red), urea (U, light orange), creatinine (Cr, yellow), sodium (Na^+, light green), calcium (Ca^{2+}, dark green), potassium (K^+, light blue), chloride (cl^-, light purple), carbonate (CO_3^{2-}, dark blue), , phosphate (PO_4^{3-}, purple), dopamine (DA, dark orange), epinephrine (EP, dark pink), norepinephrine (NEP, neon green) and levodopa (LD, pink) after 20min.

Table S1. Concentration of CNs in Real sample analysis.

Target analyte	Volume (µL) of 1 mM analyte which is added to 80 µL of urine in a 5 mL volumetric flask	concentration (µM) of analyte in the prepared urine sample	Final concentration (µM) of CNs in probe
DA	20	4	1
	80	16	4
	120	24	6
	160	32	8
	200	40	10
	240	48	12
EP	68	13.6	3.4
	100	20	5
	140	28	7
	160	32	8
	360	72	9
NEP	60	12	3
	80	16	4
	100	20	5
	160	32	8
	200	40	10
LD	200	40	10
	400	80	20
	600	120	30
	800	160	40
	1000	200	50
	1200	240	60

Table S2. Sensing strategies for determination of CNs.

No.	Method	analyte	Linear range	LOD	Simultaneous	Naked-eye	pH	time	Real sample	Reverence
1	HPLC-FLD	DA EP NEP LD	0.05–6.0 μM 0.1–24.0 μM 0.01–10.0 μM 0.025–6.0 μM	0.5 nM 2.0 nM 1.0 nM 5.0 nM	-	-	8.0	Pretreatment time (h) + 15 min	Human serum and urine	[1]
2	CE-LIF	5-HT Tyr DA	0.5-500 μM 0.05-50 μM 0.5-500 μM	0.3 nM 0.02 nM 0.2 nM	-	-	8.0	Pretreatment time (h) + 10 min	Human serum and urine	[1]
3	HPLC–MS	DA EP NEP 5-HT	- 0-0.35 μM - 0 – 1.42 μM	0.04 μM 0.01 μM 0.06 μM 0.01 μM	-	-	7.4	Pretreatment time (h) + 20 min	Human blood	[2]
4	HPLC-FLD	DA EP NEP LD Tyr MN	0.002–0.5 μM 0.002–1 μM 0.002–1 μM 0.004-0.2 μM 0.002–0.5 μM 0.002–0.2 μM	0.1 nM 0.4 nM 0.4 nM 1.45 nM 0.17 nM 0.1 nM	-	-	7.6	Pretreatment time (h) + 40 min	Liver sample and brain sample	[3]
5	Electrochemical	SE EP	- -	0.31 μM 0.27 μM	*	-	7.4	-	-	[4]
6	Electrochemical	DA AA UA	0.1-700 μM - -	30 nM - -	-	-	7.0	-	DA ampoule AA ampoule Urine samples	[5]
7	Electrochemical	DA AA UA	3–30 μM 25–300 μM 5–70 μM	2.67 μM 23.38 μM 4.70 μM	*	-	7.0	-	Human serum urine samples multivitamin tablets	[6]
8	Electrochemical	DA	0.1-5 μM	0.1 μM	-	-	7.0	<1s	-	[7]
9	Electrochemical	Ep	3-100 μM	3 μM	-	-	8.0	-	-	[8]
10	Optical (colorimetry and Fluorimetry)	EP	^{C}20-500 μM ^{F}0.5-30 μM	^{C}10 μM ^{F}0.2 μM	-	*	7.0	30 min	Artificial urine	[9]

11	Optical (nanozymes based-Colorimetry)	AA 2,4-DP EP	0–25 µM 3.1–122.7 and 122.7–613.5 µM 41.09–109.2 and 109.2–272.93 µM	0.29 µM 0.76 µM 0.70 µM	-	*	4.0 6.0	3 min 3min	Vegetables, fruits, beverages, human serum	[10]
12	Optical (photoluminescent)	DA	0.1–50 µM	10 nM	-	-	8.9	1 h	Urine	[11]
13	Optical (Colorimetry)	EP	5.5-6.5 µM	1.3 µM	-	-	alkaline	-	-	[12]
14	Optical (Colorimetry)	EP	1–400 µM	0.6 µM	-	*	-	10 min	-	[13]
15	Optical (Colorimetry and Fluorimetry)	NEP	[C]56.6-8920 µM [F]0.067-1 µM	[C]5.59 µM [F]0.018 µM	-	*	-	2 min	Synthetic blood serum	[14]
16	Optical (Colorimetry)	DA LD EP	3.2-20 µM 0.16-10 µM 1.5-40 µM	1.2 µM 0.086 µM 0.97 µM	*	*	-	-	Ringer's injection serum	[15]
17	Optical (Colorimetry)	LD	50.7-202.8 µM	3.04 µM	-	*	-	-	-	[16]
18	Optical (Colorimetry array)	DA EP NEP	6.53-195.84 µM 54.58-163.75 µM 59.10-118.22 µM	32.64 µM 5.46 µM 5.91 µM	*	*	7.0	20 min	Human Urine	[17]
19	Optical (Fluorimetry array)	DA EP NEP	1.63-65.28 µM 1.36-54.58 µM 1.48-59.11 µM	1.63 µM 0.0027 µM 0.0029 µM	*	*	7.0	5 min	Human Urine	[18]
20	Optical (Colorimetry array)	DA EP NEP LD	0.6-9 µM 0.1-10 µM 0.1-9 µM 1-70 µM	0.3 Mm 0.5 µM 0.2 µM 1.9 µM	*	*	4.5 and 7.0	20 min	Human Urine	This study

Table S3. Classification and Jackknifed classification matrix for the discrimination of mixtures of analytes with the following components (**Mix1** DA5:EP5; **Mix2** DA1:EP5; **Mix3** DA1:NEP5; **Mix4** DA5:NEP1; **Mix5** DA1:NEP0.6; **Mix6** DA0.6:NEP0.6; **Mix7** DA0.6:EP0.6; **Mix8** EP5:NEP5; **Mix9** EP0.6:NEP1; **Mix10** EP10:NEP1; **Mix11** DA1:LD100; **Mix12** EP5:LD60; **Mix13** NEP1:LD80; **Mix14** DA1:EP1:NEP1; **Mix15** DA0.6:EP1:NEP5; **Mix16** DA1:EP0.6:NEP1; **Mix17** DA1:EP0.6:LD20; **Mix18** EP0.6:NEP0.6:LD40; **Mix19** DA0.6:NEP1:LD80; **Mix20** DA5:EP5:NEP5:LD5; **Mix21** DA1:EP1:NEP1:LD10; **Mix22** DA0.6:EP0.6:NEP1:LD5; **Mix23** DA1:EP0.6:NEP1:LD1).

Classification Matrix

Samples	Pure																		Binary														Ternary						Quaternary				Sensitivity	Specificity
	DA 0.6	DA 1	DA 5	EP 0.6	EP 1	EP 5	EP 10	NEP 0.6	NEP 1	NEP 5	LD 1	LD 5	LD 10	LD 20	LD 40	LD 60	LD 80	LD 100	Mix1	Mlix2	Mix3	Mix4	Mix5	Mix6	Mix7	Mix8	Mix9	Mix10	Mix11	Mix12	Mix13	Mix14	Mix15	Mix16	Mix17	Mix18	Mix19	Mix20	Mix21	Mix22	Mix23		
DA 0.6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
DA 1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
DA 5	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
EP 0.6	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
EP 1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
EP 5	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
EP 10	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
NEP 0.6	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
NEP 1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
NEP 5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 5	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 10	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 20	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100

LD 60	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**100**	**100**
LD 80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
MIix2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	100	100
Mix14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	100	100
Mix15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	100	100
Mix16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	100	100
Mix17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	100	100
Mix18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	100	100
Mix19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	100	100
Mix20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	100	100
Mix21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	100	100
Mix22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	100	100
Mix23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	100	100
Total	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	-	-

Jack-knife classification Matrix

	Pure																		Binary												Ternary						Quaternary				Sensitivity	Specificity
	DA 0.6	DA 1	DA 5	EP 0.6	EP 1	EP 5	EP 10	NEP 0.6	NEP 1	NEP 5	LD 1	LD 5	LD 10	LD 20	LD 40	LD 60	LD 80	LD 100	Mix1	Mlix2	Mix3	Mix4	Mix5	Mix6	Mix7	Mix8	Mix9	Mix10	Mix11	Mix12	Mix13	Mix14	Mix15	Mix16	Mix17	Mix18	Mix19	Mix20	Mix21	Mix22	Mix23		
DA 0.6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
DA 1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
DA 5	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
EP 0.6	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
EP 1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
EP 5	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
EP 10	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
NEP 0.6	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
NEP 1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
NEP 5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 5	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 10	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 20	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
LD 100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
MIix2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100

Mix3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**100**	**100**
Mix4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix5	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**100**	**100**
Mix6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	100	100
Mix13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	100	100
Mix14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	100	100
Mix15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	100	100
Mix16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	100	100
Mix17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	100	100
Mix18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	100	100
Mix19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	100	100
Mix20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	100	100
Mix21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	100	100
Mix22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	100	100
Mix23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	100	100
Total	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	-	-

Table S4. Classification and Jackknifed classification matrix for the discrimination of all analytes in their entire concentration range (**DA** 1 – 12 µM; **EP** 3.6 – 9 µM; **NEP** 3 – 12 µM; and **LD** 10 - 70 µM) in the human urine sample.

Classification Matrix							
Analytes	**DA**	**EP**	**NEP**	**LD**	**Total**	**Sensitivity**	**Specificity**
DA	13	0	0	0	13	100	100
EP	0	13	0	0	13	100	100
NEP	0	0	13	0	13	100	100
LD	0	0	0	14	14	100	100
Total	13	13	13	14	53	-	-
Jackknifed Classification Matrix							
Analytes	**DA**	**EP**	**NEP**	**LD**	**Total**	**Sensitivity**	**Specificity**
DA	13	0	0	0	13	100	100
EP	0	13	0	0	13	100	100
NEP	0	0	13	0	13	100	100
LD	0	0	0	14	14	100	100
Total	13	13	13	14	53	-	-

Table S5. Analytical figures of merit for multivariate calibration of DA, EP, NEP, and LD in a human urine sample with PLSR.

Analyte	LVs	RMSEC	RMSECV	RMSEP	R^2_C	R^2_{CV}	R^2_P	SEN	Anal. SEN	LOD_{min} (μM)	LOQ_{min} (μM)	Linear Range (μM)
DA	3	0.1777	0.2232	0.2686	0.9977	0.9967	0.9897	0.0385	23.6819	0.3313	0.9938	1-12
EP	2	0.2808	0.3223	0.0855	0.9983	0.9977	1.000	0.0505	18.6798	0.4604	1.3812	3.4-9
NEP	2	0.1366	0.1602	0.0428	0.9996	0.9994	1.000	0.0485	24.3654	0.2248	0.6745	3-10
LD	2	1.1246	1.2804	1.3333	0.9992	0.9989	0.9991	0.0031	2.6408	1.8603	5.5808	10-60

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