Electronic Supplementary Information for

Portable sensor based on polymeric ion-exchanger for the assay of the controversial colorant (sunset yellow) in soft drink and pharmaceutical products

Manar Omar Heragy[1], Azza Aziz M. Moustafa[2], Eman Saad Elzanfaly[2,3], Ahmed Sayed Saad[2,4,5*]

[1] Chemistry Department, Faculty of Pharmacy, October 6 University, 6 October City, 12585, Giza, Egypt.

[2] Analytical Chemistry Department, Faculty of Pharmacy, Cairo University, Kasr-El Aini Street, 11562, Cairo, Egypt.

[3] Chemistry Department, Faculty of Pharmacy and Drug Technology, Egyptian Chinese University, Gisr Alsuez, Cairo, Egypt.

[4] Egypt-Japan University of Science and Technology (E-JUST), New Borg El-Arab City, 21934 Alexandria, Egypt.

[5] Pharmaceutical Chemistry Department, School of Pharmacy and Pharmaceutical Industries, Badr University in Cairo (BUC), Badr City, 11829, Cairo, Egypt.

*Corresponding author

Email: ahmedss_pharm@yahoo.com; ahmed.bayoumy@pharma.cu.edu.eg

Telephone No.: 00201004009443

Supplementary information S1. Derivation of the standard addition equation (equation 1).

Equation 2 was derived from Nernst equation as following:

- The measured potential in the sample solution of unknown concentration C_u and known volume V_s.

$$E_1 = K + m\log C_{s_{(M)}} \qquad \text{Equation 1}$$

Where (K) is the intercept, (m) is the slope and ($C_{s_{(M)}}$) is the analyte molar concentration.

- The measured potential in the sample solution after addition of known volume V_{std} of standard SSY solution of molar concentration $C_{std_{(M)}}$.

$$E_2 = K + m\log \frac{C_{s_{(M)}} V_s + C_{std_{(M)}} V_{std}}{V_t}$$

Equation 2

- V_t is the total volume of the sample (V_s) and the added standard (V_{std}) solutions.

$$\Delta E = E_2 - E_1 = m\,log \frac{C_{s_{(M)}} V_s + C_{std_{(M)}} V_{std}}{V_t} - m\log C_{s_{(M)}} \qquad Equation\ 3$$

$$\Delta E = E_2 - E_1 = m\,log \frac{C_{s_{(M)}} V_s + C_{std_{(M)}} V_{std}}{C_{s_{(M)}} V_t} \qquad \text{Equation 4}$$

$$10^{\left(\Delta E/_m\right)} = \frac{C_{s_{(M)}} V_s + C_{std_{(M)}} V_{std}}{C_{s_{(M)}} V_t} \qquad \text{Equation 5}$$

$$[C_{s_{(M)}} V_t \times 10^{\left(\Delta E/_m\right)}] - C_{s_{(M)}} V_s = C_{std_{(M)}} V_{std}$$

Equation 6

$$C_{s_{(M)}} \left[V_t \times 10^{\left(\Delta E/_m\right)} - V_s \right] = C_{std_{(M)}} V_{std}$$

Equation 7

$$C_{s_{(M)}} = \frac{C_{std_{(M)}} V_{std}}{\left[V_t \times 10^{\left(\Delta E/_m\right)} - V_s \right]}$$

Equation 8

$$C_{s_{(g/L)}} = \frac{C_{std_{(M)}} V_{std}}{\left[V_t \times 10^{\left(\Delta E/_m\right)} - V_s \right]} \times Mwt$$

Equation 9

$$C_{s_{(ppm)}} = \frac{C_{std_{(M)}} V_{std}}{\left[V_t \times 10^{\left(\Delta E/_m\right)} - V_s \right]} \times Mwt \times 1000$$

Equation 10

To find the concentration (ppm) in the original sample:

$$C_s(ppm) = \frac{C_{std_{(M)}} V_{std}}{\left[V_t \times 10^{\left(\Delta E/_m\right)} - V_s \right]} \times Mwt \times 1000 \times 10$$

Equation 11

For sunset yellow:

$$\frac{452.36 \times 10^4 \times C_{std} V_{std}}{\left[(V_t \times 10^{\Delta E/_m}) - V_s \right]}$$

Equation 12

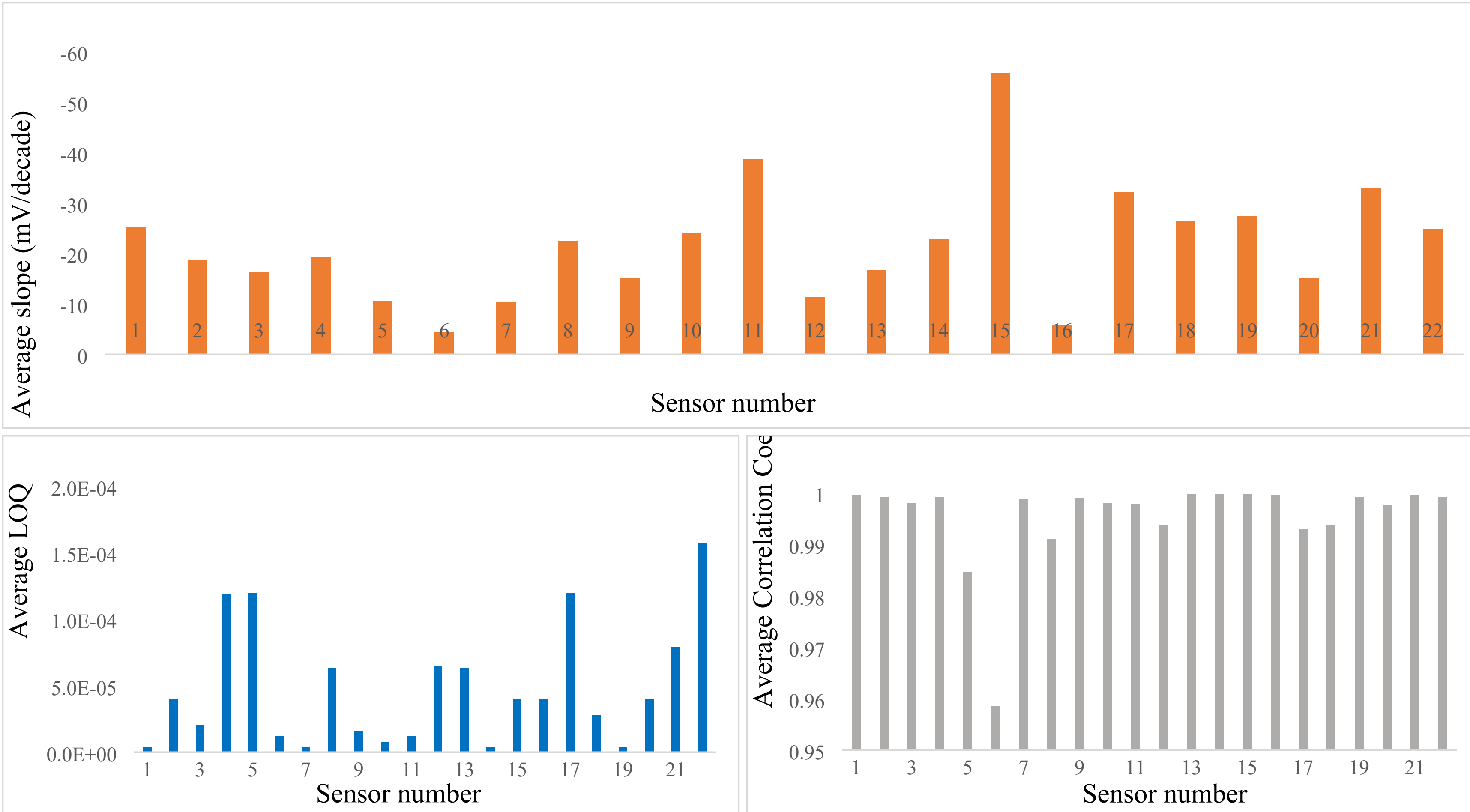


Fig. S1 The pooled data of the investigated sensors showing the average response parameters (slope, LOQ, and correlation coefficient (r)) for the 22 studied sensors during the optimization study (n=3).

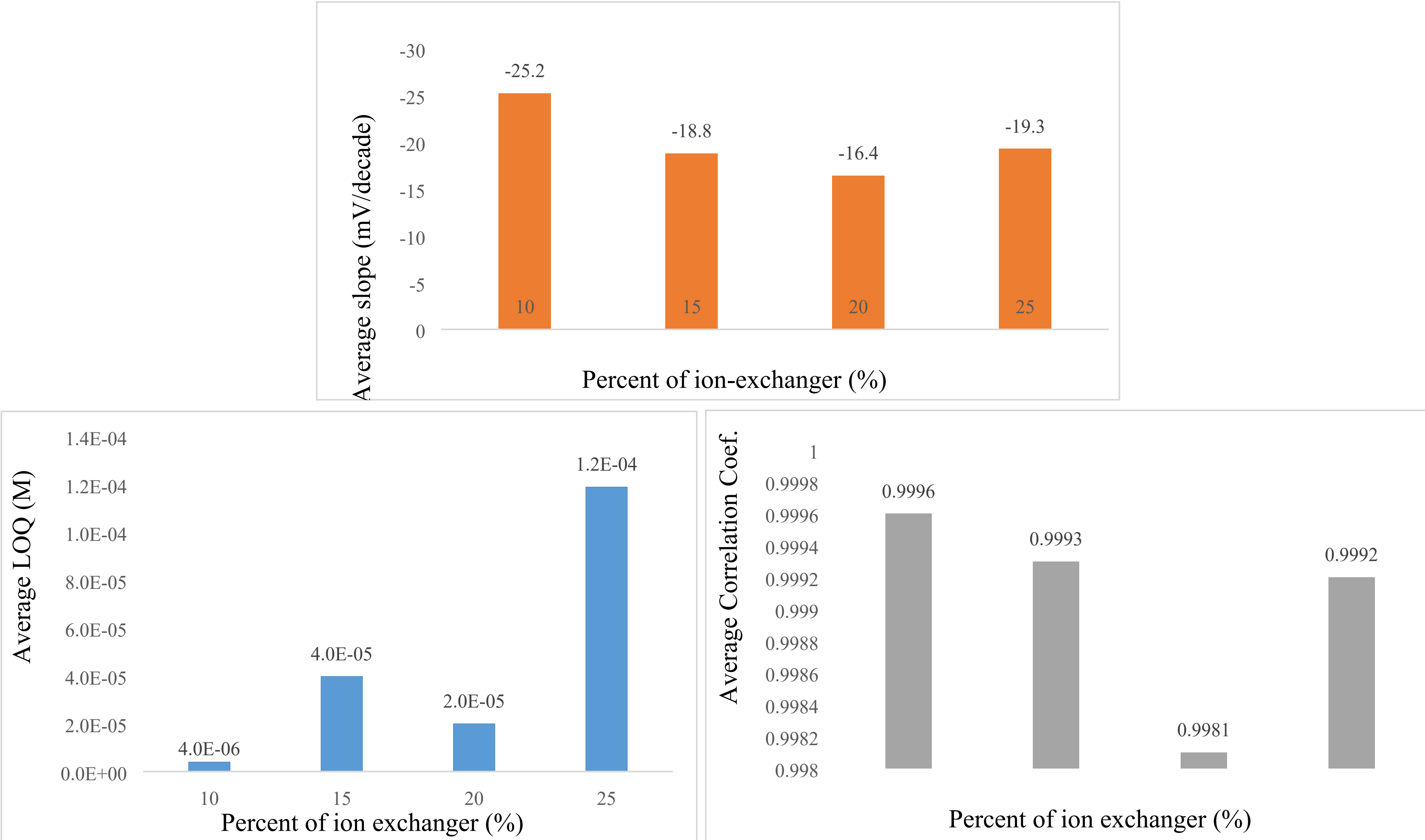
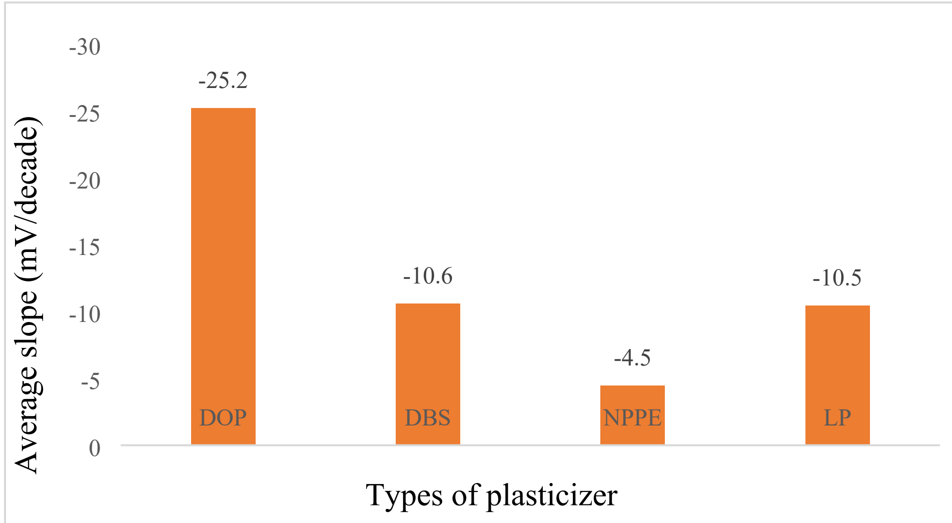
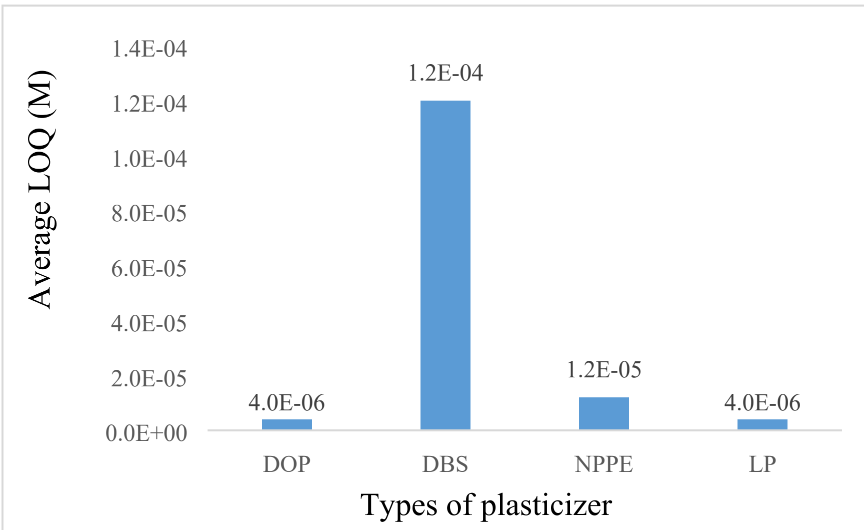


Fig. S2 The average slope, LOQ, and correlation coefficient (r) obtained using different percentages of the polymeric ion-exchanger (n=3).





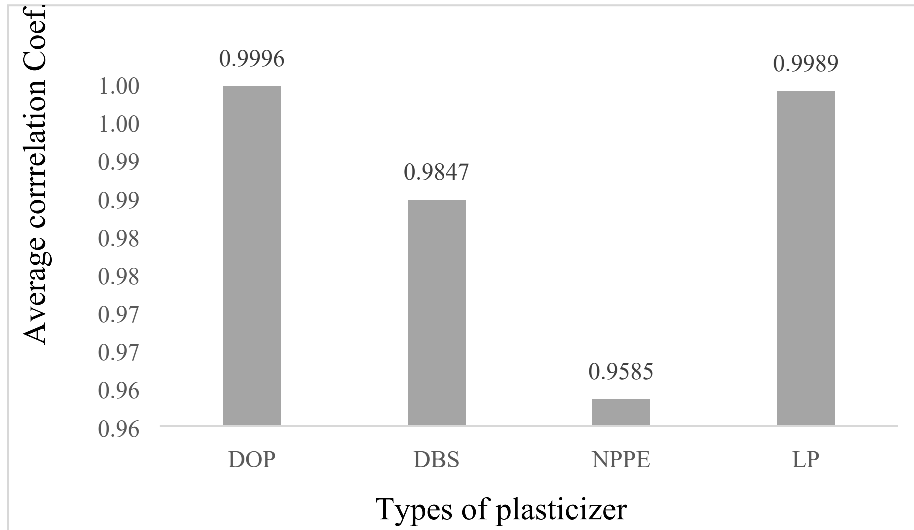


Fig. S3 The average slope, LOQ, and correlation coefficient (r) obtained using different plasticizers (n=3): dioctyl phthalate (DOP), dibutyl sebacate (DBS), nitrophenyl phenyl ether (NPPE), liquid paraffin (LP).

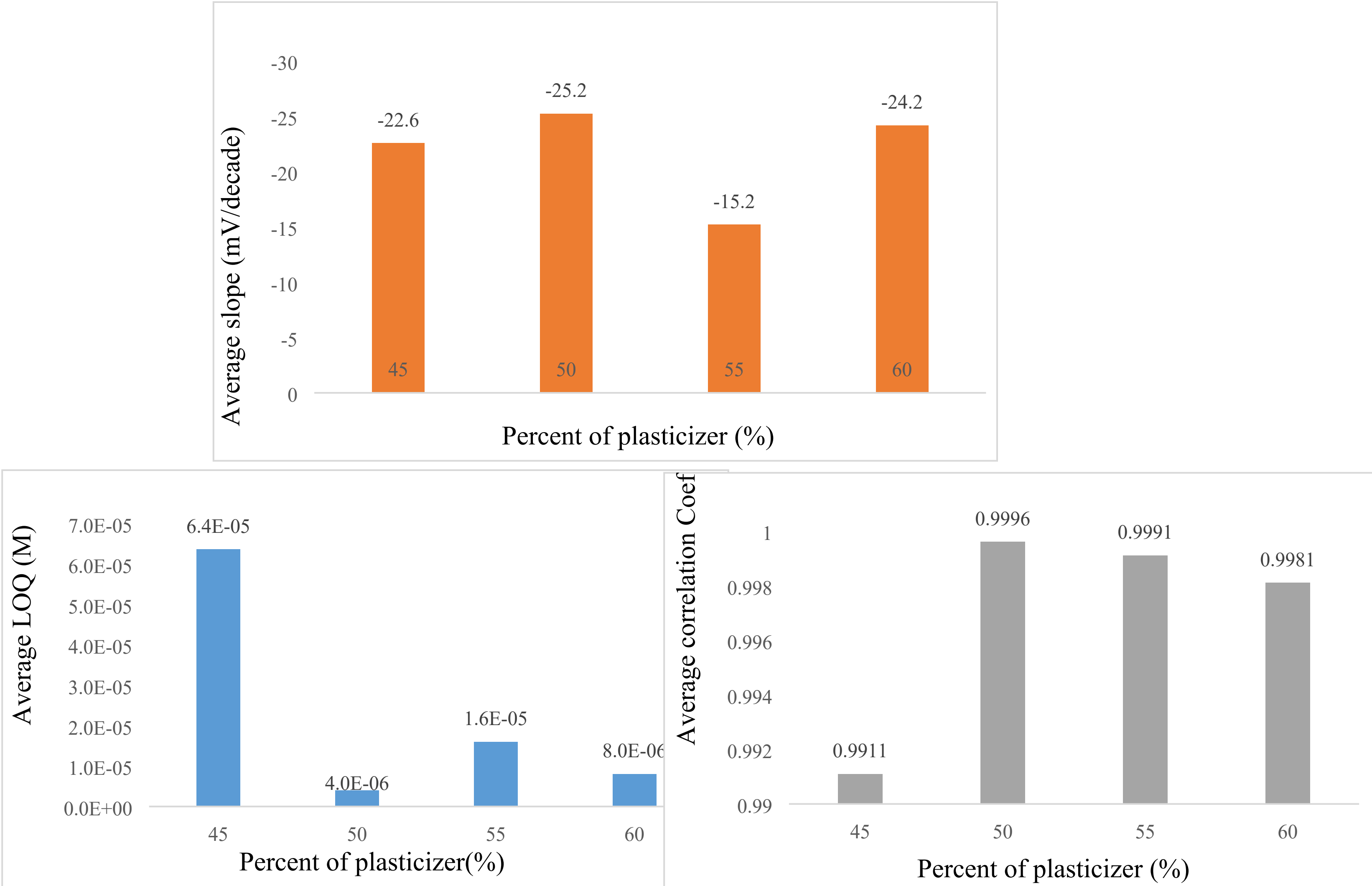


Fig. S4 The average slope, LOQ, and correlation coefficient (r) obtained using different percentages of dioctyl phthalate plasticizer (n=3).

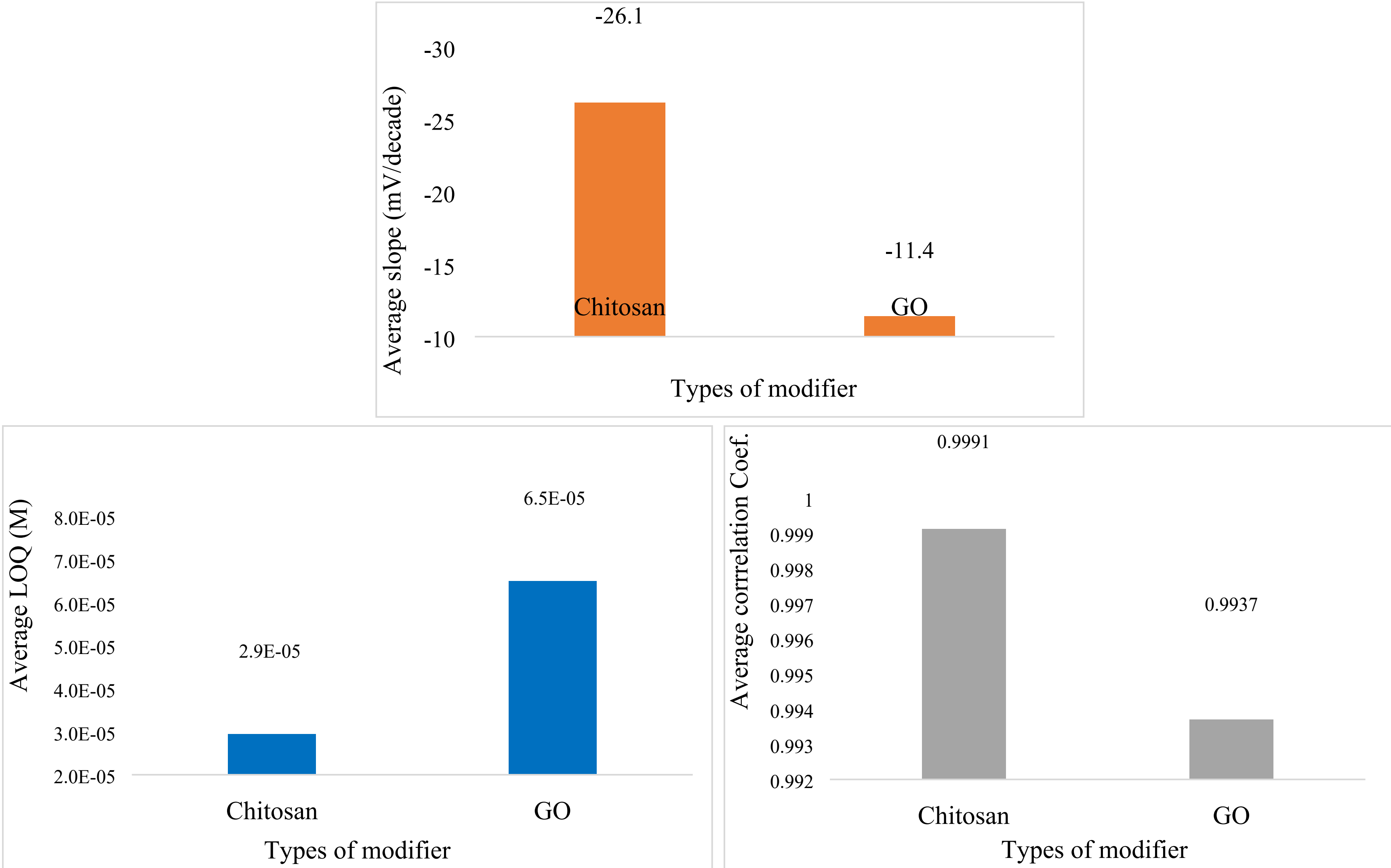


Fig. S5 The average slope, LOQ, and correlation coefficient (r) obtained using chitosan and Graphene oxide (GO) as carbon paste modifiers (n=3).

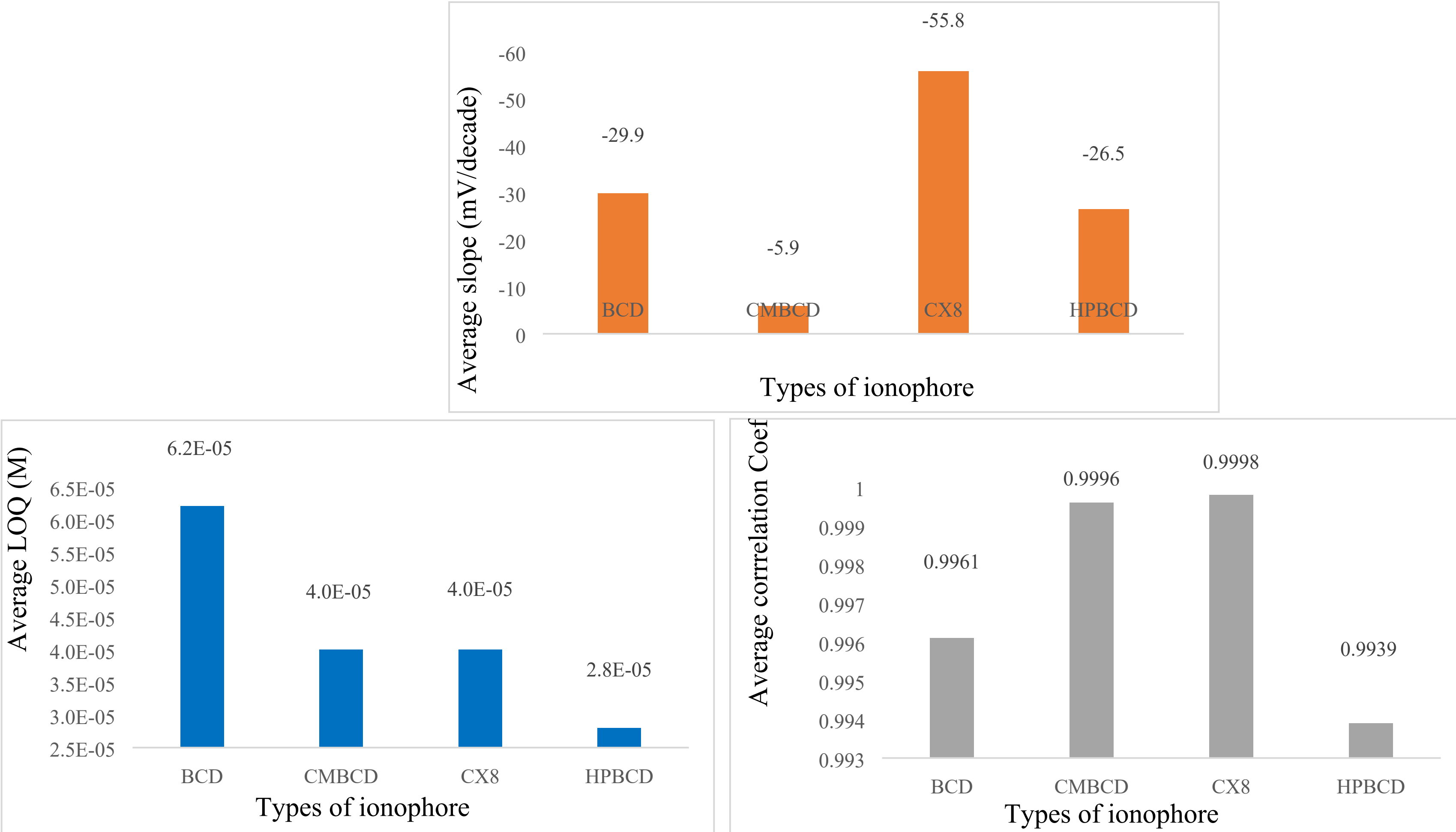


Fig. S6 The average slope, LOQ, and correlation coefficient (r) obtained using different ionophores: β-cyclodextrin (BCD), carboxymethyl-β-cyclodextrin (CMBCD), calix-[8]-arene (CX8),hydroxypropyl-β-cyclodextrin (HPBCD) (n=3).

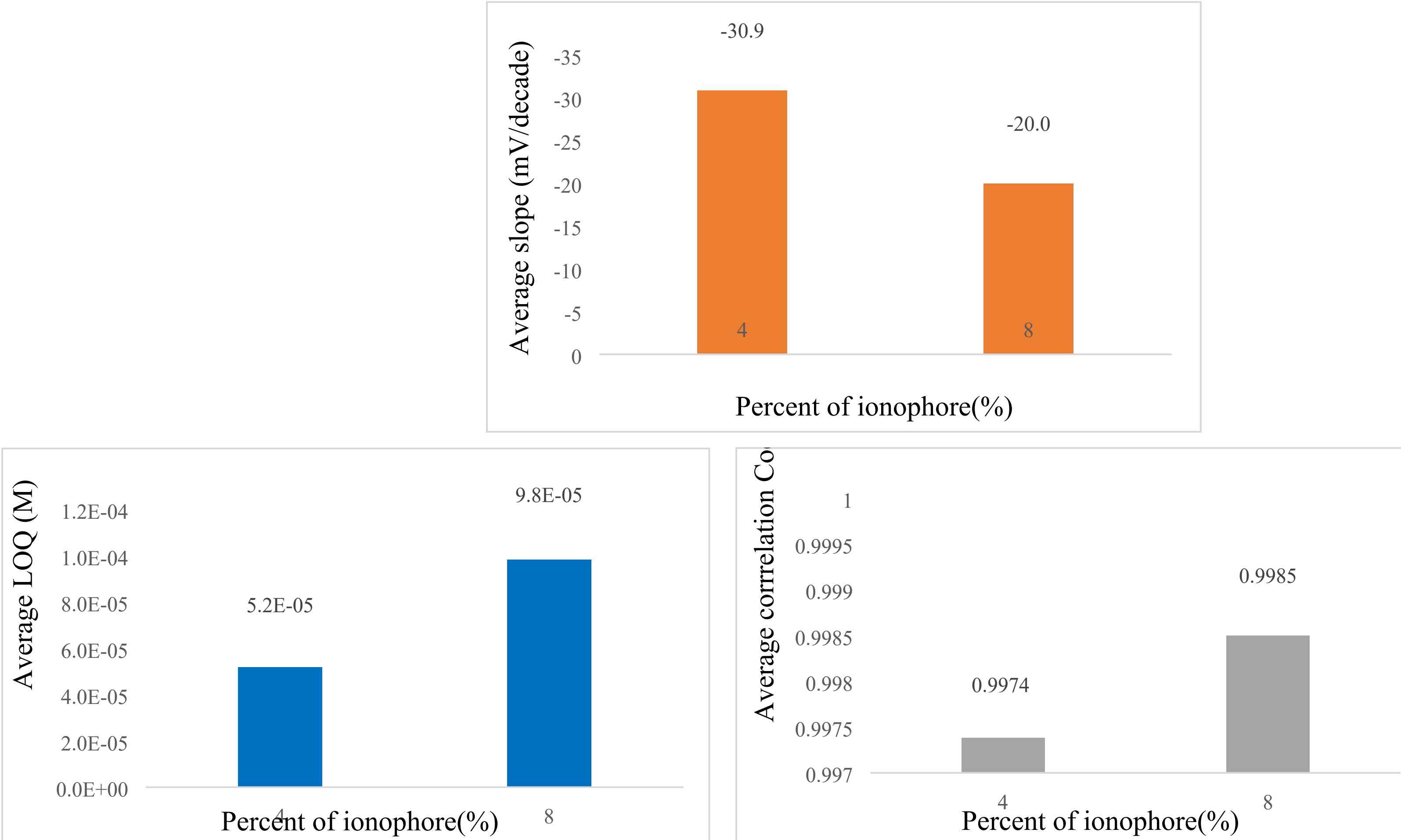


Fig. S7 The average slope, LOQ, and correlation coefficient (r) obtained using different percentages of Calix-8-arene (CX8) (n=3).