An Organic Transistor Functionalized with Molecularly Imprinted Polymer for Chiral Amino Acid Sensing

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Chiral analysis techniques are in high demand for pharmaceutical development and metabolic research.[1] To date, various chiral recognition materials have been designed considering complementarity with analytes, whereas synthetic efforts have posed the establishment of chiral sensors in practical situations. Molecular imprinting methods are promising approaches to easily obtain three-dimensional recognition scaffolds for selective analyte detection.[2,3] Notably, MIPs can be fabricated on solid substrates through electrochemical methods, which allows the formation of chiral cavities without synthetic burden. In this study, a solution-processable organic field-effect transistor (OFET) was selected to detect chiral recognition information by an MIP electrode. The transistor characteristics are modulated by applying gate voltages,[4] which indicates that a partially extended-gate electrode of the OFET can perform as a chiral sensing site. Herein, we propose an extended-gate type OFET functionalized with MIP for a chiral amino acid (i.e., L-histidine) (Figure 1(a)). The MIP layer was formed on the extended-gate electrode by electrochemically polymerizing a monomer (i.e., 1,2-diaminobenzene) in the presence of a template (i.e., L-histidine), using a molar ratio optimized by density functional theory calculations. Indeed, the combination of the OFET and the MIP electrode achieved selective detection of L-histidine over amino acid analogous (Figure 1(b)) and showed quantitative responses depending on changes in enantiomeric excess (%ee) of L-histidine (Figure 1(c)).

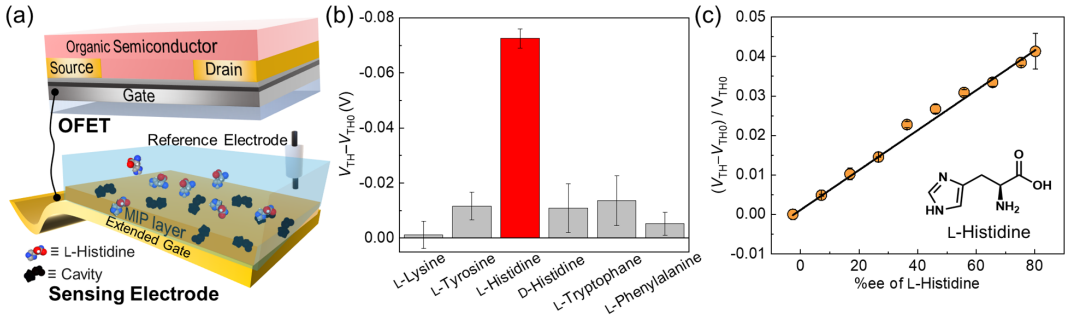

Fig. 1. (a) Schematic illustration of the extended-gate-type OFET functionalized with MIP for L-histidine. b) Selectivity test results against six amino acids. c) Changes in threshold voltage (V_{TH}) corresponding to ee% values of L-histidine.

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