유기 트랜지스터 플랫폼 기반 고성능 바이오 센서(Highly Sensitive and Selective Biosensors Based on Organic Transistor Platforms)

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Biosensors based on a field-effect transistor (FET) platform allow continuous monitoring of biologically active species with high sensitivity due to the amplification capability of detected signals. To date, a large number of sensors for biogenic substances have used high-cost enzyme immobilization methods. Here, we report highly sensitive organic field-effect transistor (OFET)-based sensors functionalized with synthetic receptors that can selectively detect acetylcholine (ACh+), a critical ion related to the delivery of neural stimulation. A cucurbit[6]uril (CB[6]) derivative, which is soluble in methanol but insoluble in water, has been solution-deposited as a selective sensing layer onto a water-stable p-channel semiconductor, DDFTTF layer. The OFET-based sensors exhibit a detection limit down to 1 pM of ACh+, which is six orders of magnitude lower than that of ion-selective electrode (ISE)-based sensors. Moreover, these OFET-based sensors show highly selective discrimination of ACh+ over choline (Ch+). Our findings demonstrate a viable method for the fabrication of OFET-based biosensors with high sensitivity and selectivity, and allow for practical applications of OFETs as high-performance sensors for biogenic substances.