CLAIMS

Claim 1. A method for detecting a drug molecule in a sample for non-diagnostic purpose, comprising the following steps:

S1 Adding the sample to an angstrom pore system, wherein the angstrom pore system comprises an angstrom pore, an insulating membrane, a first medium, and a second medium, wherein the angstrom pore is embedded in the insulating membrane that separates the first medium from the second medium, and the angstrom pore provides a channel that connects the first medium and the second medium; the angstrom pore is an MscS protein angstrom pore, the angstrom pore has a heptamer structure that is radially symmetric and is analogous to cylinder, the heptamer structure comprises seven side openings and one bottom opening; the sample is added to the first medium;

S2 Applying a driving force to the first medium and the second medium, wherein the drug molecule in the sample interacts with the angstrom pore and generates an electrical signal;

S3 Analyzing the electrical signal to identify the drug molecule in the sample;

wherein the insulating membrane comprises a membrane capable of carrying an angstrom pore and blocking a passage of an ion current through a non-angstrom pore; the first medium and the second medium comprise a conductive fluid, the conductive fluid is an alkali metal halide aqueous solution; the driving force comprises a force that drives the interaction of the drug molecule with the angstrom pore through potential difference, electro-osmotic flow, or concentration gradient; the electrical signal comprises a distinctive current generated during the interaction between the drug molecule in the first medium and the angstrom pore;

the drug molecule is a charged substance, a molecular weight of the drug molecule is less than 1000 g/mol, a concentration of the drug molecule is 10 nM~1 mM; the MscS protein angstrom pore originates from Pseudomonas aeruginosa; the MscS protein angstrom pore is a wild-type PaMscS angstrom pore or a PaMscS variant angstrom pore, a sequence of the wild-type PaMscS angstrom pore is SEQ ID NO:1, the PaMscS variant angstrom pore is one or more of the following variants of SEQ ID NO:1: K180R, V271I or W130A.

Claim 2. The method according to claim 1, wherein charge characteristic and/or pore size of the opening are adjustable; adjustment method of the opening comprises

mechanical stimulus to the insulating membrane and change in physical state of the insulating membrane;

Claim 3. The method according to claim 2, wherein the mechanical stimulus comprises one or more of osmolarity-difference change of the medium between both sides of the insulating membrane, direct physical stimulation of the insulating membrane by a microneedle, and stimulation of the insulating membrane by negative pressure.

Claim 4. The method according to claim 1, wherein pore size of the opening is capable of being adjusted by:
(1) type selection of the first medium and the second medium; and/or
(2) osmolarity-difference between the first medium and the second medium.

Claim 5. The method according to claim 1, wherein molecular weight of the drug molecule is 177.98 ~ 712.72 g/mol.

Claim 6. The method according to claim 1, wherein the sample is a body fluid sample, comprising one or more of urine, whole blood, serum, plasma, lymph fluid, cyst fluid, pleural fluid, ascitic fluid, peritoneal fluid, amniotic fluid, epididymal fluid, cerebrospinal fluid, bronchoalveolar lavage fluid, breast milk, tears, saliva, and sputum.

Claim 7. The method according to claim 6, wherein volume of the body fluid sample is greater than 10 μL.

Claim 8. The method according to claim 6, further comprising S4 Connecting a dialysis device via a catheter to the first medium to allow the whole blood sample to enter the angstrom pore system through the dialysis device, wherein the S4 is prior to the S1.