



OPTICAL BIOSENSOR FOR DOPAMINE DETECTION IN REAL SAMPLE

Ideas on utilisation

Dopamine (DA) is one of the catecholamine neurotransmitters presents in human as well as animal body fluids, playing crucial role in regulation of many processes in the organism. It is synthesized mainly in the brain and mammals' central nervous system, however, dopamine can be also applied as a remedy improving pumping strength of the heart or used for kidney failure treatment, shock, trauma or surgery. It is also confirmed that many neurodegenerative diseases (e.g Parkinson's, Huntington's disease) are connected with dopamine's deficiency in patients fluids.

The sensor was composed of 8 layers and contains the main holder (A) and microfluidic module (B) with immobilized protein - laccase. Microchannels for the analyte which are placed in the microfluidic module were cut with LTCC technology, as well as openings of the optical fibre. Microchannels which are connected to LED sensor are incorporated with chemosensitive enzymatic film. The general procedure for detection is based on application of Graphene Quantum Dots (GQD) and dopamine solution onto microchannels. Due to ability to self - polymerization, dopamine forms thick layer of film which is next adsorbed on the surface of Graphene Quantum Dots inducing Forster Resonance Energy Transfer and fluorescence quenching. The parameter is quite proportional to dopamine concentration.

Biosensor's data:

- sensor's recurrence is 20-30 measuring cycles
- 6-month Graphene Quantum Dots solution durability - confirmed after UV illumination
- interference testing passed with a positive results - sensor testes in presence of ascorbic acid, uric acid, cysteine, glutathione and a mixture of all substances
- limit of detection (LOD) for dopamine was confirmed as 80nM

Potential adopters of technology

The technological offer describes the ceramic, fluorescence-based sensor invented to detect dopamine in real samples. It is fabricated using low temperature co - fired ceramics with immobilized protein. Sensor can be mostly used in diagnostic medicine.

Advantages of technology

Ceramic, fluorescence - based sensor's advantages are:

- small size - constructed sensor's dimensions are: 4 x 2 cm² (main holder) and 1,9 x 1,1 (microfluidic module)
- replaceable microfluidic module - the part can be easily removed and replaced with different module containing other immobilized protein
- low costs - replaceable microfluidic cost does not exceed 8 USD (costs were calculated for laboratory scale)
- prototype costs do not exceed 56 USD
- tests results are obtained after 30 seconds
- high selectivity - sensor provides repeatable results in solutions of interfering substances
- high sensitivity - the sensor is capable to detect minimum dopamine concentration equal to 0,015 mg/L
- minimum sample volume to be examined is 60 µl

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Market and context of technology

The invention has been designed for dopamine detection and its concentration monitoring. As there is no similar method existing on the market, the sensor can be useful device used in diagnostic medicine and clinical laboratories. What makes the offer more attractive sensor guarantees low price, quick and easy measuring method.

Preconditions in adopting enterprises

Use of chemical compounds in the production process.