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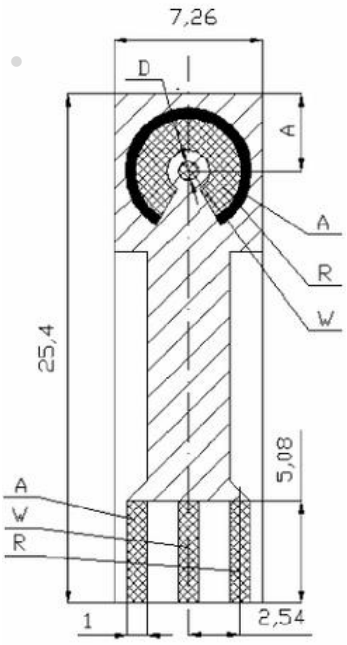
ACETYLCHOLINESTERASE BIOSENSOR

Type: AC1.ACHE

DESCRIPTION	
Substrate material	corundum ceramic
CE + WE material	Pt
Amounts of WEs	1
RE material	Ag
Final dielectric protection layer	ceramic
Electrode system	CE + RE + WE
Ø of the disc WE	1.00 ± 0.05 mm
Surface modification	**Acetylcholinesterase from electric eel type VI-S** is immobilized on the active surface of a platinum working electrode of electrochemical sensor AC1.W2.RS D_{WE} = 1 mm. Immobilized enzymatic membrane contains 1 IU of AChE enzyme.
Unit definition	• Acetylcholinesterase from electric eel AChE • True cholinesterase • EC 3.1.1.7 • Sigma Aldrich – type VI-S • One unit will hydrolyze 1.0 µmol of acetylcholine to choline and acetate per minute at pH 8 and temperature 37 °C
Possible applications	Measurement of AChE inhibitor concentration – the toxic organophosphates along with the others such as carbamate pesticides, nerve agents, and several other natural toxins in liquid samples from 5 °C to 40 °C.

$D_W = 1$ mm



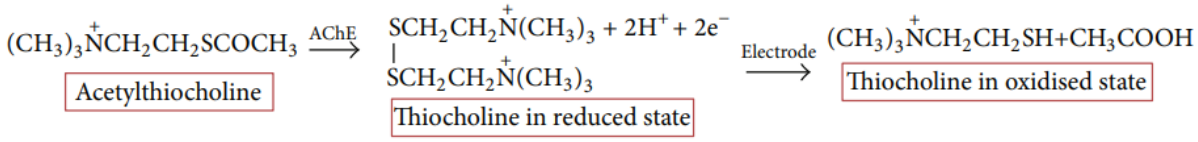
PHYSICAL PARAMETERS

Weight:	0.50	g	**Width:**	7.26	mm
Length:	25.40	mm	**Thickness:**	0.63	mm

BIOSENSOR PARAMETERS

Function principle

AChE biosensor basically works on the inhibition effect. If the inhibitor is not present in the sample, then the acetylthiocholine (used as an AChE enzyme substrate) will be converted into the thiocholine and the acetic-acid during enzymatic reaction as shown in scheme below:



Under the influence of applied voltage +350 mV at Pt working electrode of the AChE biosensor, thiocholine is oxidised. The anodic oxidation current (during chronoamperometry) is inversely proportional to the toxic compound present in the sample and the time of exposure.

But if the inhibitor is present in the sample (Syntostigmine (neostigmine) is used as an enzyme inhibitor standard) then the concentration of thiocholine is decreased or no thiocholine and acetic-acid is produced, in other words it completely inhibits the conversion.

Measuring principle – the decrease of AChE enzyme activity is proportional to the inhibitor concentration.
Measurement method: Amperometry at + 350 mV

Linear calibration range

0-2 µM Neostigmine at 60 µM Acetylthocholinchloride (ATCh) in measured solution.
Note: Linear range of biosensor is depended on concentration of ATCh.

Temperature usability

Acetylcholinesterase (AChE) enzyme activity increases with temperature. From the point of view of long-term use, it is advisable to measure at 25 °C. To achieve the highest possible activity of the AChE enzyme, a temperature of 35 °C can be used (however, the service life of the sensor decreases during thermal stress).

Lifetime and expiration

During measurement biosensor function from days to two weeks in sterile conditions.
(depends on the measurement conditions and how the sensor is stored).
Before measurement biosensor lasts in a dry state in the fridge (4-7 °C) in the original box with silica gel.

Storage

Before use, store the sensors in a dry state in the fridge (4-7 °C) in the original box with silica gel.
Once the sensors have been used in liquid solutions, they must not be allowed to dry out (the active membrane of the biosensor swells in the liquid and its subsequent drying can damage the sensor)!

When reusing AChE biosensors after measurement, it is possible to store them, for example, in a test tube with a 0.01 M PBS buffer of pH 7.2 or in a physiological solution - bacterial contamination can be prevented by adding sodium azide to the storage solution (content 0.05%).

RECCOMENDED ACCESORIES

Connector for electrochemical sensor

Connector KA1.C.*	https://bvt.cz/produkt/ka1-c/
MT-1 Minithermostat	https://bvt.cz/produkt/mt-1/
Electrochemicall glass cell TC6	https://bvt.cz/produkt/tc6/
Stirrer ST*	https://bvt.cz/kategorie-produktu/stirres/

EVALUATION UNITS

Recommended potentiostats

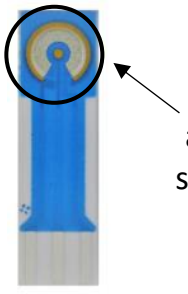
PalmSens	https://bvt.cz/kategorie-produktu/potentiostats/palmsens-potentiostats/
BVT	https://bvt.cz/produkt/gx102-potentiostat/
eDAQ	https://bvt.cz/kategorie-produktu/potentiostats/edaq-potentiostats/

HANDLING

Before starting the measurement, it is advisable to leave the active membrane of the biosensor immersed in the solution and let it swell for at least 10 minutes.

During the actual measurement, it is advisable to stir the solution and wait for the amperometric response of the sensor to stabilize before adding calibration standard.

The customer must perform their own calibration at the beginning of the measurement.

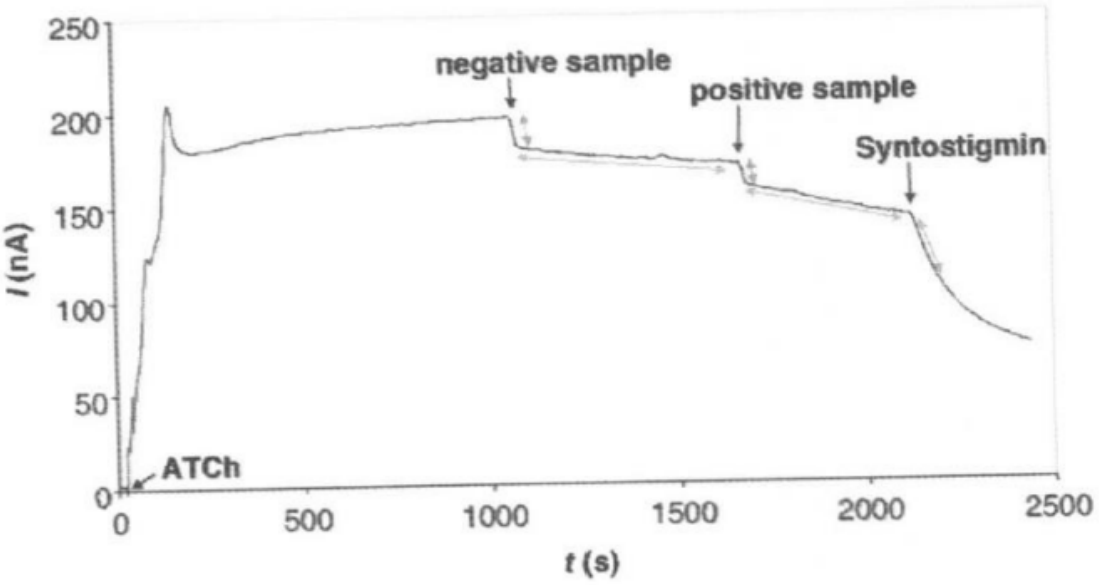


TRANSPORT

Sensors are delivered in thermoboxes keeping low temperature when ambient temperature may exceed 40 °C.

EXAMPLE OF MEASUREMENT

Response of the sensor to the addition of negative sample and positive sample (syntostigmin)



Measurement specification

Amperometry at +350 mV in 0.01 M PBS solution

Acetylthiocholine is used as an AChE enzyme substrate and Syntostigmine (neostigmine) as an enzyme inhibitor standard.

Measuring principle – the decrease of AChE enzyme activity is proportional to the inhibitor concentration – see graph above (more information can be found in Related literature below).

Used equipment

Sensor AC1.ACHE, Potentiostat BVT, Electrochemical glass cell TC6 and TC* stand, stirrer ST*

Used chemicals

0,01 M PBS solution
Acetylthiocholine
Syntostigmine (neostigmine)

RELATED LITERATURE

References

- Z. Grosmanová, J. Krejčí, J. Týnek, P. Cuhra, S. Baršová: Comparison of biosensoric and chromatographic methods for the detection of pesticides. International Journal of Environmental Analytical Chemistry 85(2005) 885-893
- J. Haze, M. Skocdopole, J. Krejci, R. Vrba, L. Fujcik, D. Krejcova, Z. Grosmanova: Artificial synapsis - The detector of pesticide toxicity. XVII IMEKO Word Congress Metrology (2003)

ORDERING INFORMATION

The order is specified by whole sensor description formula.
Minimum order quantity – **20** sensors (= 1 box).
All order quantities are to be in multiples of 20 e.g. 20, 40, 60, etc.

Example of order

20 pcs – AC1.ACHE

DELIVERY TIME

Delivery time for standard AC1.ACHE sensors is a maximum 4 weeks from receipt of order.
Delivery time for non-standard AC1.ACHE sensors depends on final technical specification of order.