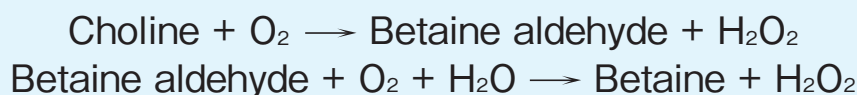


(Diagnostic Reagent Grade)

T-05

CHOLINE OXIDASE [COD]

from *Arthrobacter globiformis*
(Choline: oxygen 1-oxidoreductase, EC 1.1.3.17)



Preparation and Specification

Appearance : Yellowish amorphous powder, lyophilized
Specific activity : More than 8 U/mg solid
Contaminants :
Catalase Less than 10.0 % (U/U)
Glucose oxidase Less than 0.01 % (U/U)

Properties

Substrate specificity	: See Table 1	
Molecular weight	: 83 kDa (Sephadex G-150)	
Isoelectric point	: pH 4.5	
Michaelis constants	: Choline $1.2 \times 10^{-3}\text{M}$ Betaine aldehyde $8.7 \times 10^{-3}\text{M}$	
Optimum pH	: 7.5–8.0	Figure 1
pH stability	: 7.5–9.0 (37°C, 10 min)	Figure 2
Thermal stability	: Stable at 40°C and below (pH 7.5, 10 min)	Figure 3
Storage stability	: At least one year at -20°C	Figure 4
Effect of various chemicals	: See Table 2	

Applications for Diagnostic Test

This enzyme is useful for enzymatic determination of **phospholipids** coupled with phospholipase D (T-07).

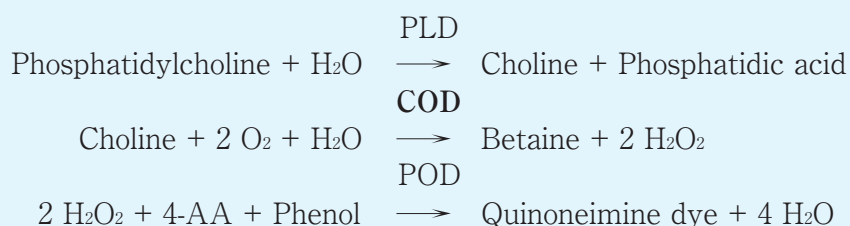


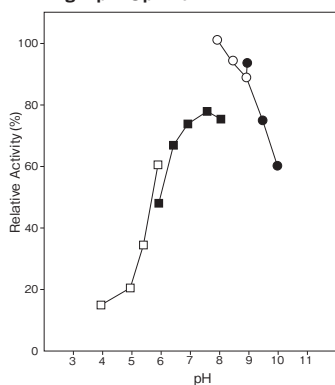
Table 1. Substrate specificity

Substrate	Relative activity (%)
Choline	100
Betaine aldehyde	46
Diethanolamine	1
Triethanolamine	3
N, N-Dimethylaminoethanol	5
N-Methylethanolamine	0

Table 2. Effect of various chemicals on COD activity

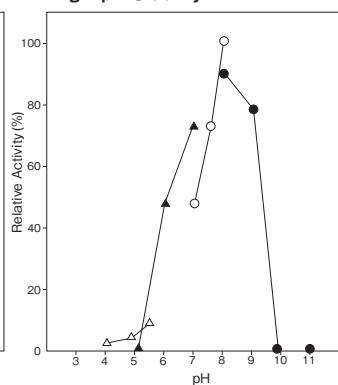
Additives	Concentration	Relative activity (%)
None	—	100
Triton X-100	0.1%	96
Adekato SO-120	0.1%	106
Sodium laurylsulfate	0.1%	94
Deoxycholate	0.1%	94
Sodium laurylbenzene sulfate	0.1%	91
CaCl ₂	5mM	101
MgCl ₂	5mM	100
FeCl ₃	5mM	0
ZnCl ₂	5mM	8
MnCl ₂	5mM	98
CoCl ₂	5mM	31
MoCl ₂	5mM	58
KCl	5mM	93
NaCl	5mM	97
NH ₄ Cl	5mM	100
LiCl	5mM	97
BaCl ₂	5mM	103

Fig.1 pH Optimum



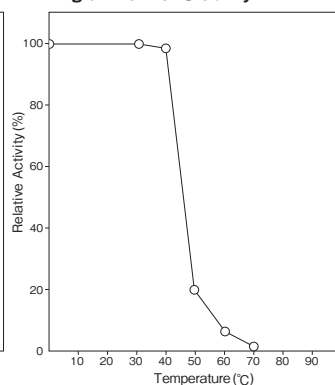
□ : Dimethylglutarate-NaOH buffer
 ■ : Phosphate buffer
 ○ : Glycylglycine buffer
 ● : Glycine-NaOH buffer

Fig.2 pH Stability



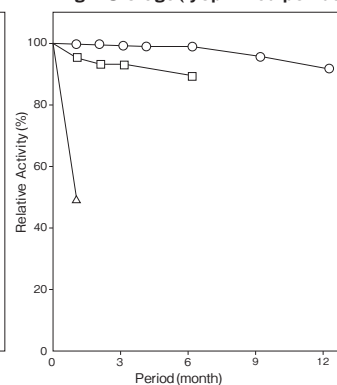
37°C, 10 min
 △ : Acetate buffer
 ▲ : Dimethylglutarate-NaOH buffer
 ○ : Tris-HCl buffer
 ● : Glycine-NaOH buffer

Fig.3 Thermal Stability



pH 7.5, 10 min

Fig.4 Storage (lyophilized powder)

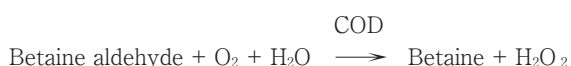


○ : -20°C
 □ : 5°C
 △ : 30°C

Assay

Principle

The assay is based on the increase in absorbance at 500 nm as the formation of quinoneimine dye proceeds in the following reactions:



Unit definition

One unit is defined as the amount of enzyme which generates 1 μmole of H₂O₂ per minute at 37°C under the conditions specified in the assay procedure.

Reagents

1. Reaction mixture

1.211 g of Tris (hydroxymethyl) amino methane, 2.1 g of choline chloride and 2 ml of 1 % (W/V) phenol are dissolved with 1 N HCl and adjusted to pH 8.0 (25°C). Then, 1 ml of 1 % (W/V) 4-AA and 3 ml of 100 PPU/ml POD are added to make a total of 100 ml.

2. Enzyme dilution buffer

10 mM Tris-HCl buffer (pH 8.0) containing 2 mM EDTA and 1 % (W/V) KCl
 EDTA: Ethylenediaminetetraacetic acid

3. Reagents

Choline chloride:

FUJIFILM Wako Pure Chemical Corporation
 1st Grade #033-09812

4-AA: NACALAI TESQUE, INC. Special grade #01907-52

POD: Sigma Chemical Co. Type II #P-8250

EDTA (2 Na·2H₂O) : KISHIDA CHEMICAL Co., Ltd.

#060-29133

■ Enzyme solution

Accurately weigh about 20 mg of the sample and add enzyme dilution buffer to make a total of 20 ml. Dilute it with enzyme dilution buffer to adjust the concentration as required.

■ Procedure

1. Pipette accurately 3.0 ml of reaction mixture into a small test tube and preincubate it at 37°C.
2. After 5 min, add 50 μ l of enzyme solution and mix to start the reaction at 37°C.
3. After starting the reaction, measure the rate of increase per minute in absorbance at 500 nm. The rate must be measured within the linear portion of the absorbance curve.

$$\Delta A/\text{min} \leq 0.040 \text{ Abs/min}$$

■ Calculation

$$\text{Activity (U/mg of powder)} = \frac{\Delta A/\text{min}}{12.0 \times 1/2} \times \frac{3.05}{0.05} \times \frac{1}{X}$$

12.0 : millimolar extinction coefficient of quinoneimine dye at 500 nm ($\text{cm}^2/\mu\text{mole}$)

1/2 : multiplier derived from the fact that 2 mole of H_2O_2 produce 1 mole of quinoneimine dye.

3.05 : final volume (ml)

0.05 : volume of enzyme solution (ml)

X : concentration of the sample in enzyme solution (mg/ml)

Storage

Storage at -20°C in the presence of a desiccant is recommended. Enzyme activity will be retained for at least one year under this condition (Figure 4).

References

1. Ikuta, S., Matsuura, K., Imamura, S., Misaki, H. and Horiuchi, Y. (1977) J. Biochem., **82**, 157-163.
2. Ikuta, S., Imamura, S., Misaki, H. and Horiuchi, Y. (1977) *ibid*, **82**, 1741-1749.
3. Ohta-Fukuyama, M., Miyake, Y., Emi, S. and Yamano, T. (1989) J. Biochem., **88**, 197-203.
4. Takayama, M. et al. (1977) Clin. Chim. Acta, **79**, 93.
5. Sugawara, K. and Kihara, A. (1978) Eisei Kensa, **27** (1), 106-111.
6. Okabe, H. et al. (1977) Clin. Chim. Acta, **80**, 87.

COD 活性測定法 (Japanese)

I. 試薬液

1. 反応試薬混合液

トリス (ヒドロキシメチル) アミノメタン 1.211g と塩化コリン 2.1g 及び 1% (W/V) フェノール液 2ml を精製水に溶解した後、1N HCl で pH8.0 (25°C) に調整し、さらに 1% (W/V) 4-AA 溶液 1ml と 100PPU/ml POD 溶液 3ml を加えて溶かし、全容 100ml とする。

2. 酵素溶解希釈用液

2mM EDTA と 1% (W/V) KCl を含む 10mM トリス - HCl 緩衝液 pH8.0 溶液

3. 試薬

塩化コリン:富士フィルム和光純薬製 一級

#033-09812

4-AA:ナカライテスク製 特級 #01907-52

POD:シグマ製 Type II #P-8250

EDTA (エチレンジアミン四酢酸・2Na・2H₂O):

キシダ化学製 #060-29133

II. 酵素試料液

検品約 20mg を精密に量り、酵素溶解希釈用液で溶解して全容 20ml とする。

その液を酵素溶解希釈用液で適宜希釈する。

III. 測定操作法

1. 小試験管に反応試薬混合液 3.0ml を正確に分注し 37°C で予備加温する。
2. 5 分経過後、酵素試料液 50 μ l を正確に加えて混和し、37°C で反応を開始する。
3. 反応開始後、500nm における吸光度を測定して直線的に反応している 1 分間当たりの吸光度変化を求める。

$$\Delta A/\text{min} \leq 0.040 \text{ Abs/min}$$

IV. 計算

$$\text{活性 (U/mg)} = \frac{\Delta A/\text{min}}{12.0 \times 1/2} \times \frac{3.05}{0.05} \times \frac{1}{X}$$

12.0 : キノンイミン色素の 500nm におけるミリモル分子吸光係数 ($\text{cm}^2/\mu\text{mole}$)

1/2 : H_2O_2 2 モルからキノンイミン色素 1 モルが生成することによる係数

3.05 : 反応総液量 (ml)

0.05 : 反応に供した酵素試料液量 (ml)

X : 酵素試料液の検品濃度 (mg/ml)