Scopus

Documents

Abdullah, A.[a] , Jameel, A.T.[b] , Ahmad, F.B.[a c] , Yusof, F.[a]

Purification, Characterization and Kinetic Study of Alpha Naphthyl Acetate Esterase From Atta Flour
(2023) *Journal of Applied Science and Engineering (Taiwan)*, 26 (5), pp. 589-595. Cited 1 time.

DOI: 10.6180/jase.202305_26(5).0001

[a] Department of Biotechnology Engineering, Kulliyyah of Engineering, International Islamic University Malaysia, Kuala Lumpur, 53100, Malaysia
[b] Department of Chemical Engineering, Aligarh Muslim University, Aligarh, 202001, India
[c] Department of Mechanical Engineering, University of Malaya, Kuala Lumpur, 50603, Malaysia

Abstract
As the most promising alternative to detect pesticides, enzyme-based electrochemical biosensors have gained considerable attention due to its operational simplicity and reliability. Alpha naphthyl acetate esterase (ANAE) enzyme, found in atta flour, can be used to detect pesticides. The crude ANAE enzyme was extracted from atta flour, filtered through a PTFE membrane and then purified using an aqueous two-phase separation system (ATPS). Polyethylene glycol (PEG) was used as it could enhance the catalytic activity and stability of enzyme in the ATPS. The ATPS, composed of PEG 1000/NaH2PO4 and PEG 1000, NaH2PO4/(NH4)2SO4, was performed at 4 °C and pH 5.0. The molecular weight of ANAE was assessed using sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE). The molecular weight of the target esterase was found to be around 65 kilodaltons (kDa). The optimal condition of ANAE to catalyze alpha naphthyl acetate as substrate was at 40 °C with pH 8 of phosphate buffer and 15 min incubation time. The Michaelis-Menten parameters of the purified enzyme were 9.765 mM and 0.084 mM/min, respectively for Km and Vmax. This purified ANAE can be applied to fabricate of screen-printed electrode as biosensor for the detection of pesticides. © The Author(’s).

Author Keywords
alpha naphthyl acetate esterase (ANAE); aqueous two-phase separation system (ATPS); biosensor; enzyme; Michaelis-Menten; pesticide

Index Keywords
Biosensors, Catalyst activity, Electrophoresis, Esters, Molecular weight, Naphthalene, Nitrogen compounds, Phase separation, Purification, Sodium dodecyl sulfate, Sulfur compounds; Alpha naphthyl acetate esterase, Aqueous two phase, Aqueous two-phase separation system, Characterization studies, Electrochemical biosensor, Esterase enzymes, Kinetic study, Michaelis-Menten, Separation systems, Two-phase separation; Pesticides

Funding details
Kementerian Pendidikan MalaysiaKPMFRGS/1/2017/TK02/UIAM/02/4, FRGS/1/2019/TK02/UIAM/02/3

The authors acknowledge financial assistance from Ministry of Education under Fundamental Research Grant Scheme (FRGS) (FRGS/1/2019/TK02/UIAM/02/3). This work was supported by Fundamental Research Grant Scheme (FRGS) Research Project FRGS/1/2017/TK02/UIAM/02/4.

References

- Sankararamakrishnan, N., Kumar Sharma, A., Sanghi, R.
Organochlorine and organophosphorous pesticide residues in ground water and surface waters of Kanpur, Uttar Pradesh, India
(2005) *Environment International*, 31 (1), pp. 113-120.

- Arduini, F., Ricci, F., Tuta, C., Moscone, D., Amine, A., Palleschi, G.
Detection of carbamic and organophosphorous pesticides in water samples using a cholinesterase biosensor based on Prussian Blue-modified screen-printed electrode
(2006) *Analytica Chimica Acta*, 580 (2), pp. 155-162.

- Chen, D., Liu, Z., Fu, J., Guo, Y., Sun, X., Yang, Q., Wang, X.
Electrochemical acetylcholinesterase biosensor based on multi-walled carbon nanotubes/dicyclohexyl phthalate modified screen-printed electrode for detection of chlorpyrifos
(2017) *Journal of Electroanalytical Chemistry*, 801, pp. 185-191.

- Audrey, S., Beatriz, P.-S., Jean-Louis, M.
Biosensors for pesticide detection: new trends
(2012) *American Journal of Analytical Chemistry*, 2012.

- Hou, C., He, K., Yang, L., Huo, D., Yang, M., Huang, S., Zhang, L., Shen, C.
Catalytic characteristics of plant-esterase from wheat flour
(2012) *World Journal of Microbiology and Biotechnology*, 28 (2), pp. 541-548.

- Dhull, V., Gahlaut, A., Dilbaghi, N., Hooda, V.
Acetylcholinesterase biosensors for electrochemical detection of organophosphorus compounds: A review
(2013) *Biochemistry Research International*,

- Bao, J., Hou, C., Chen, M., Li, J., Huo, D., Yang, M., Luo, X., Lei, Y.
Plant Esterase-Chitosan/Gold Nanoparticles-Graphene Nanosheet Composite-Based Biosensor for the Ultrasensitive Detection of Organophosphate Pesticides
(2015) *Journal of Agricultural and Food Chemistry*, 63 (47), pp. 10319-10326.

- LI, J.-k., ZHOU, Y.-l., WEN, Y.-x., WANG, J.-h., HU, Q.-h.
Studies on the Purification and Characterization of Soybean Esterase, and Its Sensitivity to Organophosphate and Carbamate Pesticides
(2009) *Agricultural Sciences in China*, 8 (4), pp. 455-463.

- Abdullah, N., Yusof, F., Ahmad, F.
(2020) *Preliminary study on immobilization of plant esterase on functionalized multi-walled carbon nanotubes (MWCNTs) for biosensor application*,
932. 1. cited By 1

- Yang, L., Huo, D., Hou, C., He, K., Lv, F., Fa, H., Luo, X.
Purification of plant-esterase in PEG1000/NaH2PO4 aqueous two-phase system by a two-step extraction
(2010) *Process Biochemistry*, 45 (10), pp. 1664-1671.

- Dong, L., Ren, Y., Li, J., Wu, H., Hou, C., Fa, H., Yang, M., Huo, D.
Detection of Carbendazim Residues in Aqueous Samples by Fluorescent Quenching of Plant Esterase
(2018) *Journal of Applied Spectroscopy*, 85 (3), pp. 535-542.

- Ramakrishnan, V., Goveas, L., Suralikerimath, N., Jampani, C., Halami, P., Narayan, B.
Extraction and purification of lipase from Enterococcus faecium MTCC5695 by PEG/phosphate aqueous-two phase system (ATPS) and its biochemical characterization
(2016) *Biocatalysis and Agricultural Biotechnology*, 6, pp. 19-27.

- Goja, A. M., Yang, H., Cui, M., Li, C.
Aqueous two-phase extraction advances for bioseparation
(2013) *Journal of Bioprocessing & Biotechniques*, 4 (1), pp. 1-8.

- Chen, J., Zhang, Y., Wu, Y., Zhang, J.
The basic study of plant esterase in pesticide residue examination
(2013) *Advanced Materials Research*, 726-731, pp. 950-957.

- Dong, L., He, L., Huo, D.
Three phase partitioning as a rapid and efficient method for purification of plant-esterase from wheat flour
(2020) *Polish Journal of Chemical Technology*, 22 (2), pp. 42-49.

- Ye, L., Liu, X., Shen, G.-H., Li, S.-S., Luo, Q.-Y., Wu, H.-J., Chen, A.-J., Zhang, Z.-Q.
Properties comparison between free and immobilized wheat esterase using glass

fiber film
(2019) *International Journal of Biological Macromolecules*, 125, pp. 87-91.

- Jiang, B., Feng, Z., Liu, C., Xu, Y., Li, D., Ji, G.
Extraction and purification of wheat-esterase using aqueous two-phase systems of ionic liquid and salt
(2015) *Journal of Food Science and Technology*, 52 (5), pp. 2878-2885.

- Abdul Aziz, N., Abbasiliasi, S., Ariff, A., Ng, H., Lan, J.-W., Ahmad, R., Tan, J.
Optimization of recovery of esterase from Serratia marcescens using combination of the solvent impregnated resin and aqueous two-phase extraction techniques
(2018) *Separation Science and Technology (Philadelphia)*, 53 (18), pp. 2952-2960.

- Lemes, A., Silvério, S., Rodrigues, S., Rodrigues, L.
Integrated strategy for purification of esterase from Aureobasidium pullulans
(2019) *Separation and Purification Technology*, 209, pp. 409-418.

- Khushairi, Z., Samad, K., Rahman, N., Yussof, H., Zainol, N.
Application of Michaelis–Menten in the kinetics of oil palm frond enzymatic hydrolysis for ferulic acid production
(2020) *SN Applied Sciences*, 2 (2).

- Zainol, N., Ismail, S.
Evaluation of enzyme kinetic parameters to produce methanol using Michaelis-Menten equation
(2019) *Bulletin of Chemical Reaction Engineering & Catalysis*, 14 (2), pp. 436-442.

Correspondence Address
Ahmad F.B.; Department of Biotechnology Engineering, Malaysia; email: farahahmad@iium.edu.my

Publisher: Tamkang University

ISSN: 27089967
Language of Original Document: English
Abbreviated Source Title: J. Appl. Sci. Eng.
2-s2.0-85139202268
Document Type: Article
Publication Stage: Final
Source: Scopus