

REFERENCES

- Adler-Nissen, A. and Jens. 1984. Control of the proteolytic reaction and of the level of bitterness in protein hydrolysis processes. *J. Chem. Tech. And Biotech.* 34B(3): 215-222.
- Ando, S. Ishikawa, K., Ishida, H, Kawarabayas, Y. Kikuchi, H. and Kosugi, Y. 1999. Thermostable aminopeptidase from *Pyrococcus horishii*. *FEBS Lett.* 447(1): 25-28.
- Anson, M.L. 1938. The estimation of pepsin, trypsin, papain and cathepsin with hemoglobin. *J. Gen. Physiol.* 22 : 79-89.
- Aphale, J.S. and Strohl, W.R. 1993. Purification and properties of an extracellular aminopeptidase from *Streptomyces lividans*. *J. Gen. Microbiol.* 139: 417-424.
- Aroonpiroj, T. 1997. Proteolytic enzymes in traditional fish sauce fermentation. M.S. Thesis in Biotechnology. Mahidol University, Thailand.
- Arora, G. and Lee, B.H. 1994. Purification and characterization and aminopeptidase from *Lactobacillus casei* subsp. *rhamnosus* S93. *Biotech. Appl. Biochem.* 19(2): 179-192.
- Aubes-Dufau, I. Seris, J.L. and Combes, D. 1995. Bitter peptide from hemoglobin hydrolyzate isolation and characterization. *FEBS. Lett.* 364: 115-119.
- Aubes-Dufau, I. and Combes, D. 1997. Effect of different proteases on bitterness of hemoglobin hydrolyzates. *Appl. Biochem. Biotechnol.* 67: 127-138.
- Baek, H.H. and Cadwallader, K.R. 1995. Enzymatic hydrolysis of crayfish processing by products. *J. Food Sci.* 60(5): 929-935.
- Ballog, D.M., Rozycki, M.D. and Edelstein, S.J. 1996. In: Protein methods second edition. Wiley-Liss, New York, pp. 62-67.
- Banerjee, V., Sani, K., Azmi, W. and Soni, R. 1999. Thermostable alkaline protease from *Bacillus brevis* and its characterization as a laundry additive.

- Proc. Biochem. 35: 213-219.
- Barett, A.J. 1994. Proteolytic enzymes: serine and cysteine peptidases. *Methods Enzymol.* 244: 1-15.
- Barett, A.J. 1995. Proteolytic enzymes: aspartic and metallopeptidases. *Methods Enzymol.* 248: 183.
- Becker, P. 1997. Determination of the kinetic parameters during continuous cultivation of the lipase producing thermophile *Bacillus* sp. IHI-91 on olive oil. *Appl. Microb. Biotechnol.* 48: 184-190.
- Behnke, U. and Schalinatus, E. 1975. Formation of bitter peptides in cheese and from Casein. *Nahrung.* 19(9-10): 839-843.
- Ben-Meir, D. Spungin, A. Ashkerazi and R. Blumberg, S. 1993. Specificity of *Streptomyces griseus* aminopeptidase and modulation of activity by divalent metal ion binding and substitution. *Eur. J. Biochem.* 212: 107-112.
- Bouchier, P.J., Gerald, R.J. and Cuinn, G.O. 1999. Hydrolysis of α_{S1} - and β -casein derived peptides with a broad specificity aminopeptidase and proline specific aminopeptidases from *Lactococcus lactis* subsp. *cremoris* AM2, *FEBS* 21617. 445(2-3): 321-324.
- Brown, S.H., Kelly, R.M. 1993. Characterization of amylolytic enzymes, having both α -1,4 and α -1,6-hydrolytic activity from the thermophilic archaea *Pyrococcus furiosus* and *Thermococcus litoralis*. *Appl. Environ. Microbiol.* 59: 2614-2621.
- Canan, R., Axelrad I., Safrin M., Ohman Dennis, E. and Kessler, E. 2001. A secreted aminopeptidase of *Pseudomonas aeruginosa*. *J. Biol. Chem.* 276(47): 43645-43652.
- Canganella, F. Jones, W.J. Gambacorta, A. and Antranikian, G., 1998. *Thermococcus guaymasensis* sp. and *Thermococcus aggregans* sp. nov., two novel thermophilic archaea isolated from the Guaymas Basin hydrothermal vent site. *Int. Syst. Bacteriol.* 48: 1181-1185.
- Cerny, G. 1978. Studies on the aminopeptidase test for the distinction of gram negative from gram-positive bacteria. *Eur. J. Appl. Microbiol. Biotechnol.* 5: 113-122.

- Chantawannukul, P., Oncharoen, A., Klanbut, K., Chukeatirote, E. and Lumyong, S. 2002. Characterization of proteases of *Bacillus subtilis* strain 38 isolated from traditionally fermented soybean in Northern Thailand. *Science Asia*. 28: 241-245.
- Chavagnat, F., Casey, M.G. and Meyer, J. 1999. Purification, characterization, gene cloning, sequencing and overexpression of aminopeptidase N from *Streptococcus thermophilus* A. *Appl. and Environ. Microb.* 65(7): 3001-3007.
- Chen, G. Edwards, T. Souza, Y. Holz, R. 1997. Mechanistic studies on the aminopeptidase from *Aeromonas proteolytica*: a two metal ion mechanism for peptide hydrolysis. *Biochemistry*. 36: 4278-4286.
- Chien, H.C.R., Lin, L.L. Chao, S.H. Chen, CC, Wang, W.H. Shaw, C.Y., Tsai, Y.C. Hu, H.Y., Hsu, W.H. 2002. Purification, characterization, and genetic analysis of a leucine aminopeptidase from *Aspergillus sojae*. *Biochim Biophys. Acta*. 1576: 119-126.
- Choorit, W. and Prasertsan, P. 1992. Characterization of protease produce by newly isolated and identified proteolytic microorganisms from fermented fish (Budu). *World J. Microbiol. and Biotechnol.* 8: 284-286.
- Cowan, D.A., Smolenski, K.A., Daniel, R.M. Morgan, H.W. 1987. An extremely thermostable extracellular proteinase from a strain of the archaebacterium *Desulfurococcus* growing at 88 °C. 247(1): 121-133.
- Cummings, S.P. and Russell, N.J. 1996. Osmoregulatory responses of bacteria isolated from fresh or composted, olive-mill waste-waters. *World J. Microbiol. and Biotechnol.* 12: 61-67.
- De Marco, A.C. and Dick., A.J. 1978. Aminopeptidase I actives in several microorganisms. *Can. J. Biochem.* 56: 66-71.
- De Rosa, M., Morana, A. Riccio, A., Gambacorta, A. Trincone, A. and Incani, O., 1994. Lipids of the archaea: a new tool for bioelectronics. *Biosens. Bioelectr.* 9: 669-675.
- Deutcher, M.P. 1990. In: *Methods in Enzymology* volume 182: Guide to protein

- purification. Academic Press, Inc., San Deigo. pp. 50-441.
- Dhandapani, R. and Vijayaragavan, R. 1994. Production of a thermophilic, extracellular alkaline protease by *Bacillus stearothermophilus* AP-4. World J. Microbiol and Biotechnol. 10: 33-35.
- Edward, S.C. 1990. Halotolerant and halophilic microorganisms. Microbiology of extreme environments. Mc Graw Hill Publish. England. pp. 148-177.
- Emtseva, T.V. 1975. Effect of carbon and nitrogen sources and complex vitamins on the synthesis of alkaline protease by different strains of *Bacillus mesentericus* and *Bacillus subtilis*. Prikl. Biokhim. Mikrobiol. 11(3): 391-396.
- Essuman, K.M. 1992. Fermented fish in Africa: A study on processing marketing and consumption. FAO, Italy. 1-9.
- Everly, C. and Alberto, J., 2000. Stressors, stress and survival: overview. Front Biosci. 5: 780-786.
- Fairbarin, D.J., Law, B.A. 1987. The effect of nitrogen and carbon sources on proteinase production by *Pseudomonas fluorescens*. J. Appl. Bacteriol. 62(2): 105-113.
- Fastrez, F. and Brouillet, N. 1973. Demonstration of the acyl-enzyme mechanism for the hydrolysis of peptides and anilided by chymotrypsis. Biochemistry. 12: 2025-2034.
- Felix, F. and Brouillet, N. 1966. Purification and properties of two peptidases from brewer's yeast. Biochim. Biophys. Acta 122: 127-144.
- Fujimaki, M., Kato, H., Arai, S. and Yamashita, M. 1971. Application of microbial protease to soybean and other materials improve acceptability, especially though the formation of plastein. J. Appl. Bacteriol. 34: 119-131.
- Fujio, Y. and Kume, S. 1991. Characteristics of highly thermostable neutral protease production from *Bacillus stearothermophilus*. World J. Microbiol and Biotechnol. 7: 12-16.
- Fujiwara, S. Okuyama, S. and Imanaka, T. 1996. The world of archea. Genome analysis, evolution and thermostable enzymes. Gene. 179: 165-170.

- Gagne, N. and Simpson, B.K. 1993. Use of pyrolytic enzymes to facilitate the recovery of chitin from shrimp wastes. *Food Biotechnol.* 7(3): 253-263.
- Garfin, E.D. 1990. One dimensional gel electrophoresis. In : guide to protein purification, Deutscher, M.P. eds. Academic Press, Inc. California. pp. 425-440.
- Gerhartz, W. 1990. In: *Enzymes in Industry: Production and applications.* VCH Publishers, New York. pp. 53-55.
- Gessesse, A. 1998. Purification and properties of two thermostable alkaline xylanase from and alkaliphilic *Bacillus* sp. *Appl. Environ. Microbiol.* 64: 3533-3535.
- Gey, M. and Unger, K. 1995. Calculation of the molecular masses of two newly synthesized thermostable enzymes isolated from thermophilic microorganisms. *J. Chromatogr.* 166: 188-193.
- Gobbetti, M. Smacchi, E. and Corsetti, A. 1996. The proteolytic system of *Lactobacillus sanfrancisco* CB 1 : purification and characterization of a proteinase, a dipeptidase, and an aminopeptidase. *Appl. Environ. Microbiol.* 62(9): 3220-3226.
- Gonzales, T. and Baudouy, R.J. 1996. Bacterial aminopeptidase: properties and functions. *FEMS Microbiol. Rev.* 18: 319-344.
- Guenet, C., Lepage, P. and Hairris, B.A. 1992. Isolation of the leucine aminopeptidase gene from *Aeromonas proteolytica*. *J. Biol. Chem.* 267(12): 8390-8395.
- Hamada, J.S. and Marshall, W.E. 1989. Preparation and functional properties of enzymatically deamidated soy proteins. *J. Food Science.* 54(3): 598-601.
- Hameed, A., Natt, M.A. and Evans, C.S. 1996. Production of alkaline protease by a new *Bacillus subtilis* isolate for use as a bating enzyme in leather treatment. 12: 289-291.
- Hanazawa, S., Hoaki, T., Jannasch, H. and Maruyama, T. 1996. An extremely thermostable serine protease from hyperthermophilic archaeum *Desulfurococcus*, isolated from a deep sea hydrothermal vent. *J. Mar. Biotechnol.* 4: 121-126.
- Harris, E.L.V. and Angal, S. 1989. In: *Protein purification: a practical approach.* Oxford: Oxford University Press, New York. USA. 317 p.

- Hartley, B.S. 1960. Proteolytic enzymes. *Annu. Rev. Biochem.* 29: 45-72.
- Hawumba, J.F., Theron, J. and Brozel, V.S. 2002. Thermophilic protease producing *Geobacillus* from I hot spring in Western Uganda. *Curr. Microbiol.* 45(2): 144-150.
- Herbert, R. and Sharp, R., 1992. *Molecular Biology and Biotechnology of extremophiles.* Chapman and Hall, New York. USA. pp. 45-60.
- Hermes, H.F.M., Sonk, T., Peter, P.J.H., Van Balken, J.A.M., Kamphuis, J. and Dijkhuizen, L. 1993. Purification and characterization of and L-aminopeptidase from *Pseudomonas putida* ATCC12633. *Appl. Environ. Microbiol.* 59: 4330-4334.
- Hibbs, M.S., Hasty, K.A. Seyer, J.M. Kang, A.H. and Mainardi, C.L. 1985. Biochemical and immunological characterization of the secreted forms of human neutrophil gelatinase. *J. Biol. Chem.* 260: 2493-2500.
- Holmes, M.a. and Matthew, B.W. 1981. Binding of hydroamic acid inhibitors to crystalline thermolysine suggests a pentacoordinate zinc intermediate in catalysis *Biochemistry.* 20: 6912-6920.
- Hoyle, N.T. and Merritt, J.H. 1994. Quality of fish protein hydrolysis from Herring (*Clupea harengus*). *J. Food Sci.* 59(1): 76-79.
- Huber, R., Langworthy, T.A., Konig, H., Thomm, M. Woese, c.R., Sleytr, U.B. Steter, K.O. 1986. *Thermotuga maritima*, sp. Nov. Represents a new genus of unique extremely thermophilic eubacteria growing up to 90 °C. *Arc. Microbiol.* 144-: 324-333.
- Irwin, J.A. and Baird, A.W. 2004. Extremophiles and their application to veterinary medicine. *Irish Verterinary J.* 57(6): 348-354.
- Ishibashi, N. I., Arita Y., Kaneshisa, H., Kogure, K., Okai, H., and Fukui, S. 1987. Bitterness of leucine-containing peptides. *Agric. Biol. Chem.* 51(9): 2389-2394.
- Ishibashi, N, I., Kubo, T, Chino, M, Fukui, I., Shinoda, E., E.,Kikuchi, E., Okai,H. and Fukui, S., 1988. Taste of proline containing peptides. *Agri. Biol. Chem.* 52: 95-98.

- James, M.N.G., Sielecki, A.R., Hayakawa, K. and Gelb, M.H. 1992. Crystallographic analysis of transition state mimics bound to penicillopepsin: difluorostatine- and difluorostatone-containing peptides. *Biochemistry*. 31: 3872-3886.
- Janson and Ryden, 1989. In : Protein purification principles, high resolution methods, and applications. VVH Publisher, Inc., New York. USA. 502 p.
- Jayanandana, S. 1979. Comparative study on some properties of certain bacteria Isolated from Thai fish sauce made from fresh water and marine fishes. M.S. Thesis in Microbiology. Kasetsart University.
- Johnevelsy, B. and Naik, G. 2001. Studies on production of thermostable alkaline protease from thermophilic and alkaliphilic *Bacillus* sp. JB-99 in a chemically defined medium. *Proc. Biochem*. 37: 139-144.
- Kalunians, K.A., Strel, L.I., Shtein, I.V. 1979. Effect of sources of carbon, nitrogen and phosphorus on the synthesis of proteases from *Bacillus subtilis* culture. *Prikl. Biokhim. Mikrobiol*. 15(1): 57-62.
- Kamekura, M. and Seno Y. 1990. A halophilic extracellular protease from a halophilic archaeobacterium strain 172 P1. *Biochem Cell Biol*. 68(1): 352-359.
- Kanasawat, P. and Wipapat, K. 1996. Thermostable metalloproteases excreted by gram-negative thermophilic bacterium. In: Poster Presentation: 10th International Biotechnology symposium. Sydney, Australia.
- Kembhavi, A.A., Kulkarni, A., Pant, A. 1993. Salt-tolerant and thermostable alkaline protease from *Bacillus subtilis* NCIM no. 64. *Appl. Biochem. Biotech*. 38: 83-92.
- Keungarp R., Kim, J. and Dordick, J.S. 1994. Catalytic properties and potential of an extracellular protease from an extreme halophile. *Enzyme Microbial Technol*. 16: 266-275.
- Khaziev, A.F., Mikhailova, N.A. and Alsynbaev, M.M. 2002. Study of the effectiveness Of methods of purification metalloprotease reduced by *Bacillus subtilis*. *Mikrobiol Epidemiol. Immunobiol*. 6: 75-77.
- Kim, M.R., Choi, S.Y., Kim, C.S. Kim, C.W., Utsumi, S. and Lee, C.H. 1999. Amino

- acid sequence analysis of bitter peptides from a soybean proglycinin subunit synthesized in *Escherichia coli*. *Biosci. Biotechnol. Biochem.* 63: 2069-2074.
- Kim, S.S., Kim, Y.J., Rhee, I.K. 2001. Purification and characterization of novel extracellular protease from *Bacillus cereus* KCTC 3674. *Arch. Microbiol* 175(6): 458-461.
- Kim, Y.K., Bae, J.H., Oh, B.K., Lee, W.H. and Choi, J.W. 2002. Enhancement of proteolytic enzyme activity excreted from *Bacillus stearothermophilus* for a thermophilic aerobic digestion process. *Bioresource. Technol.* 82(2): 157-164.
- Kohlmann, K.L., Nielson, S.S., and Ladosch, M.R. 1991. Purification and characterization of an extracellular protease produced by *Pseudomonas fluorescens* M3/6. *J. Dairy Sci.* 74: 4125-4125.
- Koka, R. and Weimer, B.C. 2000. Isolation and characterization of protease from *Pseudomonas fluorescens* RO98. *Appl. Microbiol.* 89: 280-288.
- Kocabiyik, S. and Erdem, B., 2002. Intracellular alkaline proteases produced by thermoacidophiles: Detection of protease heterogeneity by gelatin zymography and polymerase chain reaction (PCR). *Biores. Technol.* 84: 29-33.
- Kumar, S. and Nussinov, R., 2001. How do thermophilic proteins deal with heat. A review. *Cell. Mol. Life Sci.* 58: 1216-1233.
- Kushner, D.J. 1978. Life in high salt and soluted concentrations: halophilic bacteria. In D.J. Kushner(ed), *Microbial life in extreme environments*. Academic press, London, England. pp. 317-368.
- Kuo, L.Y., Hwang, G.Y., Lai, Y.J., Yang, S.L. and Lin, L.L. 2003. Overexpression, purification, and characterization of the recombinant leucine aminopeptidase II of *Bacillus stearothermophilus*. *Cur. Microbiol.* 47: 40-45.
- Labbe, J.P. Rebegrotte and Turpin. M. 1974. Demonstrating extracellular leucine Aminopeptidase (EC 3.4.1.1) of *Aspergillus oryzae* (IP 410): leucine aminopeptidase 2 fraction. *C.R. Acad. Sci. (Paris)* 278D: 2699.
- Laemmli, U.K. 1970. Cleavage of structural proteins during the assembly of the head

- of bacteriophage T4. *Nature(London)* 227: 680-685.
- Lalasis, G. 1978. Four new methods of debittering protein hydrolysates and a fraction of hydrolysates with high content of essential amino acids *Ann. Nutr. Aliment.* 32(2): 709-723.
- Lee, G.D., Chun, S.S. Kho, Y.H. and Chun, H.K. 1998. Purification and properties of extracellular leucine aminopeptidase from the *Bacillus* sp. N2. *J. Appl. Microbiol.* 84: 561-566.
- Leeuwenhoek, A.V. 1978. Purification and some properties of two extracellular proteolytic enzymes produced by *Vibrio* SA1. 44 (2): 157-169.
- Lemieux, L. and Simard, R.E., 1991. Bitter flavour in dairy products I. A review of the factors likely to influence its development in cheese manufacture. *Lait.* 71: 599-636.
- Liao, C.H. and McCallus, D.E. 1997. Biochemical and genetic characterization of an extracellular protease from *Pseudomonas fluorescens* CY091. *Appl. Environ. Microbiol.* 64: 914-921.
- Lin, L.L., Hsu W.H. and Wu, C.P. 2004. A thermostable leucine aminopeptidase from *Bacillus kaustophilis* CCRC 11223. *Extremophiles.* 8: 79-87.
- Liptasiri, S. 1975. Studies on some properties of certain bacteria isolated from Thai fish sauce. M.S. Thesis in Microbiology. Kasetsart University.
- Longo, M.A. Novella, I.S., Garcia, L.A. and Diaz, M. 1992. Diffusion of proteases in calcium alginate beads. *Enzyme Microb. Technol.* 14(7): 586-90.
- Lowrie, R.J. and Lawrence, R.C. 1972. Cheddar cheese flavour. IV. A new hypothesis to account for the bitterness. *New Zealand J. Dairy. Sci. and Tech.* 75: 1-53.
- Lowry O.H., Rosebrough, N.J., Farr, A.L. and Randall, R.J. 1951. Protein measurement with the Folin phenol reagent. *J. Biol. Chem.* 193: 265-275.
- Lu, A.Y.H., Junk, K.W. and Coon, M.J. 1969. Resolution of the cytochrome P-450 containing W-Hydroxylation system of liver microsomes into three components. *J. Biol. Chem.* 244: 3714-3721.
- Macedo, A.C., Tavares, T.G. and Malcata F.X. 2003. Purification and characterization

- of intracellular aminopeptidase from a wild strain of *Lactobacillus plantarum* isolated from traditional Serra da Estrela cheese. *Enz. and Microb. Tech.* 32: 41-48.
- Madsen, J. S. and Qvit, K.B. 1997. Hydrolysis of Milk protein by *Bacillus licheniformis* protease specific for acidic amino acid residues. *J. Food Sci.* 62(3): 579-582.
- Mahmood, A.U., Greenman, J. and Scrag, A.H. 2000. Effects of macromolecular growth substrates on extracellular protease by *Bacillus* species in continuous culture. *Microbios.* 103(405): 85-96.
- Manachini, P. and Fortina, M. and Parini, C. 1988. Thermostable alkaline protease produced by *Bacillus thermorubber* a new species of *Bacillus*. *Appl. Microbiol. Biotechnol.* 28: 409-413.
- Manachini, P. and Fortina, M.G. 1998. Production in sea-water of thermostable alkaline protease by a halotolerant strains of *Bacillus licheniformis*. *Biotechnol. Lett.* 20 (6): 565-568.
- Massucco, A.E., Mazza, L.A. and Balatti, A.P. 1980. Production on alkalined protease by *Bacillus subtilis* 3411. *Rev. Microbiol.* 12(2): 52-58.
- Matoba, T., Hayashi, R. and Hata, T. 1970. Isolation of bitter peptides in tryptic hydrolyzates of casein and their chemical structures. *Agric. Biol.Chem.* 34: 1235-1243.
- Matsushita, I. and Ozaki, S. 1993. Bitter peptides from beer yeast extracts. *Pept. Chem.* 31: 165-168.
- Maugeri, T.L., Gugliandolo, C. 2002. Three novel halotolerant and thermophilic *Geobacillus* strains from shallow marine vents. *Syst. Appl. Microbiol.* 25(3): 450-455.
- Mayer, J., Lupas, A., Kellerman, J., Eckerskorn, C., Baumeister, W. and Peters, J. 1996. A hyperthermostable protease of the subtilisin family bound to the surface of the layer of the archeon *Staphylothermus marinus*. *Curr. Biol.* 6: 739-749.
- McMullan, G., Christia, J.M., Rahman, T.J., Banat, I.M., Ternan, N.G. and Marchant, R. 2004. Habitat , applications and genomics of the aerobic, thermophilic

- genus *Geobacillus*. *Biochem. Soc. Trans.* 32(2): 214-217.
- Merkel, J.R., Lee, C.C. and Freund, T.S. 1981. A dimeric, extracellular, heatstable aminopeptidase produced by a marine *Pseudomonad*. *Biochim. Biophys. Acta* 661: 32-38.
- Minagawa, E., Kaminogawa, S. and Matsuzawa, H. 1988. Isolation and characterization of a thermostable aminopeptidase (Aminopeptidase T) from *Thermus aquaticus* YT-1, an extremely thermophilic bacterium. *Agric. Biol. Chem.* 52(7): 1755-1763.
- Minamimura, N. Matsumura, Y. and Yamamoto, T. 1972. Bitter peptides in the casein digests with bacterial proteinase: II Bitter peptide consisting of tryptophan and leucine. *J. Biochem. (Tokyo)*. 72: 841-848.
- Moriguchi, M. Sakai, K. Tateyama, R. Furuta, Y. and Wakayama, M. 1994. Isolation and characterization of salt tolerant glutaminase from marine *Micrococcus luteus* k-3. *J. Ferment. Bioeng.* 77(6): 621-625.
- Morikawa, M., Izawa, Y., Rashid, N., Toshihiro, H. and Imanaka, T. 1994. Purification and Characterization of thermostable thiol from a newly isolated hyperthermophilic *Pyrococcus* sp. *Appl. and Environ. Microb.* 65: 4559-4566.
- Morosova, I.P. Chestukhina, G.G. Bormatova, M.E., Golobov, M., Ivanova, N.M., Lysogorskaia, E.N., Filippova, I. Khodova, O.M., Timokhina, E.A. and Stepanov, V.M. 1993. Isolation and characteristics of *Bacillus megaterium* metalloproteinase *Biokhim.* 58(6): 869-907.
- Myrin, P.A. and Hofsten, B.V. 1974. Purification and metal ion activation of an aminopeptidase (aminopeptidase II) from *Bacillus stearothermophilus*. *Biochim. Biophys. Acta.* 350: 13-25.
- Nakadai, T., Nasuno and S. Iguchi, N. 1973. Purification and properties of leucine aminopeptidase I from *Aspergillus oryzae*. *Agric. Biol.* 37: 757-765.
- Ney, K.H., 1979. bitterness of peptides: amino acid composition and chain length. In: Bondreau J.C. (Ed), *Food taste chemistry*. Washinton (DC): American Chemical Society, pp. 149.

- Nigam, J.N., Pillai, K.R. and Baruah, J.N. 1981. Effect of carbon and nitrogen sources on neutral protease production by *Pseudomonas aeruginosa*. *Folia Microbiol.* 26(5): 358-363.
- Nishiwaki, T. 2002. Debittering of enzymatic Hydrolysates using and aminopeptidase from the edible Basidiomycetes *Grifola frondosa*. 93(1): 60-63.
- Oh, Y.S., Shin, I.L., Tzeng, Y.M. and Wang, S.L. 2000. Protease produced by *Pseudomonas aeruginosa* K-187 and its application in the deproteinization of shrimp and crab shell wastes. *Enz. and Microb. Tech.* 27: 3-10.
- Okada, Y., Nagase, H. and Harris, E.D. 1986. A metallo proteinase from human rheumatoid synovial fibroblasts that digests connective tissue matrix components. *J. Biol. Chem.* 261: 14245-14255.
- Olson, J.C. and Ohman, D.E. 1992. Efficient production and processing of elastase and LasA by *Pseudomonas aeruginosa* require zinc and calcium ions. *J. Bacteriol.* 174: 4140-4147.
- Panikov, N.S., Popova, N.A., Dorofeev, A.G., Nikolaev I.A., Verkhovtseva, N.V. 2003. Thermophilic bacterium *Geobacillus uralicus* growth function of temperature and pH: a synthetic chemostat model-based kinetic analysis. *Mikrobiologiya* 72(3): 320-327.
- Pearl, L.H. 1987. The catalytic mechanism of aspartic proteinases. *FEBS Lett.* 214: 8-12.
- Popova, N.A., Nikolaev, I.A., Turova, T.P. Lysenko, A.M. Osipov, O., Verkhovtseva N.V. and Panikov, N.S. 2002. *Geobacillus uralicus*, a new species of thermophilic bacteria. *Mikrobiologiya*. 71(3): 391-398.
- Pornsettakul, W. 1991. Isolation and optimization of growth condition of halophilic organisms for fermented food industry. M.S. Thesis in Microbiology. Kasetsart University.
- Porro, C.S., Martin, S. Mellado, E. and Ventosa, A. 2003. Diversity of moderately halophilic bacteria producing extracellular hydrolytic enzymes. *J. Appl. Microbiol.* 94: 295.

- Porro, C.S., Mellado, E., Bertoldo, C., Antranikian, G., Ventosa, A. 2003. Screening and characterization of the protease CP1 produced by the moderately halophilic bacterium *Pseudoalteromonas* sp. strain CP76. *Extremophiles*. 7(3): 221-228.
- Qua, D.V., Simidu, U. and Taga, N. 1981. Purification and some properties of halophilic protease produced by a moderately halophilic marine *Pseudomonas* sp. 1981. 27(5): 505-510.
- Rahman, R., C., Ampon, K., Basri, M., Yunus, W. and Salleh, A. 1994. Purification and characterization of a heat stable protease from *Bacillus stearothermophilus* F1. *Appl. Microbiol. Biotechnol.* 40: 822-827.
- Rahman, T.J., Marchant, R., Banat, I.M. 2004. Distribution and molecular investigation of highly thermophilic bacteria associated with cool soil environments. *Biochem. Soc. Trans.* 32(2): 209-213.
- Raksakulthai, R. and Haard, N.F. 2003. Exopeptidases and their application to reduce bitterness in food: a review. *Crit. Rev. Food Sci Nutr.* 43(4): 401-445.
- Rao, M.B., Tanksale, A.M., Ghatge, M.S. and Deshpande, V.V. 1998. Molecular and Biotechnological Aspects of Microbiol proteases. *Microbiol and Mol. Biol. Rev.* 62(3): 597-635.
- Ratnayake, S., Selvarkumar, P. and Hayashi, K. 2003. A putative proline iminopeptidase of *Thermotoga maritima* is a leucine aminopeptidase with lysine-p-nitroanilide hydrolyzing activity. *Enzyme Microb. Technol.* 32: 414-421.
- Razak, C., Samad, M., Basri, M., Yunus, W., Ampon, K. and Salleh, A. 1993. Thermostable extracellular protease by *B. stearothermophilus*. *World J. Microbiol. Biotechnol.* 10: 260-263.
- Razak, C., Rahman, R., Salleh, A., Yunus, W., Ampon, K. and Basri, M. 1995. Production of a thermostable protease from a new high pH isolate of *Bacillus stearothermophilus*. *J. Biosci.* 6: 94-100.
- Razak, C., Tang, S., Basri, M. and Salleh, A. 1997. Preliminary study on the production of extracellular protease from a newly isolated *Bacillus* sp. (No.1) and the physical factors affecting its production. *Pertanika. J. Sci. Technol.* 5: 169-177.

- Rebeca., B.D., Vera, M.T.P. and Castaneda, M.D. 1991. Production of fish protein hydrolysates with bacterial protease; yield and nutrition value. *J. Food. Sci.* 56(2): 309-314.
- Ross, L. and Bhatnagar, D. 1989. Enzymatic phosphorylation of soybean proteins. *J. Agric. Food Chem.* 37(4): 841-844.
- Roy, G.M. 1990. The application and future implications of bitterness reduction and inhibition in food products. 29(2): 59-71.
- Saha, B.C. and Hayashi, K. 2001. Debittering of protein hydrolyzates: Research review paper. *Biotech. Adv.*19(5): 355-370.
- Salleh, A.B., Basri, M. and Razak, C. 1977. The effect of temperature on the protease from *Bacillus stearothermophilus* strain F1. *Mal. J. Biol. Chem. Mol. Biol.* 2: 37-41.
- Santinanalerts, P. 1979. Roles of microorganisms in the fermentation of Nam-pla in Thailand : Relationship of bacteria isolated from different geographical localities in Thailand. M.S. Thesis. Mahidol Univeristy. 110 p.
- Scopes, R.K. 1982. Protein purification: principles and practice. Springer-Verlag. New York. 502 p.
- Sexton, M.M., Jones, A.L., Chaowagul, W. And Woods, D.E. 1994. Purification and characterization of a protease from *Pseudomonas pseudomallei*. *Can. J. Microbiol.* 40: 903-910.
- Sharma, A., Rao, C.L.S.N., Ball, B.K. and Hasija, S.K. 1996. Characteristics of extracellular protease produced by *Bacillus laterosporus* and *Flavobacterium* sp. isolated from gelatin factory effluents. *World J. Microbiol. and Biotechnol.* 12: 615-617.
- Singh, J. Vohra, R.M. and Sahoo, D.K. 1999. Alkaline protease from a new obligate alkalophilic isolate of *Bacillus sphaericus*. *Biotechnol. Lett.* 21: 921-924.
- Sookkheo, B. Sinchaikul, S., Phutrakul, S. and Chen, S.T. 2000. Purification and characterization of the highly thermostable proteases from *Bacillus stearothermophilus* TLS33. *Prot. Express and Purification.* 20: 142-151.

- Spungin, A. and Blumberg, S. 1989. *Streptomyces griseus* aminopeptidase is a calcium activated zinc metalloprotein. Purification and properties of the enzyme, Eur. J. Biol. Chem. 183 : 471-477.
- Stadhouders, J. and Hup, G. 1975. Factors affecting bitter flavours in Gouda cheese. Netherlands Milk and Dairy J. 29: 335-353.
- Stepaniak, L., Fox, P.F. and Daly, C. 1982. Isolation and general characterization of a heat-stable proteinase from *Pseudomonas fluorescens* AFT36. Biochem. Biophys. Act. 717: 376-383.
- Stevenson, D.E., Ofman, D.J., Morgan, K.R. and Stanley, R.A. 1998. Protease catalyzed condensation of peptides as a potential means to reduce the bitter taste of hydrophobic peptides found in protein hydrolysates. Enz. and Microb. Tech. 22(2): 100-110.
- Stoknes, I. and Rustad, T. 1995. Proteolytic activity in muscle from Atlantic salmon (*Salmo salar*) J. Food Sci. 60 (4): 711-714.
- Stoll, E., Weder, H.G. and Zuber, H. 1976. Aminopeptidase II from *Bacillus stearothermophilus*. Biochem. Biophys. Acta 438: 212-220.
- Stoscheck, C.M. 1990. Quantitation of protein, In: Guide to protein purification, Deutscher, M.P. eds. Academic Press Inc., California. pp.50-63.
- Sung, M.H., Kim, H., Bae, J.W., Rhee, S.K., Jeon, C.D., Kim, K., Kim, J, Hong, S.P., Lee, S.G., Yoon, J.H., Park, Y.H. and Baek, D.H. 2002. *Geobacillus toebii* sp. nov., a novel thermophilic bacterium isolated from hay compost. Inter. J. Syst. and Evol. Microbiol. 52: 2251-2255.
- Tai, S.K., Lin, H.P., Kuo, J., Liu, J.K. 2004. Isolation and characterization of a cellulolytic *Geobacillus thermoleovorans* T4 strain from sugar refinery waste. Extremophile. 8(5): 345-349.
- Takahashi, M. Nakata, T. Nakatani, M. Kataoka, S. Nakamura, K. and Okai, H. 1995. Conversion of bitterness of C-terminal octapeptide of bovine β -casein (Arg-Gly-Pro-Phe-Pro-Val) into sweetness. Pept. Chem. 32: 281-284.
- Takami, H., Akaba, T. and Horikoshi, K. 1990. Characterization of an alkaline protease

- from *Bacillus* sp. no. AH-101. Appl. Microbiol. Biotechnol. 33(5): 519-523.
- Takami, H. Nishi, S., Lu, J., Shimamura, S, Takaki, Y. 2004. Genomics characterization of thermophilic *Geobacillus* species isolated from the deepest sea mud of the Trench. 8(5): 351-356.
- Tanasupawat, S. and Komagata, K. 1995. Lactic acid bacteria in fermented foods in Thailand. World J. Microbiol and Biotechnol. 11 : 253-256.
- Tanskul, S. and Trirattananukul, W. 1998. Moderately halophilic and thermophilic bacteria producing neutral protease isolate from hot spring in southern Thailand. Songklanakarin J. Sci. Technol. 20(4): 437-444.
- Thongthai, C. and Siriwongpairat, M. 1978. Quality of microorganisms in fermenting Nam-pla. Symposium on Science and Technology for the Development of Northern Thailand. Chiang Mai. Abstract. 26: 86.
- Thongthai, C., Panbangred, W., Khoprasert, C. and Dhaveetianond, S. 1989. Protease Activities in the traditional process of fish sauce fermentation. In Postharvest Technology, Preservation and quality of fish in south Asia. Edited by Reilly PJA, Parry R.W.H., Barile, L.E. Manila: Echanis Press, 61-65.
- Tomita, K., Ikeda, N. and Ueno, A. 2003. Isolation and characterization of thermophilic bacterium *Geobacillus thermocatenulatus*, degrading nylon 12 nylon 66. Biotechnol. Lett. 25(20): 1743-1746.
- Uwajima, T. Yoshikawa, N. and Terada, O. 1973. A crystalline aminopeptidase from *Streptomyces peptidofaciens*: physicochemical properties and characteristics as a Cd-metalloprotease. Agric. Biol. Chem. 37: 2727-2733.
- Ventosa, A. and Nieto, J.J. 1995. Biotechnological applications and potentialities of halophilic microorganisms. World J. Microbiol and Biotechnol. 11: 85-94.
- Vitale, L., Renko, M., Lenaric, B., Turk, V. and Pokorny, M. 1986. *Streptomyces Rimosus* extracellular proteases: Isolation and characterization of leucine aminopeptidase. Appl. Microbiol. Biotechnol. 23: 449-455.
- Watanabe, Y. and Takakuwa, M. 1987. Change of lipase composition of *Zygosaccharo-*

- myces rouxii* after transfer to high sodium chloride culture medium. J. Ferment. Technol. 65(4): 365-369.
- Were, L., Hettiarachchy, N.S. and Kalpathy, U. 1997. Modified soy proteins with improved foaming and water hydration properties. J. Food Sci. 62(4): 821-824.
- Wieser, H. and Belitz, H.D. 1975. Bitter peptides isolated from corn protein zein by hydrolysis with pepsin. Lebensm-Unters Forsch 159: 329-336.
- Yang, J, K., Shin, I.L. Tzeng, Y.M. and Wang, S.L. 2000. Production and purification of protease from *Bacillus subtilis* that can deproteinize crustacean wastes. Enz. and Microbial. Technol. 26: 406-413.
- Yasuda, M. and Aoyama, M. 2000. Characterization and application of soybean milk coagulating enzyme from *Bacillus pumilus*. Abstract: Development of thermotolerant microbial resources and their applications, Japan: 84.
- Zhang, Y., Muramoto, K. and Yamauchi, F. 1996. Hydrolysis of soybean proteins by a vortex flow filtration membrane reactor with *Aspergillus oryzae* protease. J. Food Sci. 61(5): 928-931.
- Zillag, W., Holz, I., Janekonic, D., Schafer, W. and Reiter, W.D. 1983. The archaeobacterium *Thermococcus celer* represents, novel genus within the thermophilic branch of the archabacteria. Syst. Appl. Microbiol. 4: 88-94.
- WWW.indstate.edu/mwking/enzyme-kinetics.html.