

Research Areas

- The purification, isolation and characterization of carbohydrate enzymes
- Mechanism of action of amylases, maltogenic amylases, and cyclodextrin-hydrolyzing enzymes
- Structure-function and mechanism of maltogenic amylase and cyclodextrin-hydrolyzing enzymes
- Enzymatic synthesis of new carbohydrates such as branched oligosaccharides
- Enzyme engineering for enhanced enzyme specific activity
- Transglycosylation of bioactive natural compounds using maltogenic amylase
- Effect of oligomeric state of the maltogenic amylase on enzyme activity
- Developments and application of antistaling enzyme using carbohydrate enzymes
- Enzymatic synthesis and modification of carbohydrate natural products to give new inhibitors and pharmaceutical agents
- Maltose enzyme system for glycogen synthesis in *Escherichia coli*

Books and Chapters

1. Park, K.H., Roybt, J.F., and Choi, Y.D. 1996. "Enzymes for carbohydrate engineering " In: Progress in Biotechnology 12, Elsevier, Amsterdam, N.Y. (Book)
2. Park, K.H., 2008. "Carbohydrate – active enzymes: structure, function and applications", Woodhead Publishing Limited, Cambridge. (Book)
3. Cheong, T.K., Kim, T.J., Kim, M.J., Choi, Y.D., Kim, I.C., Kim, J.W., and Park, K.H. 1996. "Modulation of *Bacillus* amylolytic enzymes and production of branched oligosaccharides" In: Progress in Biotechnology 12, 43-60, Elsevier, Amsterdam, .Y. (Chapter)
4. Park, K.H., Kim, J.W., and Kim, M.J. "Application of enzymatic reactions for evaluation of quality changes in frozen vegetables" In: Chemical markers for processed and stored foods. ACS symposium Series 631. (Chapter)

5. Robyt, J.F., Park, K.H., Lee, S.B., and Yoon, S.H. 2003. "Enzymatic synthesis of acarbose oligosaccharide analogues as new enzyme inhibitors" In: Oligosaccharides in food and agriculture, G. Eggleston and G.L. Cote ed., pp 168-181, ACS Symposium series 849; American Chemical Society, Washington, DC. (Chapter)

Principal Publications (Published over 270 Scientific Papers)

1. **Park, K.H.**, and Lund, D.B. 1983. Calorimetric study of thermal denaturation of β -lactoglobulin. *J. Dairy Sci.* 67: 1699-1706.
2. **Park, K.H.**, Kim, Y.M. and Lee, C.W. 1988. Thermal inactivation kinetics of Potato Tuber lipoxygenase. *J. Agr. Food Chem.* 36: 1012-1015.
3. Kim, I.C., Cha, J.H., Kim, J.R., Jang, S.Y., Seo, B.C., Cheong, T.G., Lee, D.S., Choi, Y.D., and **Park, K.H.** 1992. Catalytic properties of the cloned amylase from *Bacillus licheniformis*. *J. Biol. Chem.* 267(31): 22108-22114.
4. Cha, H.J., Yoon, H.G., Kim, Y.W., Lee, H.S., Kim, J.W., Kwon, K., Cha, S.S., Cho, M.J., Oh, B.H., and **Park, K.H.** 1998. Molecular and enzymatic characterization of a maltogenic amylase that hydrolyzes and transglycosylates acarbose, *Eur. J. Biochem.* 253(1): 251-262.
5. **Park, K.H.**, Kim, M.J., Lee, H.S., Han, N.S., Kim, D., and Robyt, J.F. 1998. Transglycosylation reactions of *Bacillus stearothermophilus* maltogenic amylase with acarbose and various acceptors. *Carbohydr. Res.* 313: 235-246
6. Kim, T.J. Kim, M.J., Kim, B.C., Kim, J.C., Cheong, T.K. Kim, J.W., and **Park, K.H.** 1999. Modes of action of acarbose hydrolysis and transglycosylation catalyzed by a thermostable maltogenic amylase, the gene for which was cloned from a *Thermus* strain. *Appl. Environ. Microbiol.* 65(4): 1644-1651.
7. Kim, J.S., Cha, S.S., Kim, H.J., Kim, T.J., Ha, N.C., Oh, S.T., Cho, H.S., Kim, M.J. Lee, H.S., Kim, J.W., Choi, K.Y., **Park, K.H.**, and Oh, B.H. 1999. Crystal structure of a maltogenic amylase: provides insights into a catalytic versatility. *J. Biol. Chem.* 274(37):

8. Kim, T.J., Nguyen, V.D., Lee, H.S., Kim, M.J., Cho, H.Y., Kim, Y.W., Moon, T.W., Park, C.S., Kim, J.W., Oh, B.H., Lee, S.B., Svensson, B., and **Park, K.H.** 2001. Modulation of the multisubstrate specificity of *Thermus* maltogenic amylase by truncation of the N-terminal domain and by a salt-induced shift of the monomer/dimer equilibrium. *Biochemistry* 40(47): 14182-14190.
9. Lee, H.S., Kim, M.S., Cho, H.S., Kim, J.I., Kim, T.J., Choi, J.H., Park, C., Lee, H.S., Oh, B.H., and **Park, K.H.** 2002. Cyclomaltodextrinase, neopullulanase, and maltogenic amylase are nearly indistinguishable from each other. *J. Biol. Chem.* 277(24): 21891-21897.
10. Kim, Y.W., Choi, J.H., Kim, J.W., Park, C., Kim, J.W., Cha, H.J., Oh, B.H. Moon, T.W. and **Park, K.H.** 2003. Directed evolution of *Thermus* maltogenic amylase toward enhanced thermal resistance. *Appl. Environ. Microbiol.* 69(8): 4866-4874.
11. Kimura, A., Lee, J.H., Lee, I.S., Lee, H.S., **Park, K.H.**, Chiba, S., Kim, D. 2004. Two potent competitive inhibitors discriminating α -glucosidase family I and family II. *Carbohydr. Res.* 339: 1035-1040
12. Yang, S.J., Lee, H.S., Kim, J.W., Lee, M.H., Auh, J.H., Lee, B.H., **Park, K.H.** 2006. Enzymatic preparation of maltohexaose, maltoheptaose, and maltooctaose by the preferential cyclomaltooligosaccharide (cyclodextrin) ring-opening reaction of *Pyrococcus furiosus* thermostable amylase. *Carbohydr Res.* 2006 341(3):420-424
13. Auh, J.H., Chae, H.Y., Kim, Y.R., Shim, K.H., Yoo, S.H. and **Park, K.H.** 2006. Modification of rice starch by selective degradation of amylose using alkalophilic *Bacillus* cyclomaltodextrinase. *J. Agr. Food Chem.* 54(6): 2314-2319
14. Shuang-Yan Tang, Quang-Tri Le, Shim J.H, Yang S.J., Auh J.H., Park C.S., and **Park K.H.** 2006. Enhancing thermostability of maltogenic amylase from *Bacillus thermoalkalophilus* ET2 by DNA shuffling. *the FEBS Journal.* 273: 3335-3345
15. Kim J.W. Kim Y.H. Lee H.S., Yang S.J., Kim Y.W., Lee M.H., Kim J.W., Seo, N.S., Park C.S., **Park, K.H.** 2007. Molecular cloning and biochemical characterization of the first

archaeal maltogenic amylase from the hyperthermophilic archaeon *Thermoplasma volcanium* GSS1. *BBA - Proteins and Proteomics* 1774(5):661-669

16. Shim J.H., Seo N.S., Roh S.A., Kim J.W., Cha H., **Park K.H.** 2007. An improved bread-baking process using *Saccharomyces cerevisiae* displayed with engineered cyclodextrin glucanotransferase. *J. Agr. Food Chem.* 55(12):4735-4740
17. Park S.H., Kang H.K., Shim J.H., Woo E.J., Hong J.S., Kim J.W., Oh, B.H., Lee B.H., Cha, H., **Park K.H.** 2007. Modulation of substrate preference of *Thermus* maltogenic amylase by mutation of the residues at the interface of a dimer. *Biosci. Biotechnol. Biochem.* 71(6):1564-1567
18. Lee C. K., Le Q.T., Kim Y.H., Shim J.H., Lee S.J., Park J.H., Lee K.P., Song S.H., Auh J.H., Lee S.J., and **Park K.H.** 2008. Enzymatic synthesis and properties of highly branched rice starch amylose and amylopectin cluster. *J. Agric. Food Chem.* 56(1):126-131
19. Kang H.K., Cha H, Yang T.J., Park J.T., Lee S.J., Kim Y.W., Auh J.H., Okada Y., Kim J.W., Cha J., Kim C.H., and **Kwan-Hwa Park.** 2008. Enzymatic synthesis of dimaltosyl- β -cyclodextrin via a transglycosylation reaction using TreX, a *Sulfolobus solfataricus* P2 debranching enzyme. *Biochem. Bioph. Res. Co.* 366(1):98-103
20. Woo, E.J., Lee, S., Cha, H., Park, J.T., Yoon, S.M., Song, H.N., and **Park, K.H.** 2008. Structural Insight into the Bifunctional Mechanism of the Glycogen Debranching Enzyme TreX from the Archaeon *Sulfolobus solfataricus*. *J. Biol. Chem.* 283(42):28641-28648.
21. Choi, J.H., Lee, H., Kim, Y.W., Park, J.T., Woo, E.J., Kim, M.J., Lee, B.H., and Park, K.H. 2009. Characterization of a Novel Debranching Enzyme from *Nostoc punctiforme* Possessing a High Specificity for Long Branched Chains. *Biochem. Biophys. Res. Comm.* 378(2):224-229.
22. Shim, J.H., Park, J.T., Hong J.S., Kim, K.W., Kim, M.J., Auh, J.H., Kim, Y.W., Park, C.S., Boos, W., Kim, J.W., and **Park, K.H.** 2009. Role of maltogenic amylase and pullulanase in maltodextrin and glycogen metabolism of *Bacillus subtilis* 168. *J. Bacteriol.* 191(15):4835-4844

- 23 Choi, C.H., Kyung, M.O., Park, J.T., Lee, C.K., Kim, Y.W., Lee, J.H., Park, S.H., Shim, J.H., Li, X., Kim, J.W., Park, C.S., and **Park, K.H.** 2010. Enzymatic biosynthesis of a puerarin–cycloamylose inclusion complex by 4- α -glucanotransferase and maltogenic amylase. *Biocat. Biotransfor.* 28:209-214.
24. Song, H.N., Jung, T.Y., Park, J.T., Park, B.C., Myung, P.K., Boos, W., Woo, E.J., and **Park, K.H.** 2010. Structural rationale for the short branched substrate specificity of the glycogen Debranching enzyme GlgX. *Proteins*, 78:1847-1855
25. Park, J.T., Shim, J.H., Tran, P.L., Hong, I.H., Yong, H.W., Oktavina, E.F., Nguyen, H.D., Kim, J.W., Lee, T.S., Park, S.H., W, Boos and **Park, K.H.** 2011. Role of maltose enzymes in glycogen synthesis by *Escherichia coli*. *J. Bacteriol.*, 193(10) : 2517-2526
26. Jung, T.Y., Li, D., Park, J.T., Tran, P.L., Oh, B.H., Janeček, S., Park, S.G., Woo, E.J. and **Park, K.H.** 2012. Association of novel Domain in active site of archaic hyperthermophilic maltogenic amylase from *Staphylothermus marinus*. *J. Biol. Chem.* 287(11): 7979-7989.
27. Li, D., Li, X., Dang, W., Tran, P.L., Park, S.H., Oh, B.C., Hong, W.S., Lee J.S., **Park, K.H.** 2013. Characterization and application of an acidophilic and thermostable β -glucosidase from *Thermofilum pendens*. *J. Biosci. Bioeng.* 115 (5): 490-496.
28. Tran, P.L., Lee, J.S., **Park, K.H.** 2014. Experimental evidence for a 9-binding subsite of *Bacillus licheniformis* thermostable α -amylase. *FEBS Lett.* 588: 620-624.
29. Nguyen, D.H.D, Tran, P.L., Li, D., Han, J.A., Hwang, J.Y., Hong, W.S., Lee, J.S., Kim, Y.R., Yoo, S.H., Park, J.T., Choi, Y.J., Lee, S.Y., **Park, K.H.** 2014. Modification of rice grain starch for lump-free cooked rice using thermostable disproportionating enzymes. *Food Res. Int.* DOI: 10.1016/j.foodres.2014.04.007
30. Nguyen, D.H.D, Park, J.T., Shim, J.H., Tran, P.L., Oktavina, E.F., Nguyen, T.L.H., Lee, S.J., Park, C.S., Li, D., Park, S.H., Stapleton, D., Lee, J.S., **Park, K.H.** 2014. Reaction kinetics of substrate transglycosylation catalyzed by Trex of *Sulfolobus solfataricus* and effects on glycogen breakdown. *J. Bacteriol.*, 196 (11): 1941-1949.
31. Viet, H.D., Phoung L.T., Li N., **Park, K.H.** 2015. A continuous coupled

- spectrophotometric assay for debranching enzyme activity using reducing end-specific alpha-glucosidase. *Anal. Biochem.*, 492: 21-26.
32. Kwak, J.Y., Kim, M.G., Kim, Y.W., Ban, H.S., Won, M.S., Park, J.T., **Park, K.H.** 2016 Properties of a glycogen like polysaccharide produced by a mutant of *Escherichia coli* lacking glycogen synthase and maltodextrin phosphorylase. *Carbohydr. Polym.* Doi:10.1016/j.carbpol.2015.09.091.

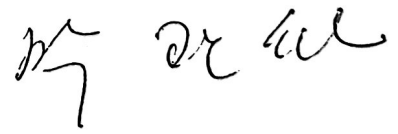
Patents (selected from 41 patents)

1. **Park, K.H.**, Kim, I.C., Jang, S.Y., Kim, J.R., Cha, J.H., Seo, B.C. and Choi, Y.D. Molecular Cloning of *Bacillus licheniformis* amylase ; Korea Patent, #104913 (1992. 2. 18)
2. **Park, K.H.**, Seo, B.C., Yoon, S.H., Lee, C.H., Kim, D.Y., and Kim, S.H. : Development of a Time-Temperature-Indicator using phospholipase ; Korea Patent, #071469 (1994. 3. 4)
3. **Park, K.H.**, Kim, I.C., Jang, S.Y., Kim, J.R., Cha, J.H., Seo, B.C. and Choi, Y.D. : *Escherichia coli* containing a gene encoding a maltogenic amylase BLMA of *Bacillus licheniformis* and gene product produced by same organism ; U.S. Patent 5583039-A 1 (1996. 12. 10)
4. **Park, K.H.**, Kim, T.J., Lee, H.S., Cha, H., Yoon, H.G., Kim, Y.W., Lee, S.B., Kim, D.M., Oh, B.H., and Kim J.W. : Carbohydrate hydrolases inhibitor and its preparation method ; Korea Patent, #0291597 (2001. 3. 14)
5. **Park, K.H.**, Kim, Y.B. : Method for preparing dough and baked products ; US Patent 09/238, 337 (1999.1.17)
6. Baek, J.S., Yoo, S.S., Jeong, T.G., Lee, S.B., Kim, H.Y., Kim, M.J., Pee, A.T., and **Park, K.H.** : Anti-Obese compound with hypoglycemic activity and preparation method thereof ; Korea Patent, #10-0349334-0000 (2002. 08. 07)
7. **Park, K.H.**, Bae, H.K., Lee, S.B., Shim, J.H., Kim, M.J., and Moon, T.H. : Ascorbic acid derivatives with antioxidant activity and high stability and preparation method for the same ; Korea Patent, #0440191, (2004.07.02)

8. **Park, K.H.**, Chung, S.L., Kim, S.Y., Lee, H.S., Kim, Y.W., Park, J.T., Kim, M.S., Lee, M.H., and Kim, M.J. Heat-resistant *Sulfolobus solfataricus* glucoamylase and preparation method of glucose with the same ; Korea Patent, #0478218 (2005. 3. 11)
9. Li,D., Park,J.H., Park,J.T., Park,C.S., and **Park,K.H.** : Isoflavone derivatives with high solubility and stability and preparation method for the same ; Korea Patent, #0554004 (2006. 2. 14)
10. **Park,K.H.**, Yang,S.J., Shim,J.H., Lee,H.S., Kim,J.W., Cho,G.S., Min,B.C., and Cheong,K.T. : Enzymatic preparation of maltodextrin syrup with high purity ; Korea Patent, #10-0735819 (2007. 6. 28)
11. **Park,K.H.**, Shim,J.H., Cha,H., and Noh,S.A. : Yeast expressing cyclodextrin glucanotransferase and method for using the same ; Korea Patent, #10-2007-0062353 (2007. 6. 25)
12. **Park,K.H.**, Park,J.T., Boos,W. : Enzymatic Synthesis of Cycloamylase ; Korea Patent (Pending) (2010. 8. 17)
13. **Park,K.H.**, Choi,C.H., Park,C.S., Lee,S.J., Kwon,D.G. : Method of preparing puerarin-cycloamylose inclusion complex ; Korea Patent, #10-1041984 (2001. 6. 9)

PKH
PARK KWAN HEWA

8. **Park, K.H.**, Chung, S.L., Kim, S.Y., Lee, H.S., Kim, Y.W., Park, J.T., Kim, M.S., Lee, M.H., and Kim, M.J. Heat-resistant *Sulfolobus solfataricus* glucoamylase and preparation method of glucose with the same ; Korea Patent, #0478218 (2005. 3. 11)
9. Li,D., Park,J.H., Park,J.T., Park,C.S., and **Park,K.H.** : Isoflavone derivatives with high solubility and stability and preparation method for the same ; Korea Patent, #0554004 (2006. 2. 14)
10. **Park,K.H.**, Yang,S.J., Shim,J.H., Lee,H.S., Kim,J.W., Cho,G.S., Min,B.C., and Cheong,K.T. : Enzymatic preparation of maltodextrin syrup with high purity ; Korea Patent, #10-0735819 (2007. 6. 28)
11. **Park,K.H.**, Shim,J.H., Cha,H., and Noh,S.A. : Yeast expressing cyclodextrin glucanotransferase and method for using the same ; Korea Patent, #10-2007-0062353 (2007. 6. 25)
12. **Park,K.H.**, Park,J.T., Boos,W. : Enzymatic Synthesis of Cycloamylase ; Korea Patent (Pending) (2010. 8. 17)
13. **Park,K.H.**, Choi,C.H., Park,C.S., Lee,S.J., Kwon,D,G. : Method of preparing puerarin-cycloamylose inclusion complex ; Korea Patent, #10-1041984 (2001. 6. 9)


PARK KWAN HEON