

Chapter 7

Depolymerization of polymers

Andersen, S. *et al.* (2020). An 1,4- α -glucosyltransferase defines a new maltodextrin catabolism scheme in *Lactobacillus acidophilus*. *Applied & Environmental Microbiology* **86**(15), e00661-20.

Bahun, M. *et al.* (2020). Insights into the maturation of pernisine, a subtilisin-like protease from the hyperthermophilic archaeon *Aeropyrum pernix*. *Applied & Environmental Microbiology* **86**(17), e00971-20. <https://aem.asm.org/content/aem/86/17/e00971-20.full.pdf>

Bugg, T. D. H. *et al.* (2020). Bacterial enzymes for lignin depolymerisation: new biocatalysts for generation of renewable chemicals from biomass. *Current Opinion in Chemical Biology* **55**, 26-33. <https://doi.org/10.1016/j.cbpa.2019.11.007>

Chaput, G. *et al.* (2020). Lignin induced iron reduction by novel sp., *Tolumonas lignolytic* BRL6-1. *PLOS ONE* **15**(9), e0233823. <https://doi.org/10.1371/journal.pone.0233823>

Chen, W. *et al.* (2020). Glycoside hydrolase family 18 chitinases: The known and the unknown. *Biotechnology Advances* **43**, 107553.

<https://doi.org/10.1016/j.biotechadv.2020.107553>

Chettri, D. *et al.* (2020). Innovations in CAZyme gene diversity and its modification for biorefinery applications. *Biotechnology Reports* **28**, e00525.

<https://doi.org/10.1016/j.btre.2020.e00525>

Coines, J. *et al.* (2019). Modeling catalytic reaction mechanisms in glycoside hydrolases. *Current Opinion in Chemical Biology* **53**, 183-191.

<https://doi.org/10.1016/j.cbpa.2019.09.007>

Garron, M.-L. & Henrissat, B. (2019). The continuing expansion of CAZymes and their families. *Current Opinion in Chemical Biology* **53**, 82-87.

<https://doi.org/10.1016/j.cbpa.2019.08.004>

Hamouda, H. I. *et al.* (2020). Exploration of two pectate lyases from *Caldicellulosiruptor bescii* reveals that the CBM66 module has a crucial role in pectic biomass degradation.

Applied & Environmental Microbiology **86**(16), e00787-20.

<https://aem.asm.org/content/aem/86/16/e00787-20.full.pdf>

Kahn, A. *et al.* (2020). Glycosylation of hyperthermostable designer cellulosome components yields enhanced stability and cellulose hydrolysis. *The FEBS Journal* **287**(20), 4370-4388. <https://febs.onlinelibrary.wiley.com/doi/abs/10.1111/febs.15251>

Klancher, C. A. *et al.* (2020). ChiS is a noncanonical DNA-binding hybrid sensor kinase that directly regulates the chitin utilization program in *Vibrio cholerae*. *Proceedings of the National Academy of Sciences of the USA* **117**(33), 20180-20189. <https://www.pnas.org/content/pnas/117/33/20180.full.pdf>

La Cono, V. *et al.* (2020). Symbiosis between nanohaloarchaeon and haloarchaeon is based on utilization of different polysaccharides. *Proceedings of the National Academy of Sciences of the USA* **117**(33), 20223-20234. <https://www.pnas.org/content/pnas/117/33/20223.full.pdf>

Lee, S. *et al.* (2020). Evolutionary analysis and protein family classification of chitin deacetylases in *Cryptococcus neoformans*. *Journal of Microbiology* **58**(9), 805-811. <https://doi.org/10.1007/s12275-020-0288-9>

Narváez-Barragán, D. A. *et al.* (2020). Expansin-related proteins: biology, microbe–plant interactions and associated plant-defense responses. *Microbiology* **166**(11), 1007-1018.

<https://doi.org/10.1099/mic.0.000984>

Nemmaru, B. *et al.* (in press). Reduced type-A carbohydrate-binding module interactions to cellulose I leads to improved endocellulase activity. *Biotechnology & Bioengineering*.

<https://doi.org/10.1002/bit.27637>

Qiu, J. *et al.* (2020). Microbial enzymes catalyzing keratin degradation: Classification, structure, function. *Biotechnology Advances* **44**, 107607.

<https://doi.org/10.1016/j.biotechadv.2020.107607>

Rocha, J. *et al.* (2020). A horizontally acquired expansin gene increases virulence of the emerging plant pathogen *Erwinia tracheiphila*. *Scientific Reports* **10**, 21743.

<https://doi.org/10.1038/s41598-020-78157-w>

Sichert, A. *et al.* (2020). Verrucomicrobia use hundreds of enzymes to digest the algal polysaccharide fucoidan. *Nature Microbiology* **5**(8), 1026-1039.

<https://doi.org/10.1038/s41564-020-0720-2>

Suleiman, M. *et al.* (2020). Biomass-degrading glycoside hydrolases of archaeal origin.

Biotechnology for Biofuels **13**(1), 153. <https://doi.org/10.1186/s13068-020-01792-y>

Tarrah, A. *et al.* (2020). Complete genome sequence and carbohydrates-active enzymes

(CAZymes) analysis of *Lactobacillus paracasei* DTA72, a potential probiotic strain with strong capability to use inulin. *Current Microbiology* **77**(10), 2867-2875.

<https://doi.org/10.1007/s00284-020-02089-x>

Thapa, S. *et al.* (2020). Microbial cellulolytic enzymes: diversity and biotechnology with

reference to lignocellulosic biomass degradation. *Reviews in Environmental Science & Bio/Technology* **19**(3), 621-648. <https://doi.org/10.1007/s11157-020-09536-y>

Tomazetto, G. *et al.* (2020). Multi-omic directed discovery of cellulosomes, polysaccharide utilization loci, and lignocellulases from an enriched rumen anaerobic consortium.

Applied & Environmental Microbiology **86**(18), e00199-20.

<https://aem.asm.org/content/aem/86/18/e00199-20.full.pdf>

Tuveng, T. R. *et al.* (2020). A thermostable bacterial lytic polysaccharide monooxygenase

with high operational stability in a wide temperature range. *Biotechnology for Biofuels* **13**, 194. <https://doi.org/10.1186/s13068-020-01834-5>

Wu, L. *et al.* (2019). An overview of activity-based probes for glycosidases. *Current Opinion in Chemical Biology* **53**, 25-36. <https://doi.org/10.1016/j.cbpa.2019.05.030>

Wu, P. *et al.* (2020). Origins and features of pectate lyases and their applications in industry. *Applied Microbiology & Biotechnology* **104**(17), 7247-7260.
<https://doi.org/10.1007/s00253-020-10769-8>

Xu, T. *et al.* (2020). Chitin degradation potential and whole-genome sequence of *Streptomyces diastaticus* strain CS1801. *AMB Express* **10**(1), 29.
<https://doi.org/10.1186/s13568-020-0963-6>

Zhang, A. *et al.* (2020). Identification of chitinolytic enzymes in *Chitinolyticbacter meiyuanensis* and mechanism of efficiently hydrolyzing chitin to *N*-acetyl glucosamine. *Frontiers in Microbiology* **11**, 2600.
<https://www.frontiersin.org/article/10.3389/fmicb.2020.572053>

Zhang, Y.-Z. *et al.* (2020). Mechanisms for induction of microbial extracellular proteases in response to exterior proteins. *Applied & Environmental Microbiology* **86**(19), e01036-20. <https://aem.asm.org/content/aem/86/19/e01036-20.full.pdf>

Zhu, Y. *et al.* (2020). Effect of quorum sensing and quorum sensing inhibitors on the expression of serine protease gene in *Hafnia alvei* H4. *Applied Microbiology & Biotechnology* **104**(17), 7457-7465. <https://doi.org/10.1007/s00253-020-10730-9>

Utilization of carbohydrates and related compounds

Arya, G. *et al.* (in press). Molecular insights into effector binding by DgoR, a GntR/FadR family transcriptional repressor of D-galactonate metabolism in *Escherichia coli*. *Molecular Microbiology*. <https://onlinelibrary.wiley.com/doi/abs/10.1111/mmi.14625>

Fuhren, J. *et al.* (2020). Phenotypic and genetic characterization of differential galacto-oligosaccharide utilization in *Lactobacillus plantarum*. *Scientific Reports* **10**, 21657. <https://doi.org/10.1038/s41598-020-78721-4>

Kim, S.-J. *et al.* (2020). Phosphate sugar isomerases and their potential for rare sugar bioconversion. *Journal of Microbiology* **58**(9), 725-733. <https://doi.org/10.1007/s12275-020-0226-x>

Kiryu, T. *et al.* (2020). Oxidation of isomaltose, gentiobiose, and melibiose by membrane-bound quinoprotein glucose dehydrogenase from acetic acid bacteria. *Bioscience, Biotechnology, & Biochemistry* **84**(3), 507-517.
<https://doi.org/10.1080/09168451.2019.1689095>

Klancher, C. A. *et al.* (2020). Species-specific quorum sensing represses the chitobiose utilization locus in *Vibrio cholerae*. *Applied & Environmental Microbiology* **86**(18), e00915-20. <https://aem.asm.org/content/aem/86/18/e00915-20.full.pdf>

Li, J. *et al.* (2020). A sulfoglycolytic Entner-Doudoroff pathway in *Rhizobium leguminosarum* bv. *trifolii* SRDI565. *Applied & Environmental Microbiology* **86**(15), e00750-20. <https://aem.asm.org/content/aem/86/15/e00750-20.full.pdf>

Sutter, J.-M. *et al.* (2020). Pentose degradation in archaea: *Halorhabdus* species degrade D-xylose, L-arabinose and D-ribose via bacterial-type pathways. *Extremophiles* **24**(5), 759-772. <https://doi.org/10.1007/s00792-020-01192-y>

Yakushi, T. *et al.* (2020). The membrane-bound sorbosone dehydrogenase of *Gluconacetobacter liquefaciens* is a pyrroloquinoline quinone-dependent enzyme.

Enzyme & Microbial Technology **137**, 109511.

<http://www.sciencedirect.com/science/article/pii/S0141022920300041>

Zabel, B. E. *et al.* (2020). Strain-specific strategies of 2'-fucosyllactose, 3-fucosyllactose, and difucosyllactose assimilation by *Bifidobacterium longum* subsp. *infantis* Bi-26 and ATCC 15697. *Scientific Reports* **10**, 15919. <https://doi.org/10.1038/s41598-020-72792-z>

Organic acid utilization

Claassens, N. J. *et al.* (2020). Phosphoglycolate salvage in a chemolithoautotroph using the Calvin cycle. *Proceedings of the National Academy of Sciences of the USA* **117**(36), 22452-22461. <https://www.pnas.org/content/pnas/117/36/22452.full.pdf>

Alcohol utilization

Nichols, T. M. *et al.* (2020). A genomic integration platform for heterologous cargo encapsulation in 1,2-propanediol utilization bacterial microcompartments. *Biochemical Engineering Journal* **156**, 107496. <https://doi.org/10.1016/j.bej.2020.107496>

Ramos-Figueroa, J. S. *et al.* (2020). Preparation and application of ^{13}C -labeled myo-inositol to identify new catabolic products in inositol metabolism in *Lactobacillus casei*. *Biochemistry* **59**(32), 2974-2985. <https://doi.org/10.1021/acs.biochem.0c00539>

Amino acid and nucleic acid base utilization

Hydrocarbon utilization

Deng, D. *et al.* (2020). Discovery of an inducible toluene monooxygenase that cooxidizes 1,4-dioxane and 1,1-dichloroethylene in propanotrophic *Azoarcus* sp. strain DD4. *Applied & Environmental Microbiology* **86**(17), e01163-20. <https://aem.asm.org/content/aem/86/17/e01163-20.full.pdf>

Kumari, S. *et al.* (in press). Naphthalene catabolism by biofilm forming marine bacterium *Pseudomonas aeruginosa* N6P6 and the role of quorum sensing in regulation of dioxygenase gene. *Journal of Applied Microbiology*.

<https://sfamjournals.onlinelibrary.wiley.com/doi/abs/10.1111/jam.14867>

Morya, R. *et al.* (2020). *Burkholderia*: An untapped but promising bacterial genus for the conversion of aromatic compounds. *Trends in Biotechnology* **38**(9), 963-975.

<https://doi.org/10.1016/j.tibtech.2020.02.008>

Murrell, J. C. *et al.* (2020). Microbial metabolism of isoprene: a much-neglected climate-active gas. *Microbiology* **166**(7), 600–613. <https://doi.org/10.1099/mic.0.000931>

Park, C. *et al.* (2020). Protective role of bacterial alkanesulfonate monooxygenase under oxidative stress. *Applied & Environmental Microbiology* **86**(15), e00692-20.

<https://aem.asm.org/content/aem/86/15/e00692-20.full.pdf>

Sakshi & Haritash, A. K. (2020). A comprehensive review of metabolic and genomic aspects of PAH-degradation. *Archives of Microbiology* **202**(8), 2033-2058.

<https://doi.org/10.1007/s00203-020-01929-5>

Spence, E. M. *et al.* (2020). The hydroxyquinol degradation pathway in *Rhodococcus jostii* RHA1 and *Agrobacterium* species is an alternative pathway for degradation of protocatechuic acid and lignin fragments. *Applied & Environmental Microbiology* **86**(19), e01561-20. <https://aem.asm.org/content/aem/86/19/e01561-20.full.pdf>

Wongbunmak, A. *et al.* (2020). BTEX biodegradation by *Bacillus amyloliquefaciens* subsp. *plantarum* W1 and its proposed BTEX biodegradation pathways. *Scientific Reports* **10**, 17408. <https://doi.org/10.1038/s41598-020-74570-3>

Utilization of natural and anthropogenic xenobiotics

Carr, C. M. *et al.* (2020). Microbial polyethylene terephthalate hydrolases: Current and future perspectives. *Frontiers in Microbiology* **11**, 2825. <https://www.frontiersin.org/article/10.3389/fmicb.2020.571265>

Časaitė, V. *et al.* (2020). Microbial degradation of pyridine: a complete pathway in *Arthrobacter* sp. strain 68b deciphered. *Applied & Environmental Microbiology* **86**(15), e00902-20. <https://aem.asm.org/content/aem/86/15/e00902-20.full.pdf>

Chmelova, K. *et al.* (2020). A haloalkane dehalogenase from *Saccharomonospora viridis* strain DSM 43017, a compost bacterium with unusual catalytic residues, unique (S)-

enantioference, and high thermostability. *Applied & Environmental Microbiology* **86**(17), e02820-19. <https://aem.asm.org/content/aem/86/17/e02820-19.full.pdf>

Chris Felshia, S. *et al.* (2020). Elucidation of 2, 4-dichlorophenol degradation by *Bacillus licheniformis* strain SL10. *Environmental Technology* **41**(3), 366-377.
<https://doi.org/10.1080/09593330.2018.1498923>

de Witt, J. *et al.* (2020). Global regulator of rubber degradation *Gordonia polyisoprenivorans* VH2: Identification and involvement in the regulation network. *Applied & Environmental Microbiology* **86**(15), e00774-20.
<https://aem.asm.org/content/aem/86/15/e00774-20.full.pdf>

Dey, A. S. *et al.* (2020). Biodegradation of unpretreated low-density polyethylene (LDPE) by *Stenotrophomonas* sp. and *Achromobacter* sp., isolated from waste dumpsite and drilling fluid. *Frontiers in Microbiology* **11**, 3095.
<https://www.frontiersin.org/article/10.3389/fmicb.2020.603210>

Fazakat, S. & Hashmi, I. (2020). A review on microorganisms involved in biodegradation of plastic. *Journal of Bioremediation & Biodegradation* **11**(4), 472.
<https://www.omicsonline.org/open-access/a-review-on-microorganisms-involved-in-biodegradation-of-plastic.pdf>

Gibu, N. *et al.* (2020). Characterization of the genes responsible for rubber degradation in *Actinoplanes* sp. strain OR16. *Applied Microbiology & Biotechnology* **104**(17), 7367-7376. <https://doi.org/10.1007/s00253-020-10700-1>

Liu, G. *et al.* (2020). Structural insights into 6-hydroxypseudooxynicotine amine oxidase from *Pseudomonas geniculata* N1, the key enzyme involved in nicotine degradation. *Applied & Environmental Microbiology* **86**(19), e01559-20.
<https://aem.asm.org/content/aem/86/19/e01559-20.full.pdf>

Maurya, A. *et al.* (2020). Enzymatic remediation of polyethylene terephthalate (PET)–based polymers for effective management of plastic wastes: An overview. *Frontiers in Bioengineering & Biotechnology* **8**, 1332.
<https://www.frontiersin.org/article/10.3389/fbioe.2020.602325>

Mohanan, N. *et al.* (2020). Microbial and enzymatic degradation of synthetic plastics. *Frontiers in Microbiology* **11**, 2837.
<https://www.frontiersin.org/article/10.3389/fmicb.2020.580709>

Qiu, L. *et al.* (2020). Biodegradation of bis(2-hydroxyethyl) terephthalate by a newly isolated *Enterobacter* sp. HY1 and characterization of its esterase properties. *Journal of Basic Microbiology* **60**(8), 699-711.
<https://onlinelibrary.wiley.com/doi/abs/10.1002/jobm.202000053>

Salgado, R. *et al.* (2020). Metabolite identification of ibuprofen biodegradation by *Patulibacter medicamentivorans* under aerobic conditions. *Environmental Technology* **41**(4), 450-465. <https://doi.org/10.1080/09593330.2018.1502362>

Sarker, R. K. *et al.* (2020). Degradation of low-density poly ethylene (LDPE) by

Enterobacter cloacae AKS7: a potential step towards sustainable environmental remediation. *Archives of Microbiology* **202**(8), 2117-2125.

<https://doi.org/10.1007/s00203-020-01926-8>

Silambarasan, S. & Abraham, J. (2020). Biodegradation of carbendazim by a potent novel *Chryseobacterium* sp. JAS14 and plant growth promoting *Aeromonas caviae* JAS15 with subsequent toxicity analysis. *3 Biotech* **10**(7), 326. <https://doi.org/10.1007/s13205-020-02319-w>

Storck, V. *et al.* (2020). Insights into the function and horizontal transfer of isoproturon degradation genes (*pdmAB*) in a biobed system. *Applied & Environmental Microbiology* **86**(14), e00474-20. <https://aem.asm.org/content/aem/86/14/e00474-20.full.pdf>

Titaley, I. A. *et al.* (2020). Recent advances in the study of the remediation of polycyclic aromatic compound (PAC)-contaminated soils: Transformation products, toxicity, and bioavailability analyses. *Environmental Science & Technology Letters* **7**(12), 873-882. <https://doi.org/10.1021/acs.estlett.0c00677>

Vivod, R. *et al.* (2019). Characterization of the latex clearing protein of the poly(cis-1,4-isoprene) and poly(trans-1,4-isoprene) degrading bacterium *Nocardia nova* SH22a. *The Journal of General & Applied Microbiology* **65**(6), 293-300. https://www.jstage.jst.go.jp/article/jgam/65/6/65_2019.01.003/article/-char/en

Wallace, N. E. *et al.* (2020). The highly crystalline PET found in plastic water bottles does

not support the growth of the PETase-producing bacterium *Ideonella sakaiensis*.

Environmental Microbiology Reports **12**(5), 578-582. <https://doi.org/10.1111/1758-2229.12878>

Wang, H. *et al.* (2020). 3-Hydroxypyridine dehydrogenase HpdA Is encoded by a novel four-component gene cluster and catalyzes the first step of 3-hydroxypyridine catabolism in *Ensifer adhaerens* HP1. *Applied & Environmental Microbiology* **86**(19), e01313-20. <https://aem.asm.org/content/aem/86/19/e01313-20.full.pdf>

Woo, S. *et al.* (2020). Fast and facile biodegradation of polystyrene by the gut microbial flora of *Plesiophthalmus davidis* larvae. *Applied & Environmental Microbiology* **86**(18), e01361-20. <https://aem.asm.org/content/aem/86/18/e01361-20.full.pdf>

Methylotrophy

Bordel, S. *et al.* (2020). Genome scale metabolic model of the versatile methanotroph *Methylocella silvestris*. *Microbial Cell Factories* **19**, 144. <https://doi.org/10.1186/s12934-020-01395-0>

Chen, F. Y. H. *et al.* (2020). Converting *Escherichia coli* to a synthetic methylotroph growing solely on methanol. *Cell* **182**(4), 933-946.e914.

<https://doi.org/10.1016/j.cell.2020.07.010>

Cho, S. *et al.* (2020). Stimulation of cell growth by addition of tungsten in batch culture of a methanotrophic bacterium, *Methylobacterium alcaliphilum* 20Z on methane and methanol. *Journal of Biotechnology* **309**, 81-84.

<https://doi.org/10.1016/j.jbiotec.2019.12.021>

Delépine, B. *et al.* (2020). Charting the metabolic landscape of the facultative methylotroph *Bacillus methanolicus*. *mSystems* **5**(5), e00745-20.

<https://msystems.asm.org/content/msys/5/5/e00745-20.full.pdf>

Farhan Ul Haque, M. *et al.* (2020). Facultative methanotrophs – diversity, genetics, molecular ecology and biotechnological potential: a mini-review. *Microbiology* **166**(10), 894-908.

<https://doi.org/10.1099/mic.0.000977>

Hakobyan, A. *et al.* (2020). Hydrogen utilization by *Methylocystis* sp. strain SC2 expands the known metabolic versatility of type IIa methanotrophs. *Metabolic Engineering* **61**, 181-

196. <https://doi.org/10.1016/j.ymben.2020.05.003>

Hogendoorn, C. *et al.* (2020). Methanol production by *Methylacidiphilum fumariolicum* SolV under different growth conditions. *Applied & Environmental Microbiology* **86**(18), e01188-20. <https://aem.asm.org/content/aem/86/18/e01188-20.full.pdf>

Nguyen, A. D. *et al.* (2020). Metabolic role of pyrophosphate-linked phosphofructokinase *pfk* for C₁ assimilation in *Methylovimicrobium alcaliphilum* 20Z. *Microbial Cell Factories* **19**, 131. <https://doi.org/10.1186/s12934-020-01382-5>

Nguyen, A. D. *et al.* (2020). Genome-scale evaluation of core one-carbon metabolism in gammaproteobacterial methanotrophs grown on methane and methanol. *Metabolic Engineering* **57**, 1-12. <https://doi.org/10.1016/j.ymben.2019.10.004>

Pastawan, V. *et al.* (2020). Regulation of lanthanide-dependent methanol oxidation pathway in the legume symbiotic nitrogen-fixing bacterium *Bradyrhizobium* sp. strain Ce-3. *Journal of Bioscience & Bioengineering* **130**(6), 582-587. <https://doi.org/10.1016/j.jbiosc.2020.07.012>

Rahalkar, M. C. *et al.* (2020). A novel Type I methanotroph *Methylobolus aquaticus* gen. nov. sp. nov. isolated from a tropical wetland. *Antonie van Leeuwenhoek* **113**(7), 959-971. <https://doi.org/10.1007/s10482-020-01410-9>

Reshetnikov, A. S. *et al.* (2020). Ectoine degradation pathway in halotolerant methylotrophs. *PLOS ONE* **15**(4), e0232244. <https://doi.org/10.1371/journal.pone.0232244>

Yang, Y. *et al.* (2020). Extracellular electron transfer of *Methylophilus methylotrophs*. *Process Biochemistry* **94**, 313-318.
<http://www.sciencedirect.com/science/article/pii/S1359511320302853>

Incomplete oxidation

Petrova, P. *et al.* (2020). New *Bacillus* spp. with potential for 2,3-butanediol production from biomass. *Journal of Bioscience & Bioengineering* **130**(1), 20-28.
<https://doi.org/10.1016/j.jbiosc.2020.02.009>