



Combinatorial Biosynthesis of Natural and Non-natural Plant-derived Phenols in Microorganisms

Jennifer Aschenbrenner

Gesundheit / Health

Band / Volume 84

ISBN 978-3-95806-419-5

Forschungszentrum Jülich GmbH
Institut für Bio-und Geowissenschaften
Biotechnologie (IBG-1)

Combinatorial Biosynthesis of Natural and Non-natural Plant-derived Phenols in Microorganisms

Jennifer Aschenbrenner

Schriften des Forschungszentrums Jülich
Reihe Gesundheit / Health

Band / Volume 84

ISSN 1866-1785

ISBN 978-3-95806-419-5

Table of contents

Abstract	I
Zusammenfassung	II
Abbreviations	III
1 Scientific context and key results of this thesis	1
1.1 Polyphenols - naturally occurring and application.....	1
1.2 Phenylpropanoids - naturally occurring and application	3
1.3 Enzymes participating in the phenylpropanoid pathway and polyphenol synthesis....	5
1.3.1 Modulations at the propene tail	5
1.3.2 Modification at the phenyl group	6
1.3.3 Polyphenol synthesis: Multicopper oxidase/Laccase	8
1.4 Microbial production of phenylpropanoids and phenylpropanoid-derived polyphenols	10
1.4.1 Phenylpropanoids	10
1.4.2 Polyphenols.....	11
1.4.3 Production of non-natural compounds.....	11
1.5 Aim of this thesis	12
1.6 Key results.....	13
1.6.1 Microbial production of natural and non-natural monolignols.....	14
1.6.2 Development of a suitable screening method.....	18
1.6.3 Combinatorial biosynthesis using 4-coumarate 3-hydroxylase (C3H).....	20
1.6.4 <i>In vivo</i> application and engineering of caffeic acid <i>O</i> -methyltransferase (COMT)	22
1.6.5 Expression of <i>cueO</i> and <i>in vivo</i> pinoresinol synthesis.....	27
1.7 Conclusion and Outlook.....	29
2 Publications and Manuscripts	32
2.1 Production of plant-derived polyphenols in microorganisms: current state and perspectives	32
2.2 Microbial production of natural and non-natural monolignols with <i>Escherichia coli</i>	43
2.3 Engineering the substrate specificity of a caffeic acid <i>O</i> -methyltransferase from <i>Medicago sativa</i>	61
3 References.....	84

4	Appendix.....	100
4.1	Supplementary material “Microbial production of natural and non-natural monolignols with <i>Escherichia coli</i> ”.....	100
4.2	Supplementary material “Engineering the substrate specificity of a caffeic acid <i>O</i> -methyltransferase from <i>Medicago sativa</i> ”.....	120
4.3	Authors’ Contributions.....	124
4.4	Other activities.....	125
	Danksagung.....	126
	Erklärung.....	128

Gesundheit / Health
Band / Volume 84
ISBN 978-3-95806-419-5

Mitglied der Helmholtz-Gemeinschaft

