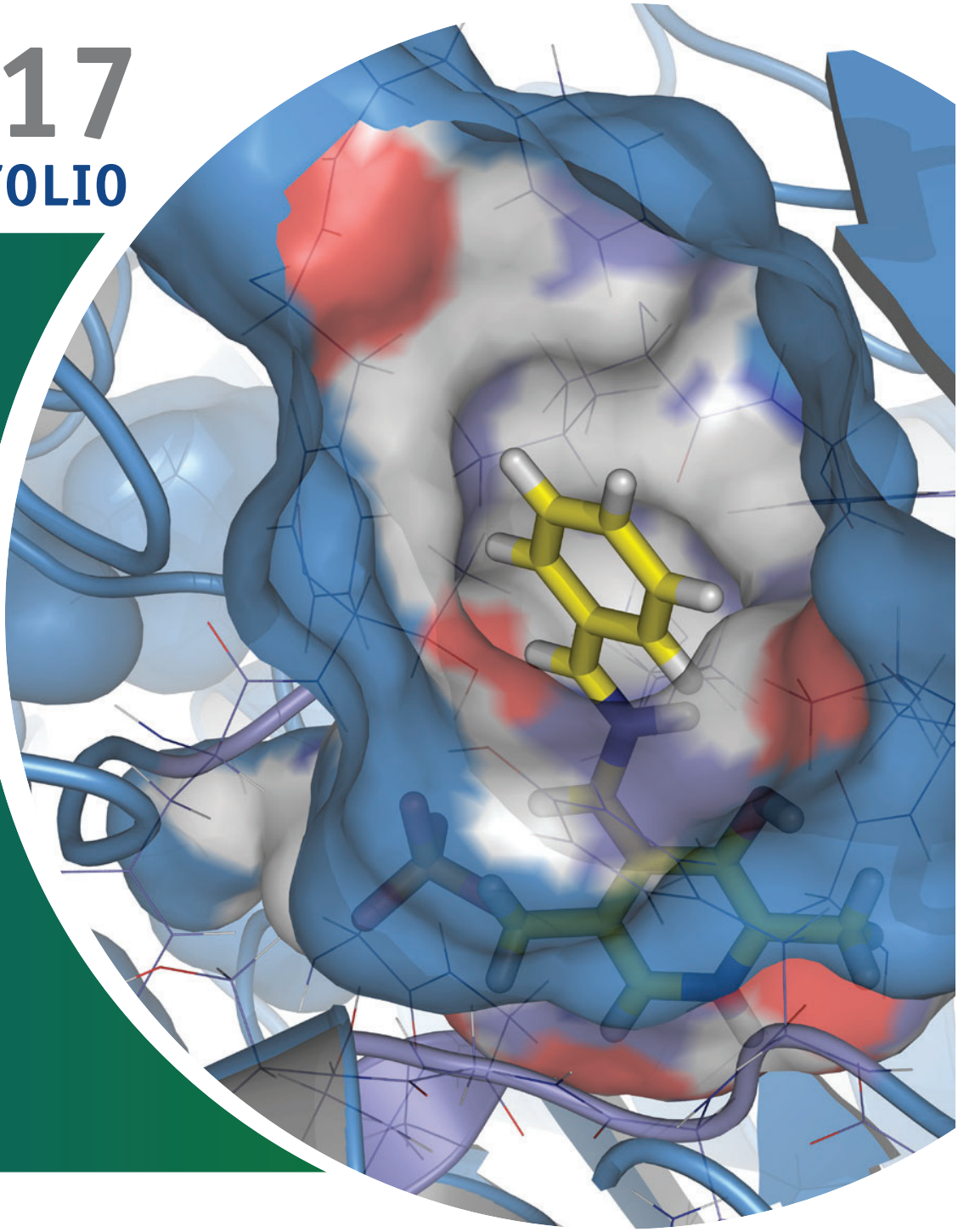
Enzymical®

Enzymes | Chemicals | Solutions

2017 PORTFOLIO



For product updates visit
www.enzymicals.com

HANGSEN EXHIBIT 1006
Hangsen v. Zanoprima, IPR2023-00503

Portfolio Enzymicals - Chemicals & Enzymes

Enzymical®
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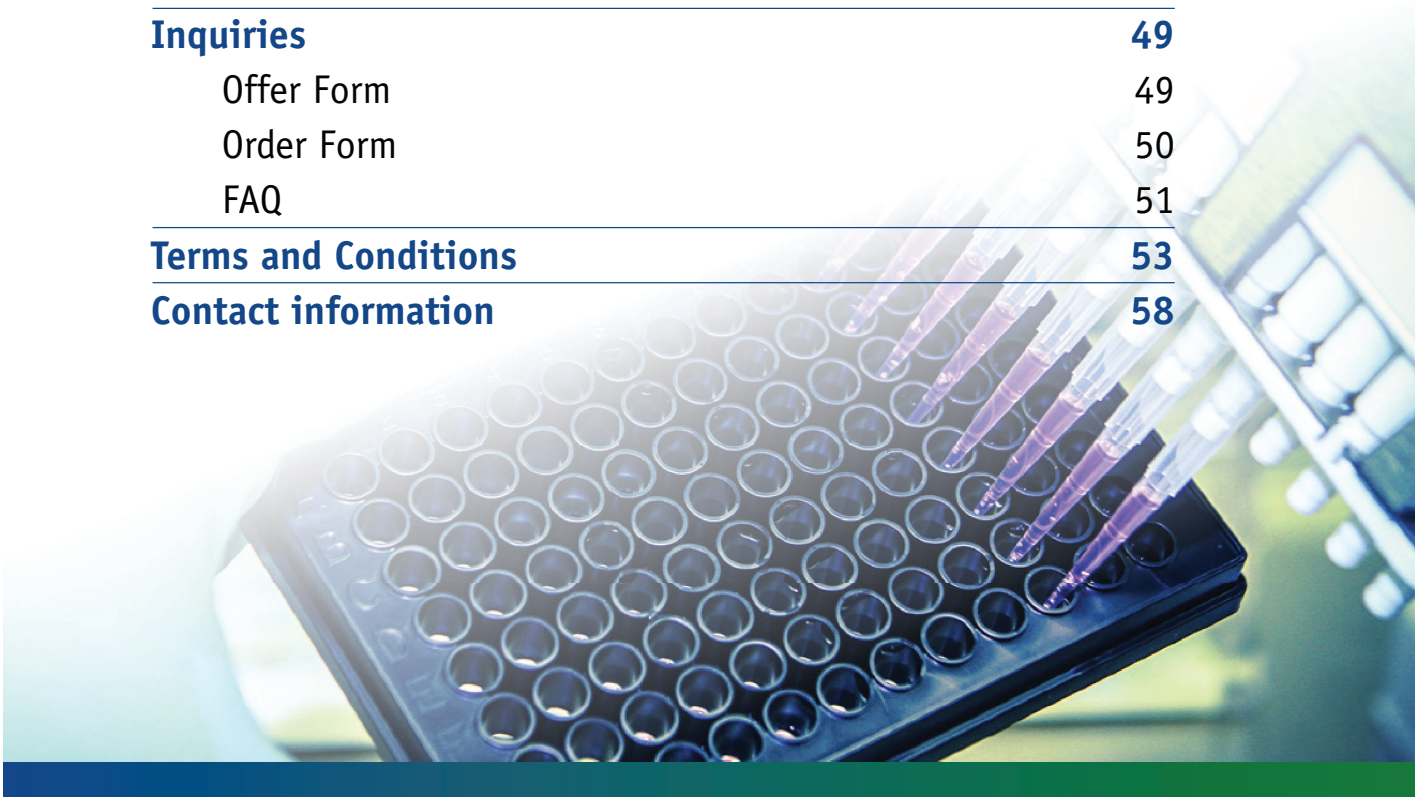


About us

The focus of Enzymicals:

Is to provide integrated solutions for biocatalytic applications. Dedicated to design, develop and implement cost-effective, sustainable and scalable chemo-biocatalytic routes - Enzymicals offers recognized expertise in the use of enzymatic processes for complex chemicals synthesis for its three business segments.

- The independent enterprise provides state of the art **SOLUTIONS** in development, optimiztion and piloting of robust chemo-enzymatic processes for the production of fine & specialty chemicals.

- The company manufactures a range of **CHEMICALS** as chiral building blocks, intermediates and specialty chemicals as well offer custom synthesis on request. The product range includes chiral secondary and tertiary alcohols, carboxylic acids, lactones, esters, amines and amino-alcohols.

- Enzymicals offers a broad selection of recombinant **ENZYMES** suitable for research, development, production and diagnostics as well as a tailor-made protein expression and optimization service. Our portfolio contains a continually expanding selection from diverse enzyme classes at desired formulations to solve specific questions at best performance.

Enzymicals service covers the whole value chain towards a tailor-made process for a special application: enzyme identification, expression, characterization, improvement and application in an efficient production process. Together with our network partners, we expand our service to ASMF filing, regulatory affairs, cGMP production and bulk scale supply.

The present catalog portfolio reflects a small selection of our internal portfolio and gives an overview about our services.

Please contact us if you have any questions!

+49 (0)3834 515 470
info@enzymicals.com

Chemicals - General

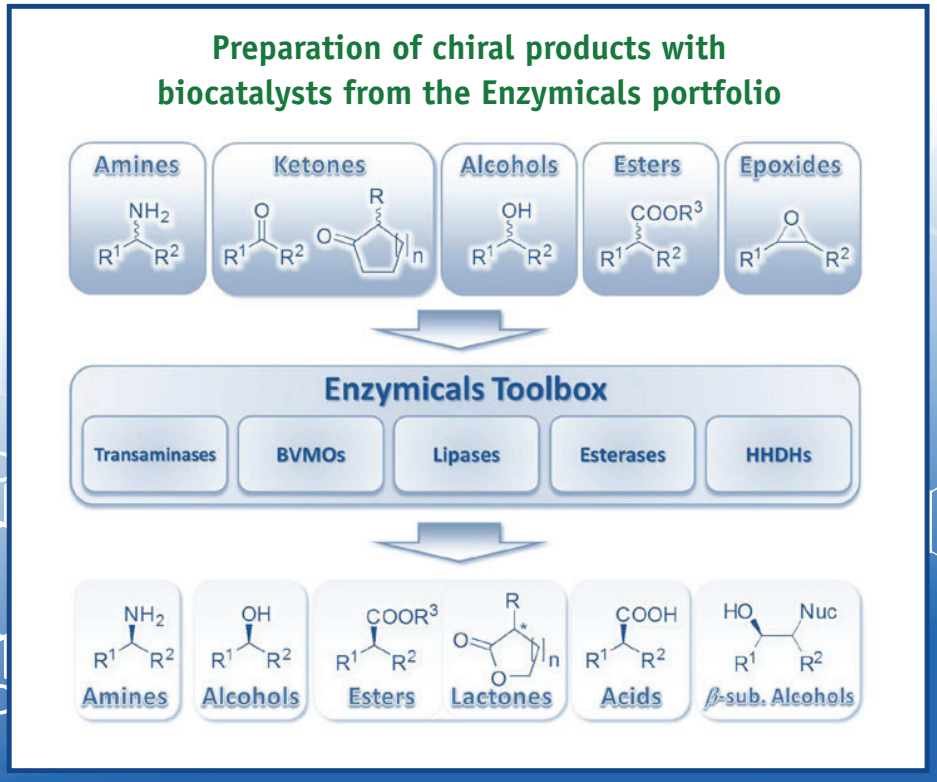
One focus of Enzymicals is the production of high value chemicals by using chemo- enzymatic routes.

We offer a custom synthesis and custom research service, which can be done by a) the straight forward production of a target substance on a price per kg model or b) a project based individual route scouting for the synthesis of your desired compounds, feasibility studies, reaction optimization, scale up and piloting of complete processes orientated on your demands.

We offer **chiral building blocks and specialty chemicals** from analytical to multi-kilogram scale and up to multi-ton scale within our network. The product range includes chiral secondary and tertiary alcohols, carboxylic acids, lactones, esters, amines and amino-alcohols. The majority of special chemicals are produced tailor made on request.

This catalog **contains a selection of substances** for which the production processes were internally developed and which are available direct from Enzymicals up to kilogram quantities. Please contact us to get an offer or to request bulk supply from our network.

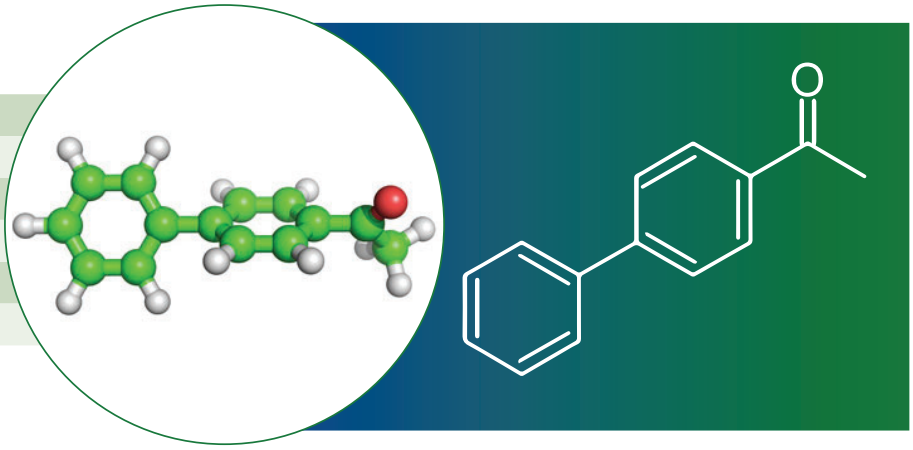
Please contact us if you have any questions!



Chemicals made by Enzymicals

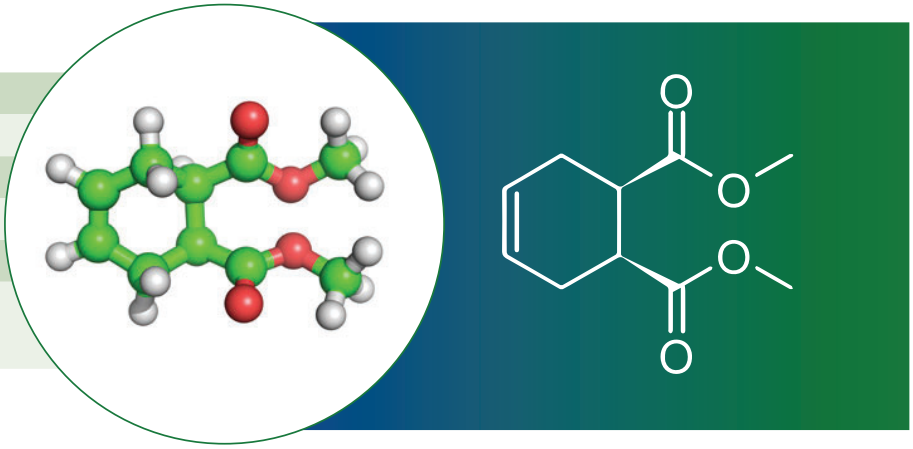
4-Phenyl acetophenone

Catalog no: ECS-C-01
CAS no: 92-91-1
MW: 196,24 g/mol
Purity: ≥ 95 %
ee: n/a
Availability: on request



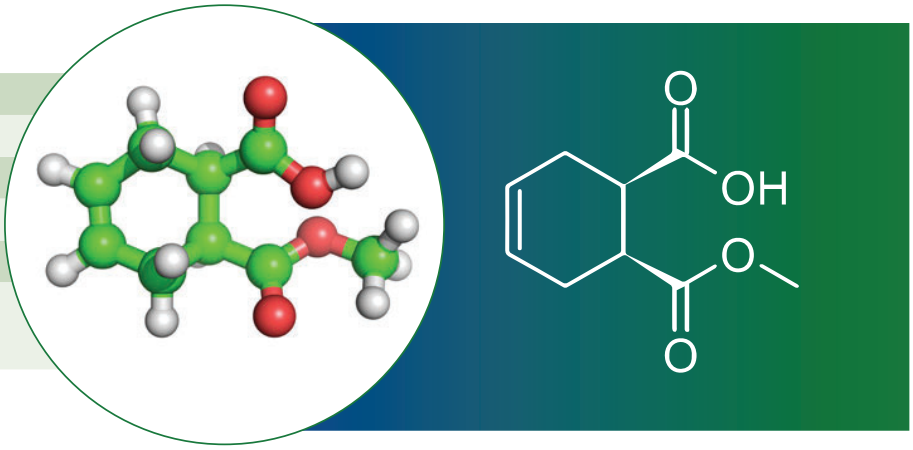
Dimethyl *cis*-cyclohex-4-ene-1,2-dicarboxylate

Catalog no: ECS-C-02
CAS no: 4841-84-3
MW: 198,22 g/mol
Purity: 98 %
ee: n/a
Availability: Commercial Scale



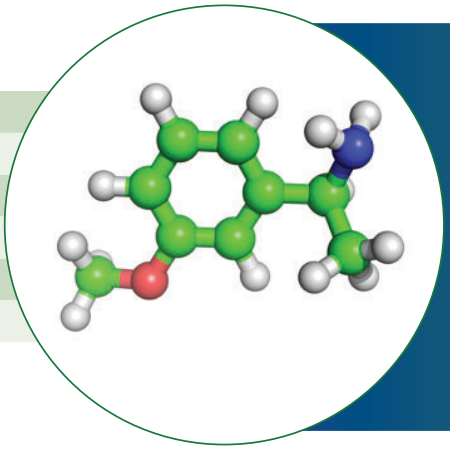
(1*R*,6*S*)-6-(Methoxycarbonyl)cyclohex-3-ene-1-carboxylic acid

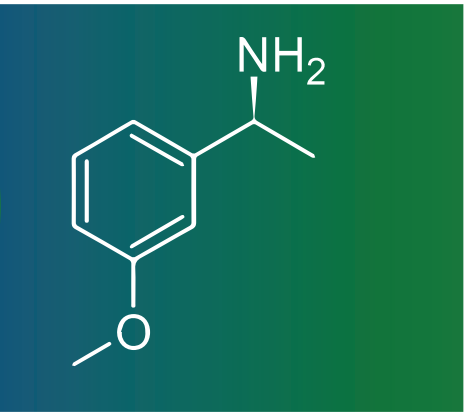
Catalog no: ECS-C-03
CAS no: 88335-93-7
MW: 184,19 g/mol
Purity: > 97 %
ee: > 99 %
Availability: Commercial Scale



(*S*)-1-(3-Methoxy)-phenylethylamine

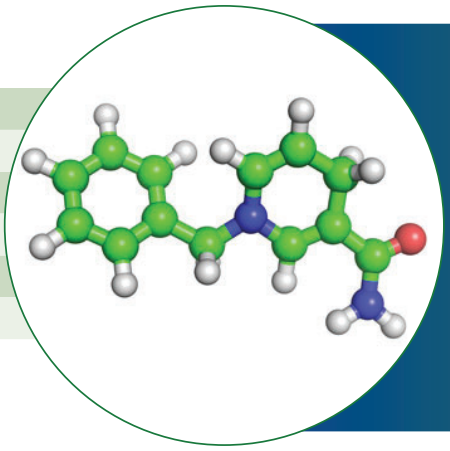
Catalog no: ECS-C-04
CAS no: 82796-69-8
MW: 151,21 g/mol
Purity: 95 %
ee: > 99 %
Availability: on request

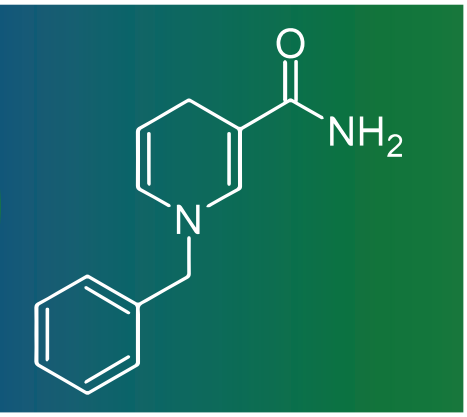




1-Benzyl-1,4-dihydronicotinamide

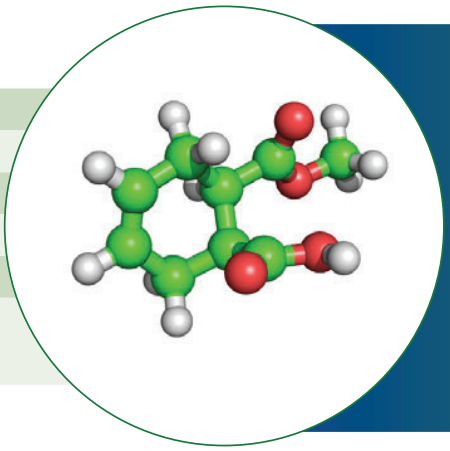
Catalog no: ECS-C-05
CAS no: 952-92-1
MW: 214,26 g/mol
Purity: ≥ 95 %
ee: n/a
Availability: Lab scale

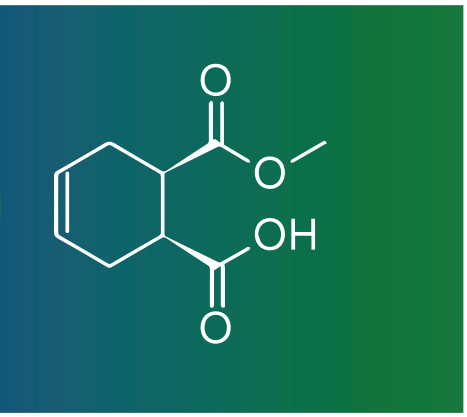




(1*S*,6*R*)-6-(Methoxycarbonyl)cyclohex-3-ene-1-carboxylic acid

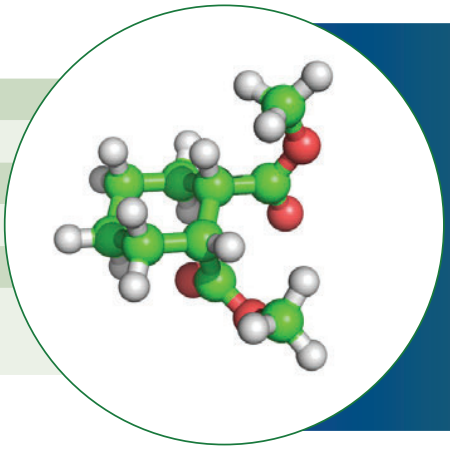
Catalog no: ECS-C-06
CAS no: n/a
MW: 184,19 g/mol
Purity: ≥ 95 %
ee: > 99 %
Availability: Commercial Scale

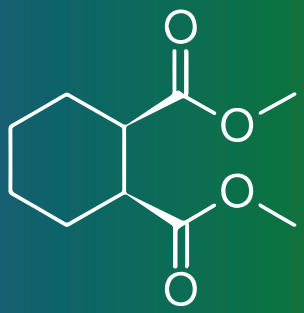




Dimethyl *cis*-1,2-Cyclohexanedicarboxylate

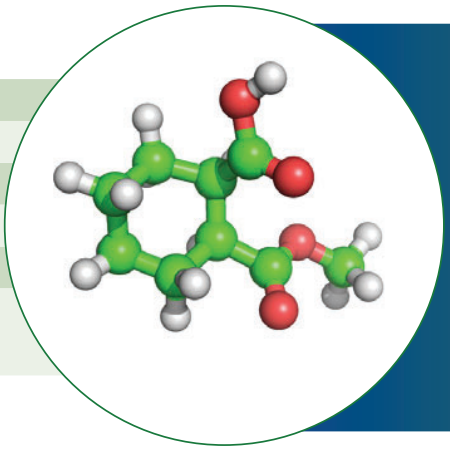
Catalog no: ECS-C-07
CAS no: 1687-29-2
MW: 200,23 g/mol
Purity: ≥ 98 %
ee: n/a
Availability: Commercial Scale

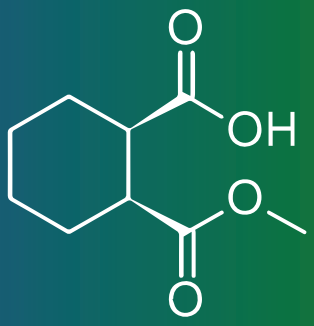




(1*R*,2*S*)-2-(Methoxycarbonyl) cyclohexanecarboxylic acid

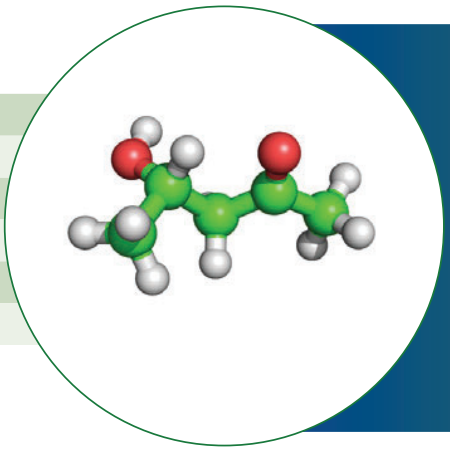
Catalog no: ECS-C-08
CAS no: 111955-05-6
MW: 186,21 g/mol
Purity: ≥ 95 %
ee: > 99 %
Availability: Commercial Scale

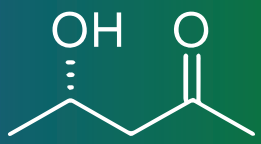




(4*S*)-4-Hydroxypentan-2-one

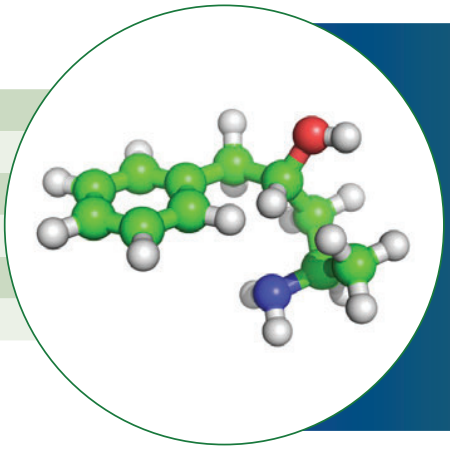
Catalog no: ECS-C-09
CAS no: 73836-68-7
MW: 102,13 g/mol
Purity: ≥ 95 %
ee: > 99 %
Availability: Lab scale

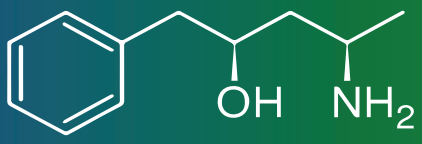




(2*S*,4*R*)-4-Amino-1-phenylpentan-2-ol

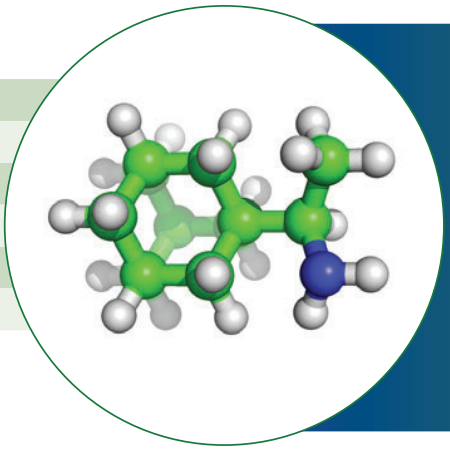
Catalog no: ECS-C-10
CAS no: n/a
MW: 179,26 g/mol
Purity: ≥ 95 %
ee: >99 %, de: > 99 %
Availability: on request

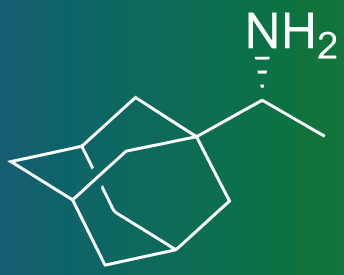




(*R*)-1-(1-adamantyl)ethanamine

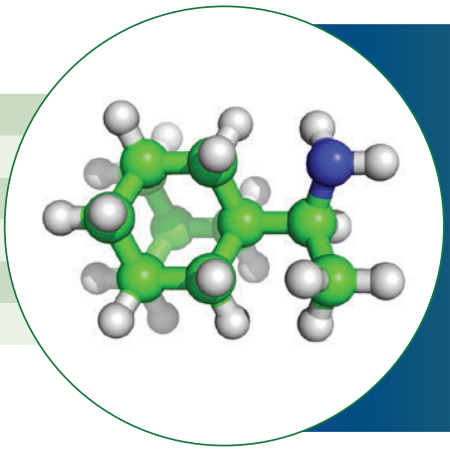
Catalog no: ECS-C-11
CAS no: 887336-05-2
MW: 184,19 g/mol
Purity: > 95 %
ee: > 99,5 %
Availability: Lab Scale

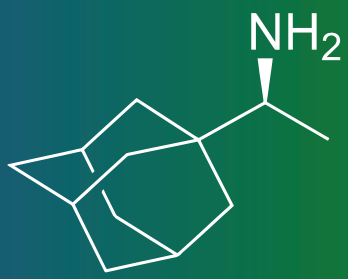




(*S*)-1-(1-adamantyl)ethanamine

Catalog no: ECS-C-12
CAS no: 887336-06-3
MW: 184,19 g/mol
Purity: > 95 %
ee: > 99,5 %
Availability: Lab scale





Enzymes – General

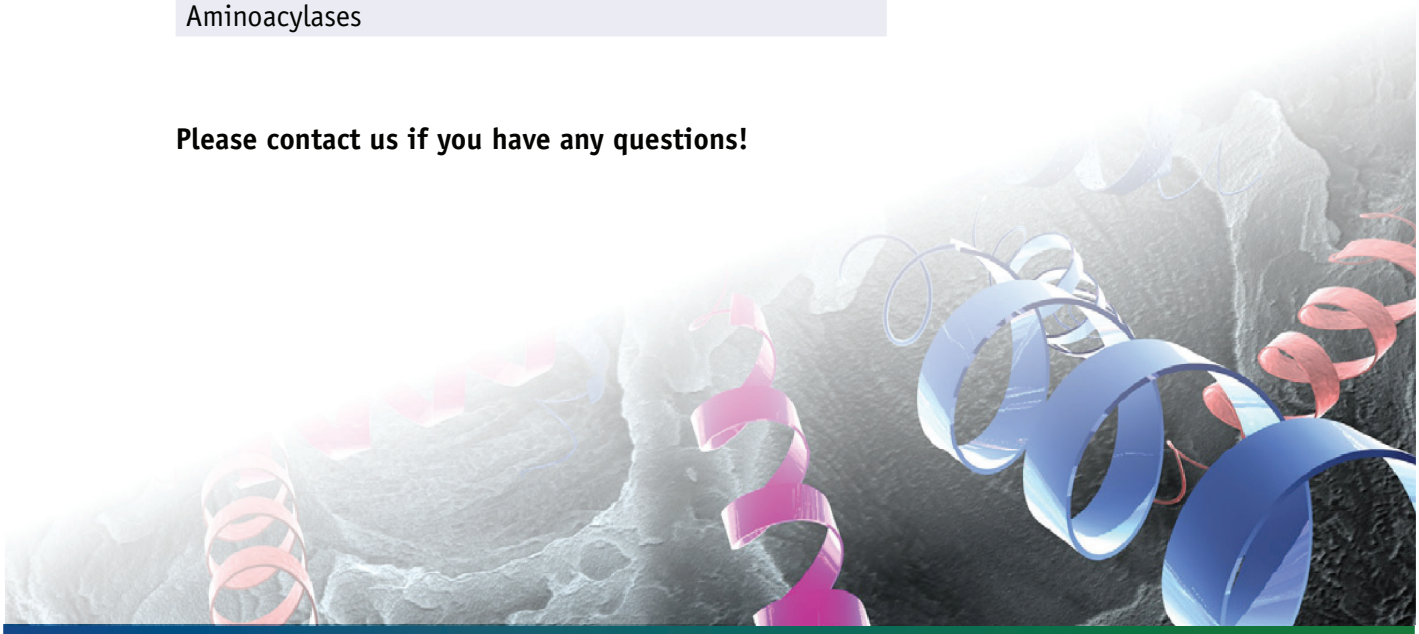
Enzymicals offers a broad enzyme selection, and is an outstanding resource of biocatalysts suitable for research and development, production and diagnostics. Our enzyme portfolio provides a continually expanding toolbox with innovative biocatalysts and a range of proteins is offered in this catalog.

The present catalog reflects a small selection of our catalyst portfolio whereas the majority of our internally available enzymes are exclusively used for in-house screenings and for tailor made solutions on customer request. All catalogue enzymes are offered as recombinant produced crude protein extracts from microbial host systems in technical grade. Final formulations, as well higher grades of purity, can be adapted on request to meet specific process requirements. All enzymes are available in bulk scale.

Our company also **offers a tailor made expression service**, for the case that you need a special enzyme which is rarely or not available by standard providers.

Biocatalytic toolbox in Enzymicals catalog:
Transaminases
Halohydrin Dehalogenases
Imine Reductases
Lipases/Esterases
Baeyer-Villiger-Monooxygenases
Phosphotransferases
Aminoacylases

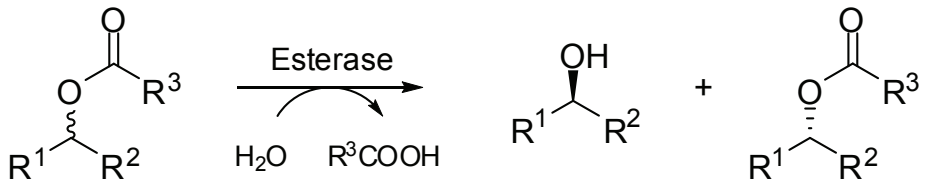
Please contact us if you have any questions!



Esterases

General properties

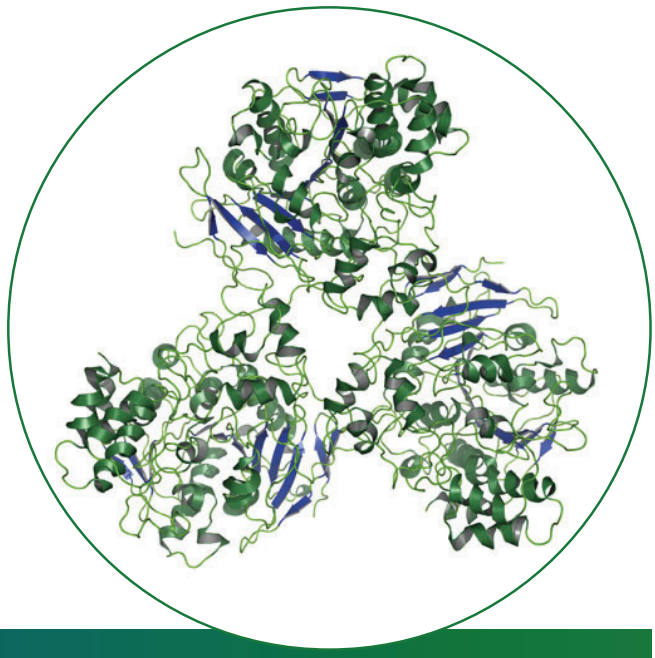
Esterases represent a diverse group of hydrolases catalyzing the cleavage and formation of ester bonds. Carboxylesterases (EC 3.1.1.1) are a subset of esterases that specifically hydrolyse carboxylic esters to give two products: a carboxylic acid and an alcohol.



Many of them show a wide substrate tolerance and also high regio- and stereospecificity, which make them attractive biocatalysts for the production of optically pure compounds for fine chemical synthesis. The interest in these enzymes also resides in the fact that they do not require cofactors, are stable and are even active in organic solvents. Preferred substrates are esters and short-chain triglycerides.

Further information can be found in:

Hydrolases in Organic Synthesis.
U.T. Bornscheuer and R.J. Kazlauskas,
2nd edition, Wiley-VCH (2005)



Recombinant pig liver esterases

Product name	Origin	Catalog no.	Quantity	Price	Formulation
Recombinant pig liver esterases					
PLE isoenzyme 1	pig liver, rec. from *E. coli*	**ECS-PLE01**	50 mg	150 €	Solid [a)]
			500 mg	580 €	
PLE isoenzyme 2	pig liver, rec. from *E. coli*	**ECS-PLE02**	50 mg	150 €	Solid [a)]
			500 mg	580 €	
PLE isoenzyme 3	pig liver, rec. from *E. coli*	**ECS-PLE03**	50 mg	150 €	Solid [a)]
			500 mg	580 €	
PLE isoenzyme 4	pig liver, rec. from *E. coli*	**ECS-PLE04**	50 mg	150 €	Solid [a)]
			500 mg	580 €	
PLE isoenzyme 5	pig liver, rec. from *E. coli*	**ECS-PLE05**	50 mg	150 €	Solid [a)]
			500 mg	580 €	
PLE isoenzyme 6	pig liver, rec. from *E. coli*	**ECS-PLE06**	50 mg	150 €	Solid [a)]
			500 mg	580 €	
PLE screening kit	pig liver, rec. from *E. coli*	**ECS-PLE-KIT**		690 €	Solid [a)]
	(contains all six pig liver esterase isoenzymes 50 mg each)				

a) Lyophilized powder

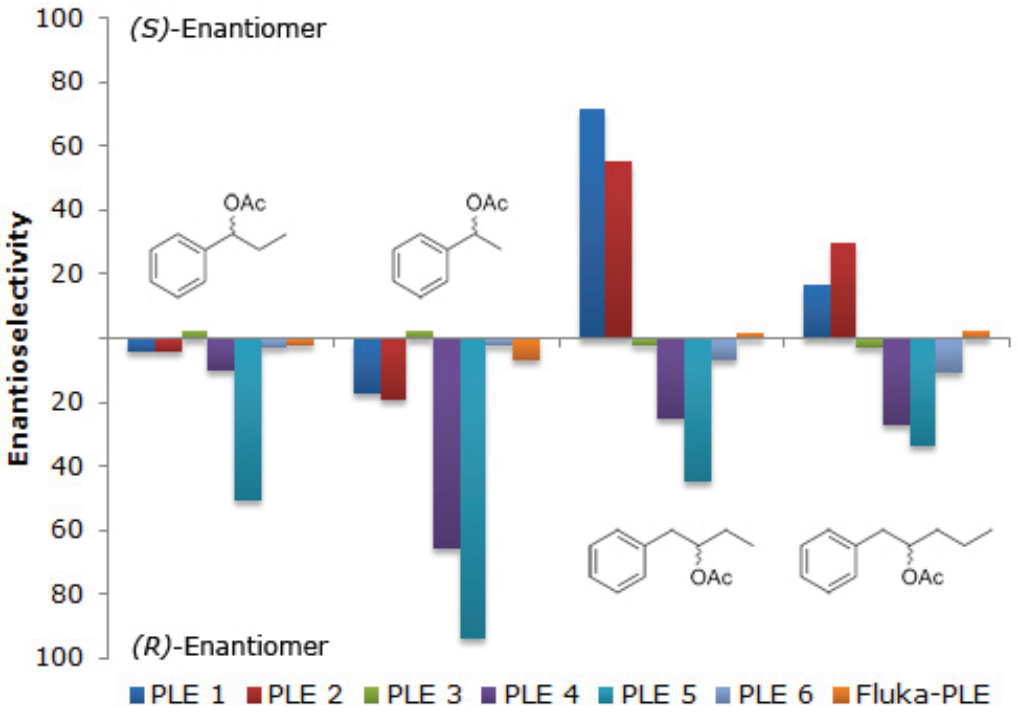
Bulk amounts available.

For more information see chapter FAQ.

Background:

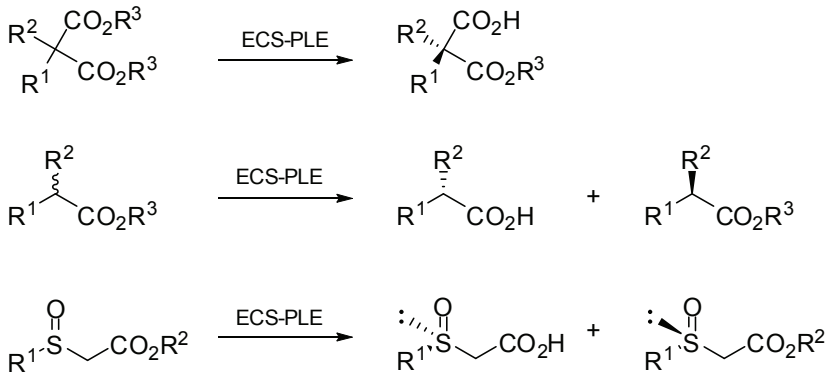
The pig liver esterase (PLE) is a widely used enzyme in organic synthesis. Due to its ability to work under mild conditions and with organic solvents it is a very useful biocatalyst for the synthesis of optically pure compounds. The traditional use of isolates from pig liver had the disadvantage of being an ill-defined mixture of hydrolases including PLE-isoenzymes. Six isoenzymes of the pig liver esterase have been identified and are commercially available from Enzymicals. The application of single isoenzymes guarantees a reproducible enzyme activity and prevents undesired side reactions. Our recombinant expression platform ensures their animal free manufacturing and direct production scale-up. Final formulation can be adapted to meet specific process requirements.

All isoenzymes show high enantioselectivities and even opposite enantiopreferences in the kinetic resolution of several secondary alcohols (see Figure 1). They also exhibit different specific activities towards chiral esters and offer diverse selectivities for the desymmetrization of prochiral compounds.

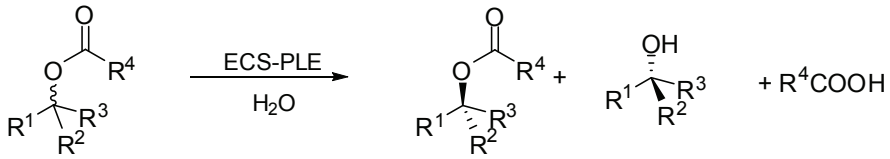


Enantioselectivity of PLE isoenzymes towards selected secondary alcohol esters. Data for Fluka-PLE refers to a commercially available enzyme preparation which contains a mixture of isoenzymes.

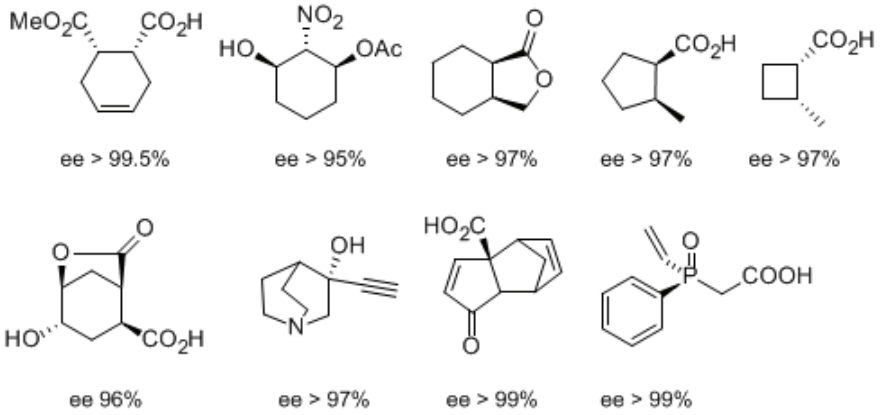
Examples:



Enantioselective resolutions and desymmetrizations.



Stereoselective hydrolysis of tertiary alcohol esters.



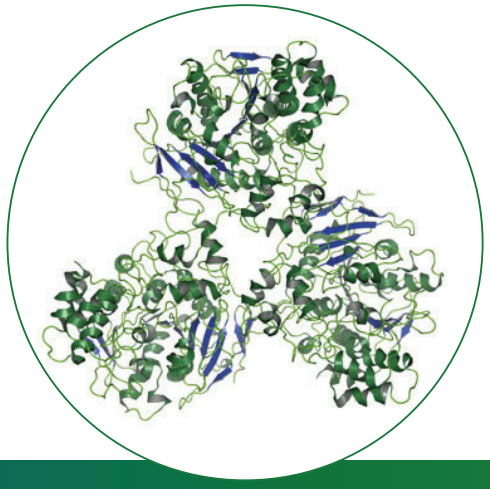
Chiral products obtained from PLE-mediated hydrolysis of carboxylic esters.

Enzymicals offers a PLE screening kit with samples of six isoenzymes of the pig liver esterase (50 mg each). This enables the quick and easy identification of the best isoenzyme with respect to enantioselectivity and enantiopreference. For quality assurance enzymes are tested against p-nitrophenyl acetate as standard substrate at 30°C and pH 7.5.

Other recombinant esterases

Product name	Origin	Catalog no.	Quantity	Price	Formulation
Other recombinat esterases					
Esterase 01	bacterial, rec. from *E. coli*	**ECS-Es01**	50 mg 500 mg	150 € 580 €	Solid [a)]
Esterase 02	bacterial, rec. from *E. coli*	**ECS-Es02**	50 mg 500 mg	150 € 580 €	Solid [a)]
Esterase 03	bacterial, rec. from *E. coli*	**ECS-Es03**	50 mg 500 mg	150 € 580 €	Solid [a)]
Esterase 01	bacterial, rec. from *E. coli*	**ECS-Es01**	50 mg 500 mg	150 € 580 €	Solid [a)]
Esterase 04	bacterial, rec. from *E. coli*	**ECS-Es04**	50 mg 500 mg	150 € 580 €	Solid [a)]
Esterase 05	bacterial, rec. from *E. coli*	**ECS-Es05**	50 mg 500 mg	150 € 580 €	Solid [a)]
Esterase 06	bacterial, rec. from *E. coli*	**ECS-Es06**	50 mg 500 mg	150 € 580 €	Solid [a)]
Esterase 07	bacterial, rec. from *E. coli*	**ECS-Es07**	50 mg 500 mg	150 € 580 €	Solid [a)]
Esterase 08	bacterial, rec. from *E. coli*	**ECS-Es08**	50 mg 500 mg	150 € 580 €	Solid [a)]
Esterase 09	bacterial, rec. from *E. coli*	**ECS-Es09**	50 mg 500 mg	150 € 580 €	Solid [a)]
Esterase 10	bacterial, rec. from *E. coli*	**ECS-Es10**	50 mg 500 mg	150 € 580 €	Solid [a)]
Esterase screening kit	bacterial, rec. from E. coli (contains all ten bacterial esterases 50 mg each)	**ECS-ES-KIT**		990 €	Solid [a)]
Esterase kit for tertiary alcohols	rec. from E. coli (contains eleven suitable esterases PLE01-06, Es1, Es6, Es8-10, 50 mg each)	**ECS-ETA-KIT**		1090 €	Solid [a)]

a) Lyophilized powder;
Bulk amounts available.
For more information see chapter FAQ.

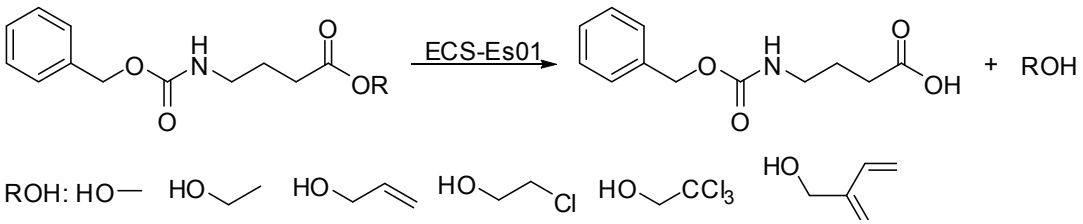


ECS-Esterase 01 - *Bacillus subtilis* (EC 3.1.1.1)

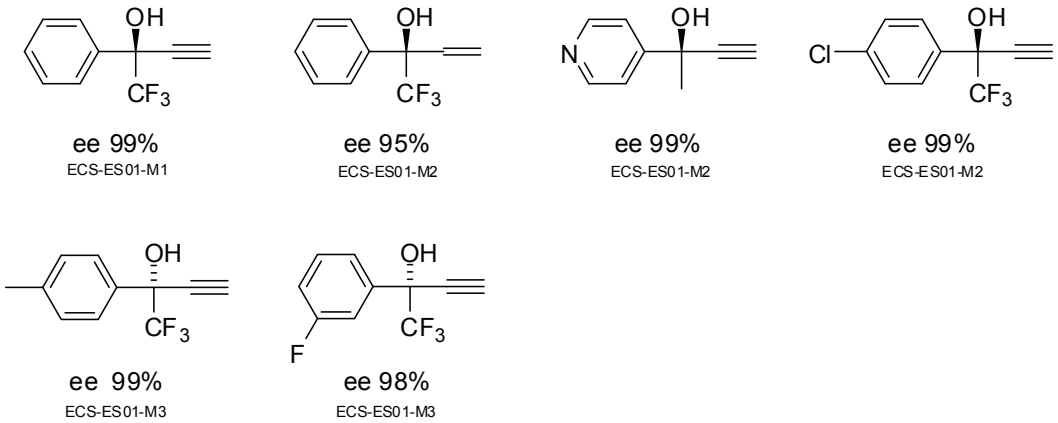
Properties:

- Removes tert-butyl ester protecting group, e.g. from peptides
- Acts on tertiary alcohols in the kinetic resolution of racemic esters
- Exhibits promiscuous amidase activity
- Optimum conditions: 40°C, pH 8-9

Examples:



Deprotection by ECS-Es01 with various alcohol moieties.



Chiral products obtained from hydrolysis of tertiary alcohol esters by variants of ECS-Es01.

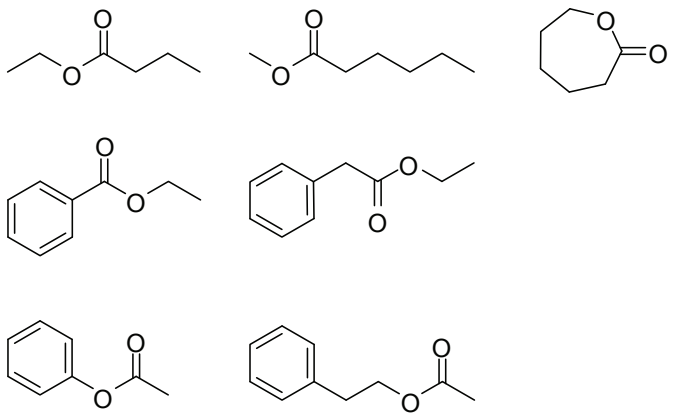
Comment: For quality assurance ECS-Es01 is tested against p-nitrophenyl acetate as standard substrate at 30°C and pH 7.5. **Several mutants with enhanced substrate specificity and/or increased stereoselectivity and/or inverted stereopreference are available upon request.**

ECS-Esterase 02 - *Bacillus subtilis* (EC 3.1.1.1)

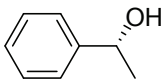
Properties:

- Acts on esters with medium chain length fatty acids
- Good acceptance of branched alcohol moieties
- Active towards several lactones
- Optimum conditions: 40°C, pH 7.5-8

Examples:



Substrates hydrolyzed by ECS-Es02.



ee > 99 %

Chiral product obtained from hydrolysis of carboxylic ester by ECS-Es02.

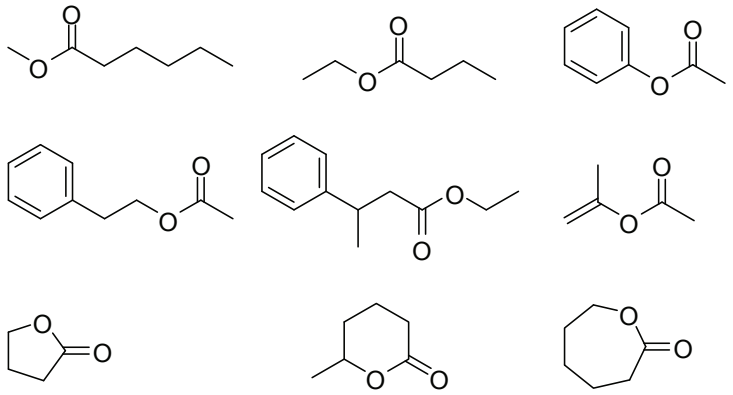
Comment: For quality assurance ECS-Es02 is tested against p-nitrophenyl acetate as standard substrate at 30°C and pH 7.5.

ECS-Esterase 03 - *Bacillus stearothermophilus* (EC 3.1.1.1)

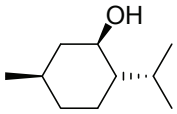
Properties:

- Active towards various carboxylic acid esters
- Accepts substrates with sterically demanding carboxylic acid groups
- Active towards several lactones
- High temperature stability
- Optimum conditions: 65°C, pH 7

Examples:



Substrates hydrolyzed by ECS-Es03.



ee > 99

Chiral product obtained from hydrolysis of carboxylic ester by ECS-Es03.

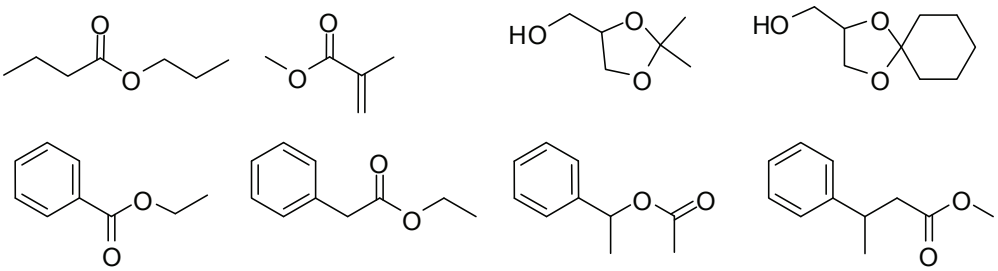
Comment: For quality assurance ECS-Es03 is tested against p-nitrophenyl acetate as standard substrate at 30°C and pH 7.5.

ECS-Esterase 04 - *Pseudomonas fluorescens* (EC 3.1.1.1)

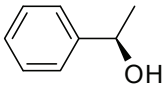
Properties:

- Acts on a wide range of aliphatic and aromatic esters
- Active and stable at elevated temperatures and in organic solvents
- Can be used for acetylation reactions
- Optimum conditions: 45°C, pH 7.5-8

Examples:



Substrates hydrolyzed by ECS-Es04.



ee > 99

Chiral product obtained from hydrolysis of carboxylic ester by ECS-Es04.

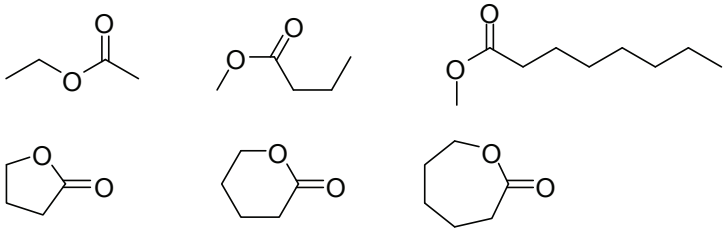
Comment: For quality assurance ECS-Es04 is tested against p-nitrophenyl acetate as standard substrate at 30°C and pH 7.5. Several mutants with enhanced substrate specificity and/or increased stereoselectivity are available upon request.

ECS-Esterase 05 - *Pseudomonas fluorescens* (EC 3.1.1.1)

Properties:

- Active towards various carboxylic acid esters and lactones
- Optimum conditions: 43°C, pH 7.5

Examples:



Substrates hydrolyzed by ECS-Es05.

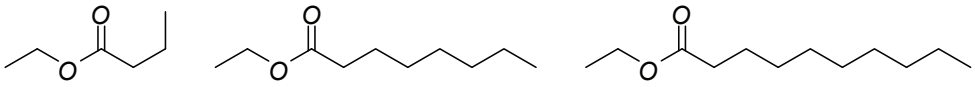
Comment: For quality assurance ECS-Es05 is tested against p-nitrophenyl acetate as standard substrate at 30°C and pH 7.5.

ECS-Esterase 06 - *Paenibacillus barcinonensis* (EC 3.1.1.1)

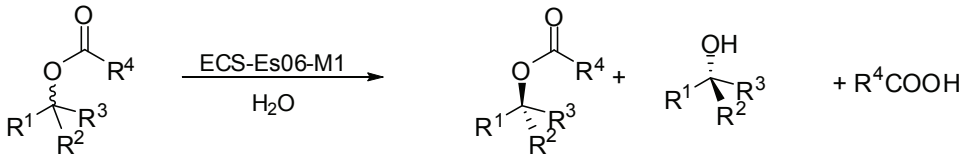
Properties:

- Active towards various carboxylic acid esters
- Variants act on tertiary alcohols esters
- Optimum conditions: 37°C, pH 7.5

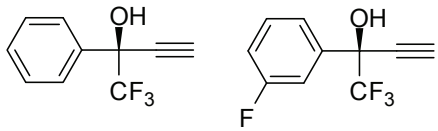
Examples:



Substrates hydrolyzed by ECS-Es06.



Stereoselective hydrolysis of tertiary alcohol esters by ECS-Es06 variant.



Chiral products obtained from hydrolysis of carboxylic esters by variant of ECS-Es06.

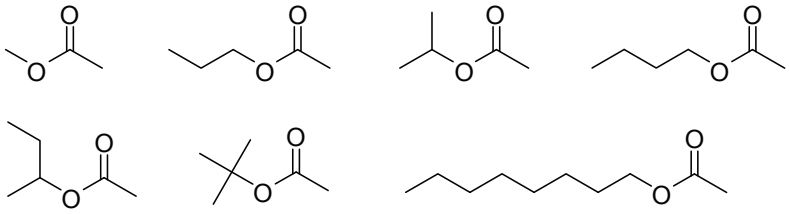
Comment: For quality assurance ECS-Es06 is tested against p-nitrophenyl acetate as standard substrate at 30°C and pH 7.5. **Several mutants with enhanced substrate specificity and/or increased stereoselectivity towards tertiary alcohols are available upon request.**

ECS-Esterase 07 - *Pyrobaculum calidifontis* (EC 3.1.1.1)

Properties:

- Active towards esters with short to medium chain length
- Accepts straight and branched chain alcohols
- Excellent enantioselectivity in the resolution of tertiary alcohol esters
- Active in organic media
- Optimum conditions: 90°C, pH 7

Examples:



Substrates hydrolyzed by ECS-Es07.

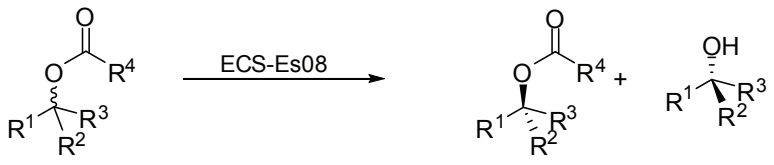
Comment: For quality assurance ECS-Es07 is tested against p-nitrophenyl acetate as standard substrate at 30°C and pH 7.5.

ECS-Esterase 08 - *Nocardia farcinica* (EC 3.1.1.1)

Properties:

- Acts on a range of tertiary alcohols in the kinetic resolution of racemic esters
- Excellent enantioselectivity (E>100) in the hydrolysis of menthyl acetate
- Optimum conditions: pH 7.5

Examples:



Stereoselective hydrolysis of tertiary alcohol esters by ECS-Es08.

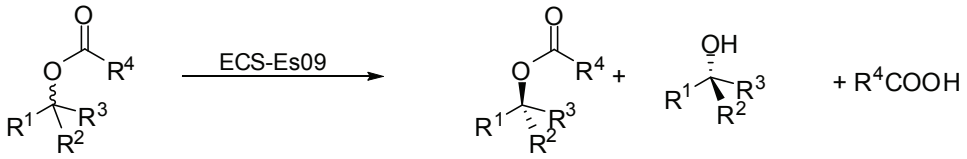
Comment: For quality assurance ECS-Es08 is tested against p-nitrophenyl acetate as standard substrate at 30°C and pH 7.5.

ECS-Esterase 09 - *Methylobacterium populi* (EC 3.1.1.1)

Properties:

- Acts on a range of tertiary alcohols in the kinetic resolution of racemic esters
- Optimum conditions: pH 8.0

Examples:



Stereoselective hydrolysis of tertiary alcohol esters by ECS-Es09.

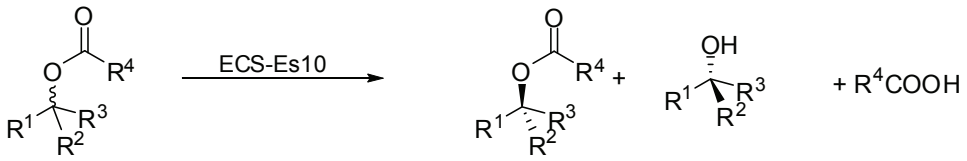
Comment: For quality assurance ECS-Es09 is tested against p-nitrophenyl acetate as standard substrate at 30°C and pH 7.5.

ECS-Esterase 10 - *Pelobacter propionicus* (EC 3.1.1.1)

Properties:

- Acts on tertiary alcohols in the kinetic resolution of racemic esters
- Optimum conditions: pH 7.5

Examples:



Stereoselective hydrolysis of tertiary alcohol esters by ECS-Es10.

Comment: For quality assurance ECS-Es10 is tested against p-nitrophenyl acetate as standard substrate at 30°C and pH 7.5.

Lipases

Product name	Origin	Catalog no.	Quantity	Price	Formulation
Lipases					
Lipase 01	microbial, rec. from *Pichia pastoris*	**ECS-LIP01**	50 mg or 0.50 ml	150 €	Solid [a)] Liquid-Aqu [c)]
			500 mg or 5.00 ml	580 €	Solid [a)] Liquid-Aqu [c)]
Lipase 02	microbial, rec. from *Bacillus subtilis*	**ECS-LIP02**	50 mg or 0.50 ml	150 €	Solid [a)] Liquid-Aqu [c)]
			500 mg or 5.00 ml	580 €	Solid [a)] Liquid-Aqu [c)]
Lipase 03	bacterial, rec. *Corynebacterium glutamicum*	**ECS-LIP03**	0.50 ml	150 €	Liquid-Aqu [c)]
			5.00 ml	580 €	Liquid-Aqu [c)]
Lipase 04	microbial, rec. from *E. coli*	**ECS-LIP04**	50 mg or 0.50 ml	150 €	Solid [a)] Liquid-Aqu [c)]
			500 mg or 5.00 ml	580 €	Solid [a)] Liquid-Aqu [c)]
Lipase screening kit	*rec. from different origins (contains all four lipases 0.50 ml each)*	**ECS-LIP-KIT**		580 €	Liquid-Aqu [c)]

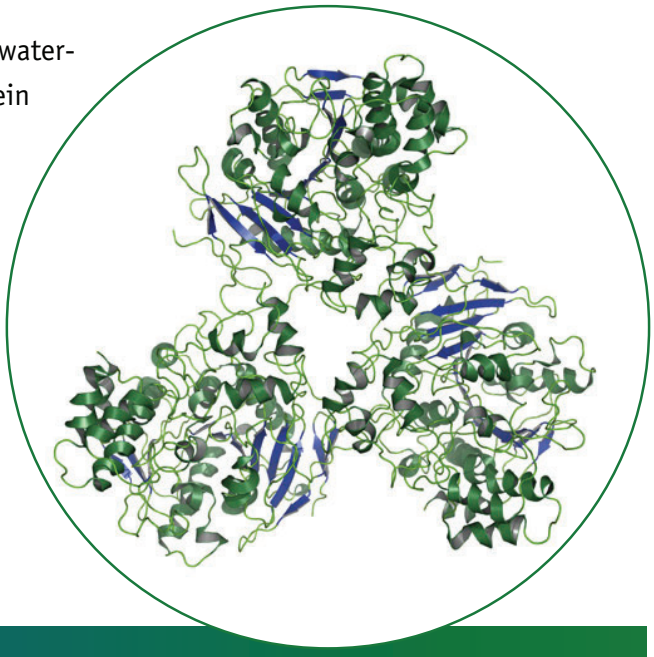
a) Lyophilized powder; c) Concentrated culture supernantant

Bulk amounts available.

For more information see chapter FAQ.

General properties

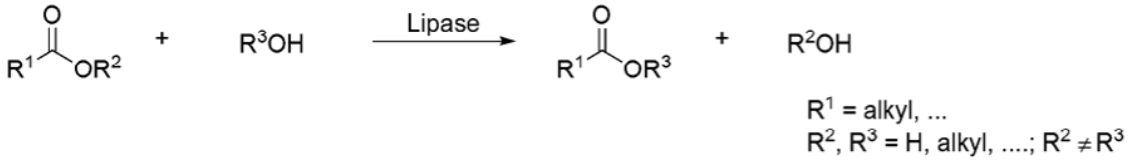
Lipases (EC 3.1.1.3) catalyze the hydrolysis of water-insoluble esters such as triglycerides like triolein to diolein. In addition, lipases also catalyze the hydrolysis of a broad range of natural and un-natural esters, while retaining high enantio- or regioselectivity. They require no cofactors and are simple to use. They act in water, biphasic and pure organic solvent systems as well as on water-insoluble substrates.



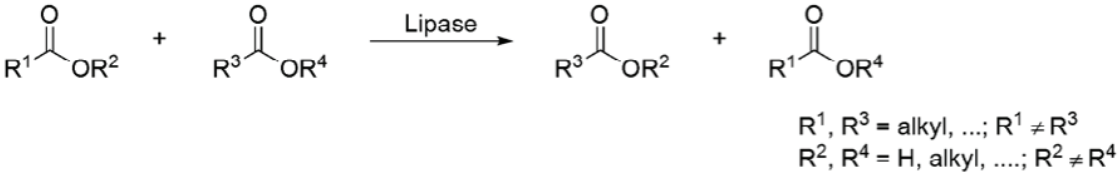
This combination of broad substrate range and high selectivity makes lipases an ideal catalyst for organic synthesis. Chemists use lipase-cata-lyzed biotransformations for regio- and sterio-selective transformation, to prepare enantiomerically-pure pharmaceuticals and synthetic intermediates, to protect and deprotect synthetic intermediates as well as for more specialized uses.
Examples for very well described lipase catalyzed reactions are hydrolysis, esterification, aminolysis in which the natural nucleophile – water – is replaced by an alcohol, hydroperoxide or amine. The lipase-catalyzed esterification reactions are among the most significant chemical and biochemical processes of industrial relevance due to an increased use of organic esters in biotechnology and the chemical industry.

Origins:
LIP01 *Candia antarctica*
LIP02 *Fusarium solani pisi*
LIP03 *Geobacillus thermoleovorans* IHI-91
LIP04 *Kurtzmanomyces spec.*

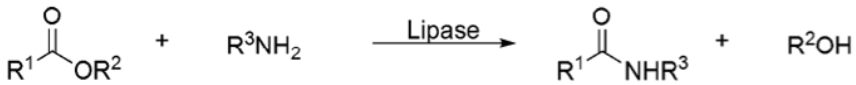
a) Hydrolysis or esterification



b) Transesterification



c) Aminolysis



Reactions catalyzed by lipases.

Further information can be found in:
Hydrolases in Organic Synthesis. U.T. Bornscheuer and R.J. Kazlauskas, Wiley online libary, 2nd edition (2006)

Baeyer-Villiger monooxygenases (BVMOs)

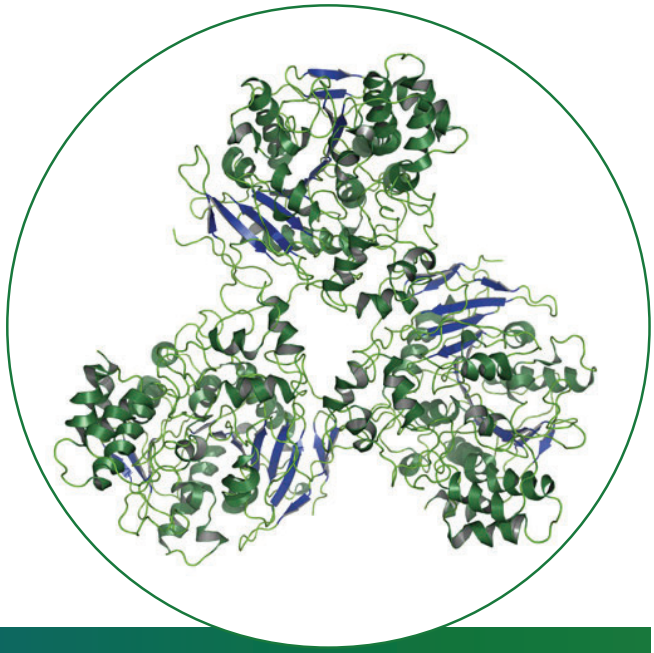
Product name	Origin	Catalog no.	Quantity	Price	Formulation
Bayer-Villiger monooxygenases					
BVMO 01	bacterial, rec. from *E. coli*	**ECS-Mo01**	50 mg or 0.50 ml	150 €	Solid [a)] Liquid-Gly [b)]
			500 mg or 5.00 ml	580 €	Solid [a)] Liquid-Gly [b)]
BVMO 02	bacterial, rec. from *E. coli*	**ECS-Mo02**	0.50 ml 5.00 ml	150 € 580 €	Liquid-Gly [b)]
BVMO 03	bacterial, rec. from *E. coli*	**ECS-Mo03**	0.50 ml 5.00 ml	150 € 580 €	Liquid-Gly [b)]
BVMO 04	bacterial, rec. from *E. coli*	**ECS-Mo04**	0.50 ml 5.00 ml	150 € 580 €	Liquid-Gly [b)]
BVMO 05	bacterial, rec. from *E. coli*	**ECS-Mo05**	0.50 ml 5.00 ml	150 € 580 €	Liquid-Gly [b)]
BVMO 06	bacterial, rec. from *E. coli*	**ECS-Mo06**	0.50 ml 5.00 ml	150 € 580 €	Liquid-Gly [b)]
BVMO screening kit	bacterial, rec. from *E. coli* (contains all six bacterial BVMOs 0.50 ml each)	**ECS-BVMO-KIT**		690 €	Liquid-Gly [b)]

a) Lyophilized powder

b) Liquid formulation with glycerin

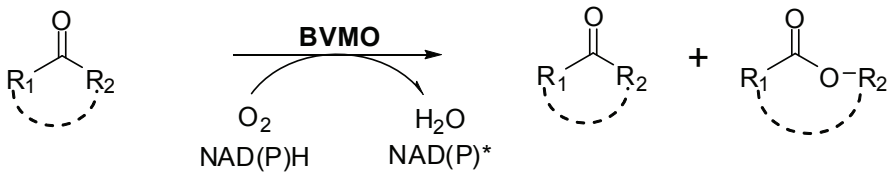
Bulk amounts available.

For more information see chapter FAQ.



General properties:

BVMOs are flavoenzymes and belong to the class of oxidoreductases. They catalyze the oxidation of linear, cyclic and aromatic ketones to esters or lactones, respectively, higly similar to the chemical Baeyer-Villiger oxidation. During the enzymatic oxidation one atom of molecular oxygen is incorporated into a carbon-carbon bond of a non-activated ketone, whereas the other oxygen atom ends up in a water molecule with the hydrogen atoms originating from the cofactor NAD(P)H.



BVMOs are typical soluble proteins and work without additional proteins. Furthermore these enzymes require NADH or NADPH as cofactors.

Further information can be found in:

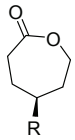
Monooxygenases, Baeyer-Villiger oxidations in organic synthesis. J. Rehdorf and U. T. Bornscheuer in Encyclopedia of Industrial Biotechnology. Flickinger, Michael C. (ed.). Wiley-VCH (2010)

ECS-BVMO 01 - *Acinetobacter calcoaceticus* (EC 1.14.13)

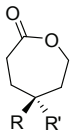
Properties:

- Baeyer-Villiger-Oxidation of aliphatic and alicyclic ketones
- High regio- and enantioselectivity
- NADPH-dependent

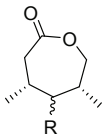
Examples:



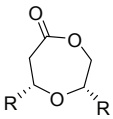
R = Me / 83%; ee >98% (-)
R = Et / 91%; ee 97% (-)
R = Pr / 80%; ee > 98% (-)
R = Cl, Br, I / >56%; ee >95% (-)



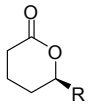
R = Me, Et' / 91%; ee 75% (-)
R = Et, OH'/ 54%; ee 94% (-)



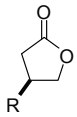
R = Cyclopropyl / 57%; ee >99% (+)
R = *cis*-OH / 88%; ee >98% (-)
R = trans-OH / 80%, ee >96%(+)



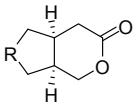
R = Me / 80%; ee >99% (-)
R = *Et* / 90%; ee >99% (-)



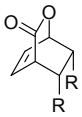
R = n-Hex / 32%; ee >98% (-)
R = *n-Undec* / 39%; ee >98% (-)
R = CH_2Oallyl / 33%; ee 93% (n.r.)



R = 4-Cl-Ph / 88%; ee 85% (+)
R = *3-MeO-Bn* / 83%; ee 96% (-)
R = 3,4-(OCH_2O)-Bn / 83%; ee 95% (-)



R = CH_2 / 50%; ee 89% (-)
R = *exo >CHOMe* / 40%; ee 96% (-)
R = *exo >CHCl* / 78%; ee >99% (-)



R = Me, Et / >70%; ee >93% (+)
R = CH_2OCH_2 / 74%; ee >98% (+)

Chiral products obtained from reactions catalyzed by ECS-Mo01 with isolated enzyme or whole cell systems.

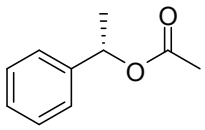
Comment: For quality assurance ECS-Mo01 is tested against cyclohexanone as standard substrate at 30°C and pH 8.5.

ECS-BVMO 02 - *Thermobifida fusca* (EC 1.14.13)

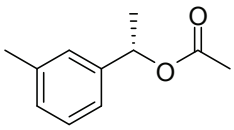
Properties:

- Baeyer-Villiger-Oxidation of aromatic and aliphatic ketones
- Able to perform sulfur oxidations
- Moderate thermostability
- High regio- and enantioselectivity
- NADPH-dependent

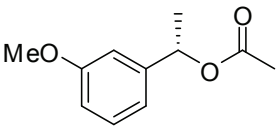
Examples:



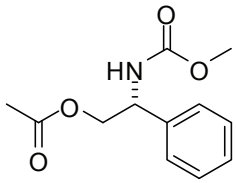
ee 98%



ee 97%



ee 95%



ee > 99%

Chiral products obtained from reactions catalyzed by ECS-Mo02 with isolated enzyme or whole cell systems.

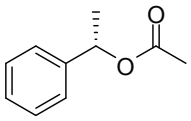
Comment: For quality assurance ECS-Mo02 is tested against benzylacetone as standard substrate at 30°C and pH 8.5.

ECS-BVMO 03 - *Thermobifida fusca* (EC 1.14.13)

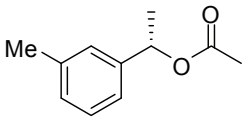
Properties:

- Baeyer-Villiger-Oxidation of aromatic ketones and amines
- Able to perform sulfur oxidations
- Moderate thermostability
- High regio- and enantioselectivity
- NADPH-dependent

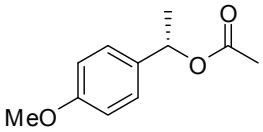
Examples:



ee 97%



ee 98%



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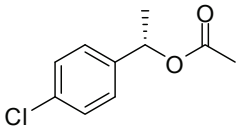
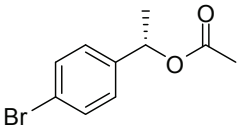




Chiral products obtained from reactions catalyzed by ECS-Mo03 with isolated enzyme or whole cell systems.

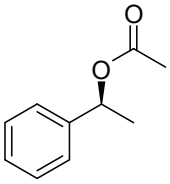
Comment: For quality assurance ECS-Mo03 is tested against benzylacetone as standard substrate at 30°C and pH 8.5.

ECS-BVMO 04 - *Pseudomonas putida* (EC 1.14.13)

Properties:

- Baeyer-Villiger-Oxidation of aromatic ketones
- Able to perform sulfur oxidations
- High regio- and enantioselectivity
- NADPH-dependent

Examples:



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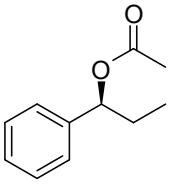
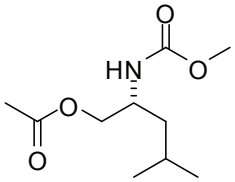
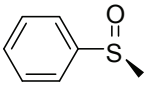
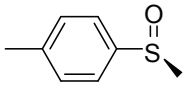


ee 99%





ee > 99%



ee > 99%

Chiral products obtained from reactions catalyzed by ECS-Mo04 with isolated enzyme or whole cell systems.

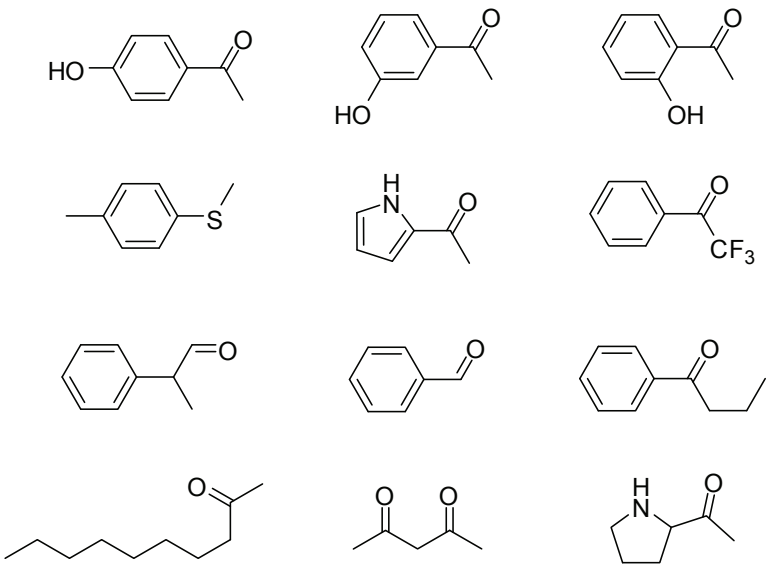
Comment: For quality assurance ECS-Mo04 is tested against 4-Hydroxyacetophenone as standard substrate at 30°C and pH 8.5.

ECS-BVMO 05 - *Pseudomonas fluorescens* (EC 1.14.13)

Properties:

- Baeyer-Villiger-Oxidation of aromatic ketones
- Able to perform sulfur oxidations
- High regio- and enantioselectivity
- NADPH-dependent

Examples:



Substrates converted by ECS-Mo05.

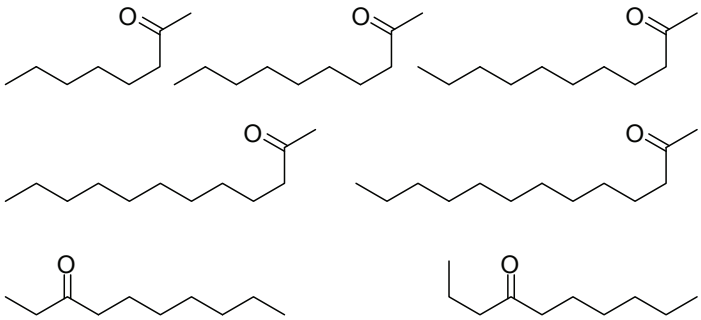
Comment: For quality assurance ECS-Mo05 is tested against 4-Hydroxyacetophenone as standard substrate at 30°C and pH 8.5.

ECS-BVMO 06 - *Pseudomonas veronii* (EC 1.14.13)

Properties:

- Baeyer-Villiger-Oxidation of linear ketones
- High regio- and enantioselectivity
- NADPH-dependent

Examples:



Substrates converted by ECS-Mo06.

Comment: For quality assurance ECS-Mo06 is tested against 4-Decanone as standard substrate at 30°C and pH 8.5.

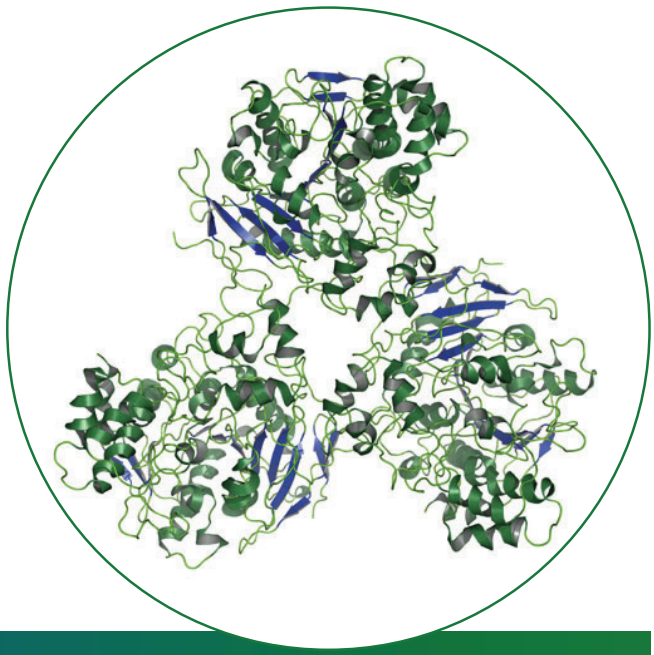
Amine Transaminases (ATAs)

Product name	Origin	Catalog no.	Quantity	Price	Formulation
Amine Transaminases					
Transaminase 01	eukaryotic, rec. from *E. coli*	**ECS-ATA01**	50 mg 500 mg	150 € 580 €	Solid [a)]
Transaminase 02	eukaryotic, rec. from *E. coli*	**ECS-ATA02**	50 mg 500 mg	150 € 580 €	Solid [a)]
Transaminase 03	eukaryotic, rec. from *E. coli*	**ECS-ATA03**	50 mg 500 mg	150 € 580 €	Solid [a)]
Transaminase 04	eukaryotic, rec. from *E. coli*	**ECS-ATA04**	50 mg 500 mg	150 € 580 €	Solid [a)]
Transaminase 05	eukaryotic, rec. from *E. coli*	**ECS-ATA05**	50 mg 500 mg	150 € 580 €	Solid [a)]
Transaminase 06	eukaryotic, rec. from *E. coli*	**ECS-ATA06**	50 mg 500 mg	150 € 580 €	Solid [a)]
Transaminase 07	bacterial, rec. from *E. coli*	**ECS-ATA07**	50 mg 500 mg	150 € 580 €	Solid [a)]
Transaminase 08	bacterial, rec. from *E. coli*	**ECS-ATA08**	50 mg 500 mg	150 € 580 €	Solid [a)]
ATA screening kit	rec. from *E. coli* (contains all eight ATAs 50 mg each)	**ECS-ATA-KIT**		990 €	Solid [a)]
ATA-kit „Ready to use“ available upon request					

a) Lyophilized powder

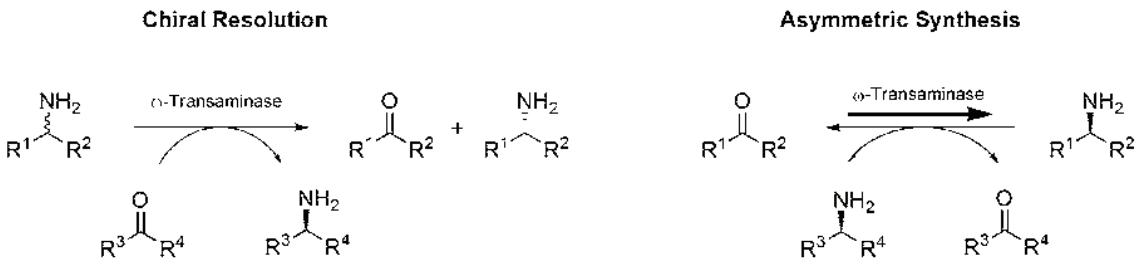
Bulk amounts available.

For more information see chapter FAQ.



General properties:

Amine transaminases catalyze the transfer of an amino group from a primary amine to a pro-chiral ketone (or aldehyde). Amine transaminases are highly enantioselective and therefore can be used for the resolution of racemic amines or the synthesis of chiral amines from inexpensive ketones.



ATAs are pyridoxal-5'-phosphate dependent enzymes and their substrate range includes alkyl and aromatic amines, amino acids, amino esters and amino alcohols. Typical amine donors are: alanine, ethylamine, 1- and 2-propylamine, 1- and 2-butylamine and others. Our recombinant microbial expression platform ensures stable quality and easy production scale-up.

Final formulation can be adapted to meet the production process requirements.

Further information can be found in:

Höhne, M., Bornscheuer, U.T. , Biocatalytic routes to optically active amines, ChemCatChem, 1, 42-51, (2009).

ECS-Transaminase 01-08 (EC 2.6.1)

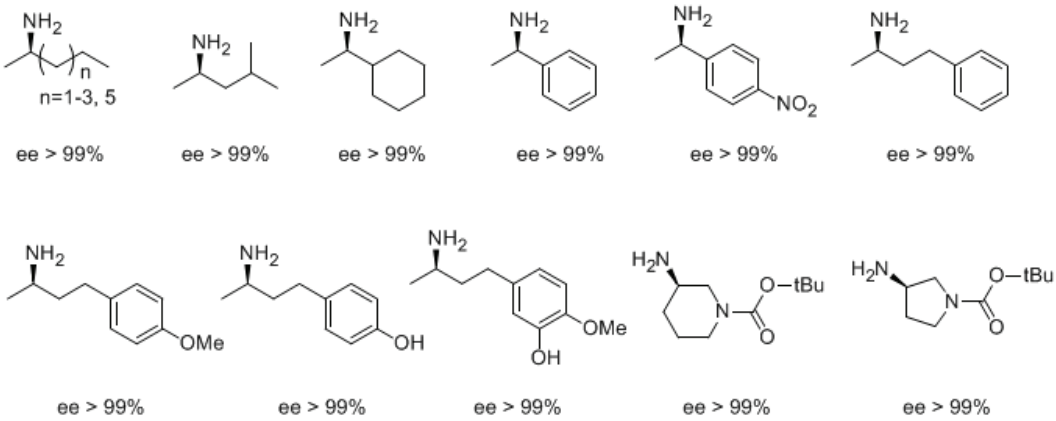
Properties:

- Catalytic tool box for the evaluation of synthesis routes
- ATA01-07 strict (*R*)-selective, ATA08 strict (*S*)-selective
- Conversion of aliphatic, arylaliphatic and aromatic ketones

Origins:

ATA01	*Aspergillus fumigatus*	ATA02	*Gibberella zeae*	ATA03	*Neosartorya fischeri*
ATA04	*Aspergillus oryzae*	ATA05	*Aspergillus terreus*	ATA06	*Penicillium chrysogenum*
ATA07	*Mycobacterium vanbaalenii*	ATA08	*Silicibacter pomeroyi*		

Examples:



Chiral products obtained by asymmetric synthesis catalyzed by ECS-ATAs.

Comment: For quality assurance ATA01-07 are tested against (*R*)-1-phenylethanamine at pH 7.5 and ATA08 against (*S*)-1-phenylethanamine as standard substrate at pH 9.5 and 25°C.

"Ready to use" kit for asymmetric synthesis of chiral amines from ketones:
The kit contains seven diverse catalysts, co-factors and co-substrates, reaction buffer, the needed enzyme cascade for an equilibrium shift and a well described protocol to perform the asymmetric synthesis of (*R*)-amines in less than 10 easy-to-perform steps.

The "Ready to use" screening kit and more ATAs are available upon request.

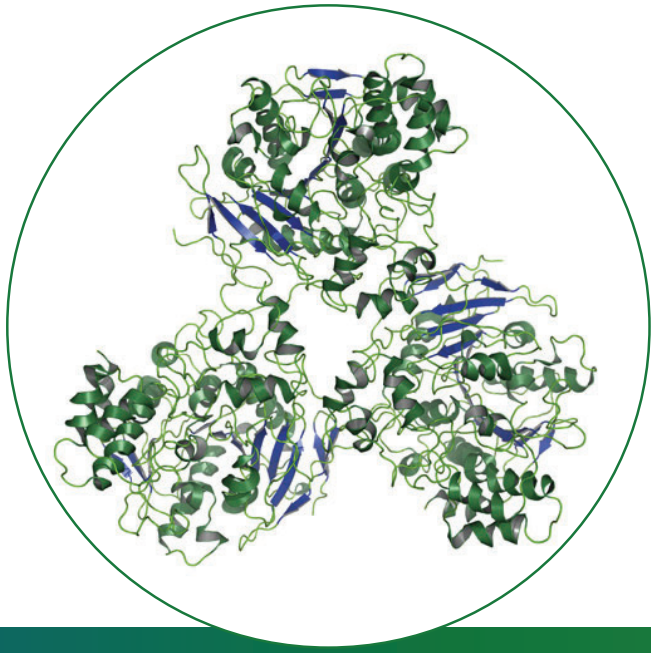
Imine Reductases (IREDs)

Product name	Origin	Catalog no.	Quantity	Price	Formulation
Imin Reductases					
Imin Reductase 01	bacterial, rec. from *E. coli*	**ECS-IRED 01**	0.50ml	150 €	Liquid-Gly [b)]
			5.00ml	580 €	
Imin Reductase 02	bacterial, rec. from *E. coli*	**ECS-IRED 02**	0.50ml	150 €	Liquid-Gly [b)]
			5.00ml	580 €	
Imin Reductase 03	bacterial, rec. from *E. coli*	**ECS-IRED 03**	0.50ml	150 €	Liquid-Gly [b)]
			5.00ml	580 €	
Imin Reductase 04	bacterial, rec. from *E. coli*	**ECS-IRED 04**	0.50ml	150 €	Liquid-Gly [b)]
			5.00ml	580 €	
IRED screening kit	bacterial, rec. from *E. coli* (contains all four IREDs 0.50ml each)	**ECS-IRED-KIT**		580 €	Liquid-Gly [b)]

b) Liquid formulation with glycerin

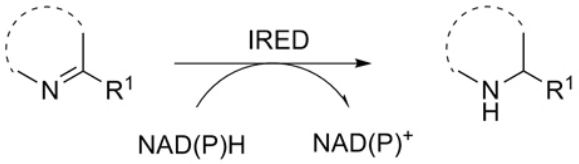
Bulk amounts available.

For more information see chapter FAQ.



General properties:

Enzymatic asymmetric imine reduction is a promising alternative for the synthesis of chiral amines. Imine reductases (IREDs) catalyze the reduction of imines to amines by using NAD(P)H as a hydride source. These enzymes are classified as EC 1.5.1.48, alongside other enzymes with imine-forming and imine-reducing activity.



The transformation of prochiral imines to chiral amines using IREDs offer quantitative asymmetric route to amine products of high optical purity. So these enzymes can have a valuable complementary role to play in chiral amine synthesis.

Further information can be found in:

Gamenara, U. and Domínguez de María, P., Enantioselective imine reduction catalyzed by imine reductases and artificial metalloenzymes, Organic & Biomolecular Chemistry, 2014,12, 2989-2992

ECS- Imine Reductases 01-04 (EC 1.5.1.48)

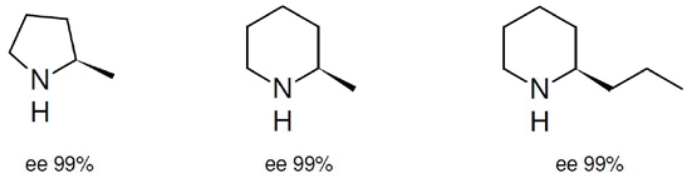
Properties:

- Accept cyclic and acyclic substrates
- IRED01 and IRED02 are (*R*)-selective towards the standard substrate 2-Methyl-1-pyrroline
- IRED03 and IRED04 are (*S*)-selective towards the standard substrate 2-Methyl-1-pyrroline

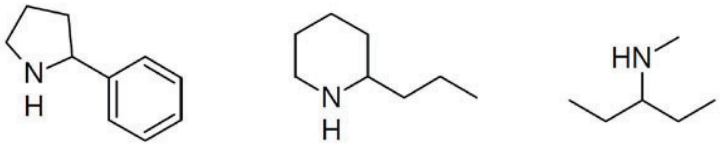
Origins:

IRED01 *Streptomyces sp.* GF3587	IRED02 *Streptomyces ipomoeae* 91-03
IRED03 *Streptomyces sp.* GF3546	IRED04 *Paenibacillus elgii* B69

Examples:



Chiral products obtained by asymmetric reduction catalyzed by ECS-IREDs



Substrates converted by ECS-IREDs

Comment: For quantitative assurance IRED01-04 are tested against 2-Methyl-1-pyrroline as standard substrate at pH 7.5 in presence of NADPH. **Mutants with changed cofactor specificity are available upon request.**

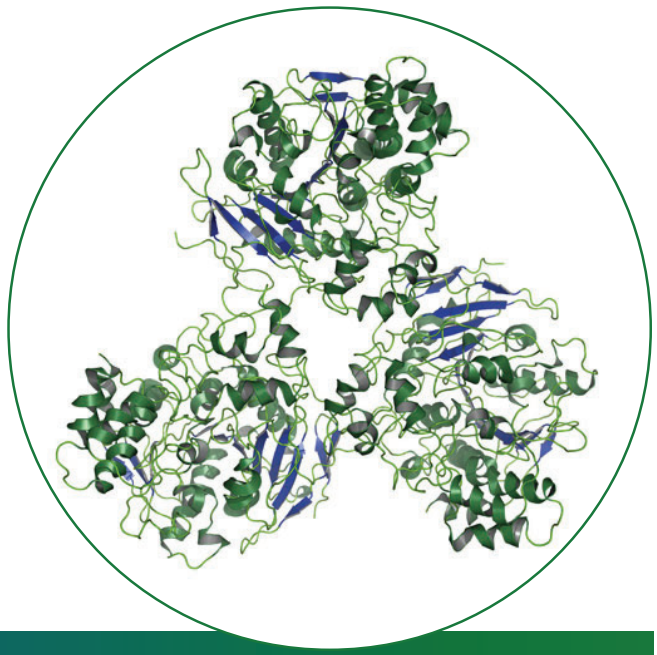
Halohydrin Dehalogenases (HHDHs)

Product name	Origin	Catalog no.	Quantity	Price	Formulation
Hylohydrin Dehalogenases					
HH-Dehalogenase 01	bacterial, rec. from *E. coli*	**ECS-HHDH01**	50 mg 500 mg	150 € 580 €	Solid [a)]
HH-Dehalogenase 02	bacterial, rec. from *E. coli*	**ECS-HHDH02**	50 mg 500 mg	150 € 580 €	Solid [a)]
HH-Dehalogenase 03	bacterial, rec. from *E. coli*	**ECS-HHDH03**	50 mg 500 mg	150 € 580 €	Solid [a)]
HH-Dehalogenase 04	bacterial, rec. from *E. coli*	**ECS-HHDH04**	50 mg 500 mg	150 € 580 €	Solid [a)]
HH-Dehalogenase 05	bacterial, rec. from *E. coli*	**ECS-HHDH05**	50 mg 500 mg	150 € 580 €	Solid [a)]
HH-Dehalogenase 06	bacterial, rec. from *E. coli*	**ECS-HHDH06**	50 mg 500 mg	150 € 580 €	Solid [a)]
HH-Dehalogenase 07	bacterial, rec. from *E. coli*	**ECS-HHDH07**	50 mg 500 mg	150 € 580 €	Solid [a)]
HH-Dehalogenase 08	bacterial, rec. from *E. coli*	**ECS-HHDH08**	50 mg 500 mg	150 € 580 €	Solid [a)]
HH-Dehalogenase 09	bacterial, rec. from *E. coli*	**ECS-HHDH09**	50 mg 500 mg	150 € 580 €	Solid [a)]
HHDH screening kit	rec. from *E. coli* (contains all nine HHDHs 50 mg each)	**ECS-HHDH-KIT**		1.080 €	Solid [a)]
HHDH-kit „Ready to use“ available upon request					

a) Lyophilized powder

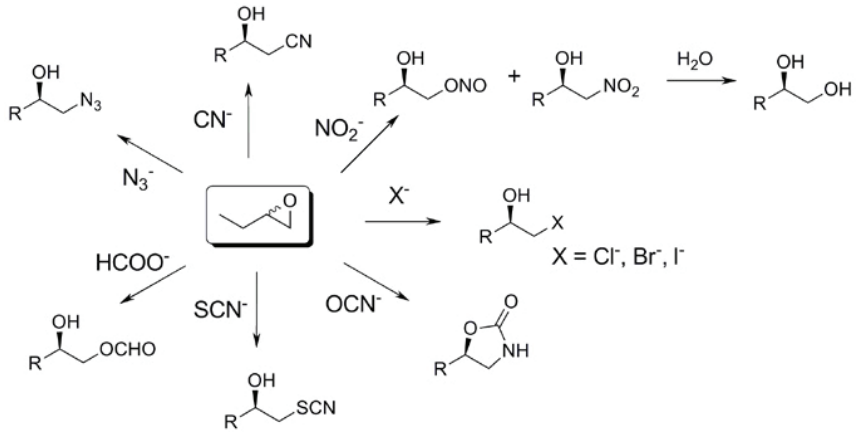
Bulk amounts available.

For more information see chapter FAQ.



General properties:

Halohydrin dehalogenases are enzymes that convert vicinal halohydrins to an epoxide, a halide ion, and a proton. The conversions catalyzed by halohydrin dehalogenases are reversible, depending on the nature of the leaving group. In the reverse (epoxide-ring opening) reaction various alternative negatively charged nucleophiles can be accepted, such as cyanide and azide. Thus a wide range of reactions can be carried out.



Catalytic scope of halohydrin dehalogenase-catalyzed epoxide-ring opening of 1,2-epoxybutane and various nucleophiles.

Thus, products of this enzymatic reactions are enantiomerically pure compounds (a chiral epoxide and a chiral b-sub. Alcohol) which can be used as chiral building blocks for the production of a wide range of chemicals.

Final formulation can be adapted to meet the production process requirements.

Further information can be found in:

Zhong-Yu You et al, Properties and biotechnological applications of halohydrin dehalogenases: current state and future perspectives, Applied Microbiology and Biotechnology, 2013, 97 (1), pp 9-21

ECS-Halohydrine Dehalogenase 01-09 (EC 4.5.1.-)

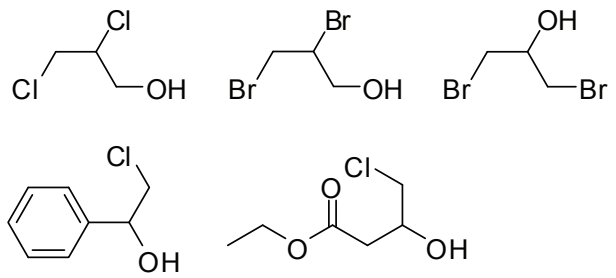
Properties:

- Catalytic tool box for the evaluation of synthesis routes
- Reversible dehalogenation of beta-haloalcohols under epoxide formation
- Formation of novel carbon-carbon, carbon-nitrogen, or carbon-oxygen bonds
- Promiscuous epoxide ring-opening activity
- Cyanide, azide, or nitrite are accepted as nucleophiles

Origins:

HHDH01	*Tistrella mobilis*	HHDH02	Marine metagenome
HHDH03	*Methylibium petroleiphilum*	HHDH04	Marine metagenome
HHDH05	*Thauera sp.*	HHDH06	Marine metagenome
HHDH07	*Gamma proteobacterium*	HHDH08	*Parvibaculum lavamentivorans*
HHDH09	uncultured bacterium		

Examples:



Substrates converted by ECS-HHDH 01-09.

Comment: For quality assurance HHDH01-09 are tested against 1,3-Dichloro-2-propanol as standard substrate at pH 8.2 and 30°C.

"Ready to use" kit for fast investigation and screening of substrate scope:
The kit contains nine diverse catalysts, substrates, reaction buffer, the needed indicator for detecting a ph-shift during the dehalogenation of haloalcohols to epoxides and a well described protocol to perform the screening in less than 10 easy-to-perform steps.

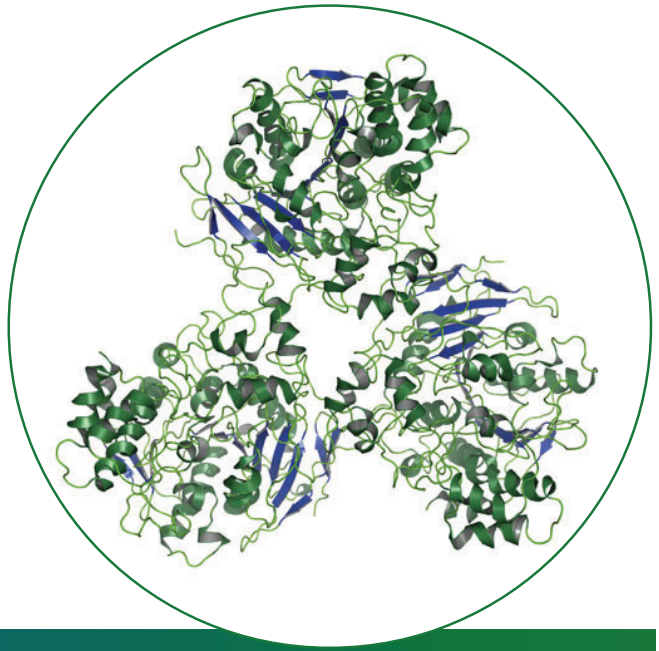
The "Ready to use" screening kit and more HHDHs are available upon request.

Phosphotransferases

Product name	Origin	Catalog no.	Quantity	Price	Formulation
Hylohydrin Dehalogenases					
Phosphotransferase 01	bacterial, rec. from *E. coli*	**ECS-PTF01**	0.50 ml	150 €	Liquid-Gly [b)]
			5.00 ml	580 €	
Phosphotransferase 02	bacterial, rec. from *E. coli*	**ECS-PTF02**	0.50 ml	150 €	Liquid-Gly [b)]
			5.00 ml	580 €	
Phosphotransferase 03	bacterial, rec. from *E. coli*	**ECS-PTF03**	0.50 ml	150 €	Liquid-Gly [b)]
			5.00 ml	580 €	

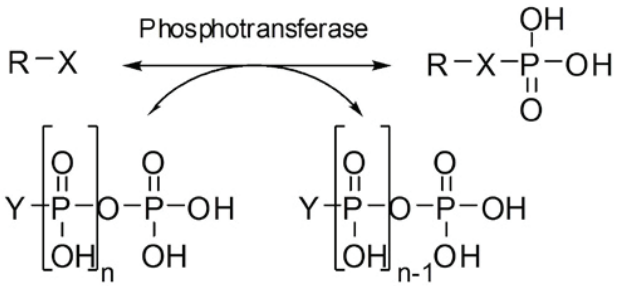
a) Liquid formulation with glycerin

For more information see chapter FAQ.



General properties:

Phosphotransferases (EC 2.7) catalyzes the transfer of phosphate groups from phosphate-donating molecules to specific substrates. This process is known as phosphorylation, where the substrate gains a phosphate group and a specific donor molecule provides a phosphate group.



The sub-category phosphotransferase is divided up in categories based on the type of group that accepts the transfer. Groups that are classified as phosphate acceptors include: alcohols, carboxy groups and nitrogenous groups. Important constituents of this subclass of transferases are various kinases which are types of phosphotransferases that transfers a phosphate group from ATP to a substrate.

Further information can be found in:

Biocatalytic Phosphorylation of Metabolites. Dominik Gauss, Bernhard Schönenberger, Getachew S. Molla, Birhanu M. Kinfu, Jennifer Chow,, Andreas Liese, Wolfgang R. Streit, and Roland Wohlgemuth in Applied Biocatalysis: From Fundamental Science to Industrial Applications WILEY-VCH (2016)

ECS- Phosphotransferases 01-05 (EC 2.7.x.x)

Properties:

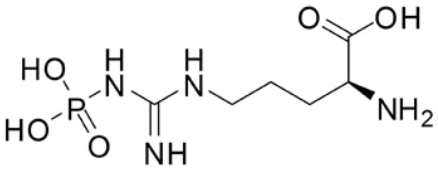
- PTF01 (EC 2.7.3.3) Catalyzes the synthesis of N(omega)-phospho-L-arginine using ATP as donor
- PTF02 (EC 2.7.1.27) Catalyzes the synthesis of D-erythritol 4-phosphate using ATP as donor
- PTF03 (EC 2.7.1.71) Catalyzes the synthesis of shikimate 3-phosphate using ATP as donor

Origins:

PTF01 *Limulus polyphemus*	PTF02 *Brucella abortus*
PTF03 *E. coli*	

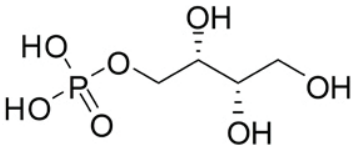
Examples:

PTF01 – Arginine- Kinase



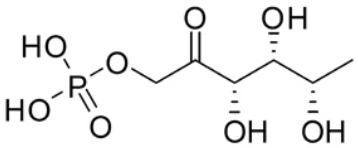
N(omega)-phospho-L-arginine

PTF02 – Erythritol -Kinase



D-erythritol 4-phospahate

PTF03 – Shikimat-Kinase



L-rhamnulose 1-phosphate

Comment: For quality assurance ECS-PTF01-03 are tests against their corresponding standard substrate at pH 7.5 and 25°C by the use of a coupled enzymatic assay system with phospho-enolpyruvate, pyruvatkinase and lactatdehydrogenase and photometric measurement of NADH consumption. Robust standard operation procedures are provided with each delivery.

Other enzymes

Product name	Origin	Catalog no.	Quantity	Price	Formulation
Other Enzymes					
Aminoacylase 01	eukaryotic, rec. from *E. coli*	**ECS-Ac01**	50 mg	150 €	Solid [a)]
			500 mg	580 €	
Aminoacylase 01-M1	eukaryotic, rec. from *E. coli*	**ECS-Ac01-M1**	50 mg	140 €	Solid [a)]
			500 mg	550 €	

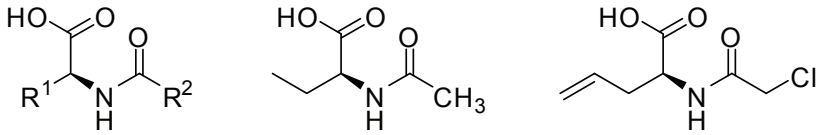
a) Lyophilized powder
Bulk amounts available.
For more information see chapter FAQ.

ECS-Aminoacylase 01 - *Sus scrofa* (EC 3.5.1.14)

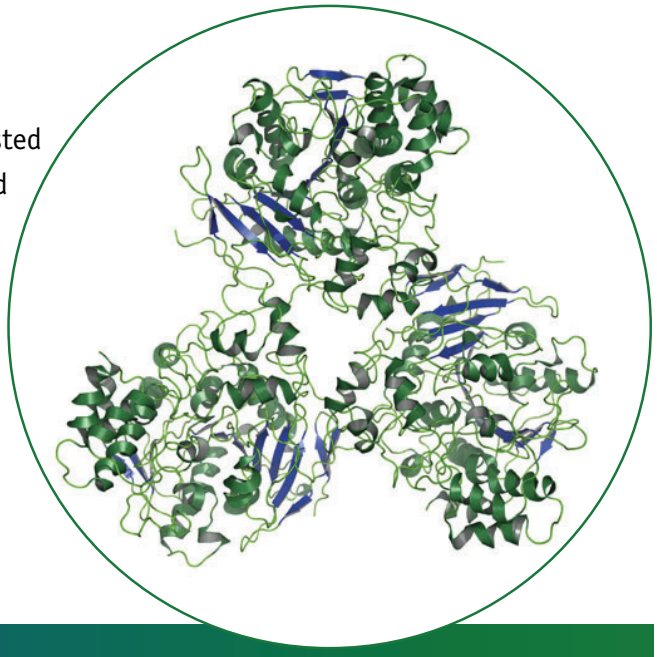
Properties:

- Catalyzes the stereospecific deacylation of racemic N-acylated amino acids
- Optimum conditions: 37°C, pH 7-8

Examples:



Substrates hydrolyzed by ECS-Ac01.



Comment: For quality assurance ECS-Ac01 is tested against N-furylacryloyl-L-methionine as standard substrate at 30°C and pH 7.5.

Mutant ECS-Ac01-M1 with activity towards *para*-amino substituted benzoylamino acids is available.

Solution and Services

The team of Enzymicals AG is always looking forward to working with you and committed to find the best solution for your task in biotechnology. Our service covers the whole value chain towards a tailor-made process for a special application.

We offer:

- **In-house enzyme screening**
  We screen your substrate to find out the most suitable enzyme for your desired reaction. For this, we use our catalog- and our internal enzyme-portfolio. Additional we can integrate enzyme collections commercial available from third parties.
- **Protein Expression Service**
  This is a tailor-made protein expression and expression optimization service for the recombinant production of rarely or commercial not available proteins. This service can include assaying the functionality of the obtained protein by adaptation of specific assay methods.
- **Custom Synthesis**
  We offer custom synthesis of chiral building blocks and specialty chemicals with a production capacity from analytical to kilogram scale. The production capacity can be extended to multi ton scale within our network.
- **Custom Research Service**
  This project-based service includes literature research, individual route scouting for the synthesis of your desired compounds, feasibility studies, reaction optimization, scale up and piloting of complete processes orientated on your demands.

Please contact us if you have any questions!

+49 (0)3834 515 470
info@enzymicals.com

Enzymical®
Enzymes | Chemicals | Solutions

Offer Form

To inquire an formal offer please fill in this form and send it by mail to:

Enzymicals AG
Walther-Rathenau-Straße 49a
D-17489 Greifswald
Germany

Telephone: +49 (0)3834-515-470
e-mail: info@enzymicals.com
web: www.enzymicals.com

Request for formal offer:

catalog no.	product name	quantity	price (€)	total price (€)

bulk quantities on request

delivery address:	billing address:
name	name
company institute	company institute
address	address
country	country
telephone number	telephone number
e-mail	e-mail
	VAT-number

For shipping and payment details see FAQ & TAC.

signature:

date

signature (company stamp)

Enzymical®
Enzymes | Chemicals | Solutions

Order Form

To place an order please fill in this form and send it by mail or fax to:

Enzymicals AG
Walther-Rathenau-Straße 49a
D-17489 Greifswald
Germany

Telephone: +49 (0)3834-515-470
Fax.: +49 (0)3834-515-473
e-mail: info@enzymicals.com
web: www.enzymicals.com

order:

catalog no.	product name	quantity	price (€)	total price (€)

bulk quantities on request

delivery address:

name
company
institute
address
country
telephone number
e-mail

billing address:

name
company
institute
address
country
telephone number
e-mail
VAT-number

For shipping and payment details see FAQ & TAC.

signature:

date

signature (company stamp)

FAQ

How the enzymes and chemicals will be shipped?

The enzymes and chemicals will be shipped preferred via FedEx. Other authorized services are possible. Insensitive enzymes are shipped with cool packs. Sensitive enzymes and chemicals are shipped with the „FedEx international Priority Alert+“ service. For this we use cold shipping packages with 96 hour duration. We prefer to ship our goods in the beginning of a week. If you are interested, you can organize the shipment yourself or you can provide e.g. your courier account number to use your own special service and conditions.

How much is shipping?

The price depends on the destination, the costs for package and kind of shipping service. These costs are shown separately in the offer and the invoice. The enzyme prices in the catalog do not include the cost of packaging and shipment.

What about the duty payments?

The import duties are to be paid by the recipient.
It would be very helpful if you inform us if country-specific documents are needed.

Do discounts apply to large orders / bulk enzymes?

Dependent on the size of the order, and the product(s) involved, large order / bulk enzyme discounts may be available (please enquire to info@enzymicals.com).

What purity have the enzymes?

All enzymes are formulated as GMO free crude protein extracts. Other purities are available on request.

What formulation have the enzymes?

Our standard formulations are:
a) Lyophilized powder of soluble protein fraction
b) Liquid formulation of soluble protein fraction with glycerin
c) Concentrated liquid aqueous culture supernatant

If you prefer other formulations please let us know.

Are Variants of the Enzymes available?

Mutants with enhanced substrate specificity and/or increased stereoselectivity towards appropriate substrates are available upon request. Please contact us for more information about enzymes with available mutants or mutants libraries.

What do I do if I require technical assistance?

Technical queries should be submitted by email and will are answered within a few days (please enquire to info@enzymicals.com).

Are the products of animal origin as defined for import / export restrictions?

Our products are recombinant enzymes and not derived from animals.

Is an activity-screening with my special substrate possible?

Enzymicals offer on request an in-house screening with suitable enzyme classes about all available enzymes from public or private panel. The price of this screening depends from the kind of the usable assay and necessary analytics and number of used enzymes.

How can I get access to the other enzymes from the enzyme panel of Enzymicals and the private enzyme collections?

The majority of the enzymes from our private panel are for exclusive projects between our costumer and Enzymicals AG. For this we have to initiate a customized project and all steps, including the screening (with the real or artificial substrates), has to be performed in our labs. After identification of a positive hit the particular catalyst will be exclusively out-licensed for your application.

The enzymes from the public panel which are not incorporated in our current catalog can be provided after signing a material transfer agreement. Another opportunity is a screening with your substrate at Enzymicals. In both cases we have to negotiate the conditions for the commercial application of the identified suitable enzyme.

Can I get additional enzymes outside your panels?

Yes - Enzymicals offers a comprehensive expression service for enzymes on your demand.

What information are necessary for a formal offer or for an order?

Please complete the form “request for an offer” respectively “request for an order” and send it by email to info@enzymicals.com or by fax to +49 (0)3834 515473.

Terms and Conditions

§ 1 General

(1) These terms and conditions are the basis of all offers, supplies and services of Enzymicals AG. Conflicting or additional terms and conditions of the customer are denied. They will become part of a contract only if Enzymicals AG agreed to their inclusion in written form.

(2) These general terms and conditions have been built in the German language. Any English translati on is made available for reading purposes only and the German version prevails in case of any discrepancies in the wording.

§ 2 Offer and capacity

(1) All offers of Enzymicals AG are non-binding and subject to change. The scopes of supplies or services are defined by the written order confirmation of Enzymicals AG. If none exist, the offer of Enzymicals AG is relevant.

(2) The supply of a product or contribution of a service by Enzymicals AG does not include any agreement for the use of intellectual property of Enzymicals, embodied or related to the product or service.

§ 3 Prices and terms of payment

(1) Prices of Enzymicals AG are non-binding and represent only net ex-work values, excluding packing, shipping or transport, customs duty, taxes and insurance expenses (Incoterm: EXW).

(2) If any supply is made on the basis of scheduled prices of Enzymicals AG and the delivery takes place more than three months after signing of the agreement the scheduled prices at the time of delivery are relevant.

(3) In case of increase of costs, Enzymicals AG reserve a proportional addition to agreed prices. This also includes current orders.

(4) Invoices have to be paid within 14 days starting from the date of issue.

(5) After this mentioned time limit a delay of payment accrues. During the delay of payment the full debt is charged with interests at the legal interest-rate for delay of payment. We are entitled to charge a higher damage caused by the delay.

(6) In case of delay of payment of more than 30 days or of more than 5,000.00 €, cessation of payment or in case of a known substantial debasement of the economic situation of the customer, which might compromise the pecuniary claim of Enzymicals AG we are entitled to request immediate payment, return of already adduced services, to request advance payments or to retain outstanding supplies.

(7) Credits are given exclusively for compensations. A claim on reimbursement does not exist.
(8) Enzymicals is not obliged to accept drafts.
(9) The exchange rates at date of invoicing are relevant if payments are made in other currencies than EURO.
(10) Payments are considered as complete on the day at which Enzymicals AG received the invoiced amount.
(11) The customer shall have no right to set-off counterclaims and the retention of payments, except counterclaim has not been disputed or been determined by a final and binding decision.

§ 4 Reservation of title

(1) Enzymicals AG retains legal title to any good or service supplied by us until current or future accounts for such product has been fully paid.
(2) The customer is not be entitled to pledge or to transfer for security reasons any good or service supplied by Enzymicals AG which is under retention of title. The customer has to inform us in written form immediately if any third party occupies our goods.
(3) In case of breach of contract by the customer, in particular nonpayment, we are entitled to terminate the contract by law and to demand our goods or services due to our retention of title. In the case of nonpayment we are not entitled before the customer failed to pay within a given time limit, except a time limit is legally expendable.
(4) The customer is entitled to resell and/or manufacture products delivered by us which are under retention of title in the ordinary course of its business. In that case the following rules apply:
    a) The retention of title comprises also the goods originated by manufacture, mixture or combination in the full amount. Enzymicals will be seen as the producer. If in that case any title of a third party remains, we acquire co-property in the equal ratio as the value of the manufactured, mixed or combined goods. Apart from that we stipulate the same retention of title as for the originated goods.
    b) The customer hereby assigns to us any claims arising from any resale in the full amount or the ratio mentioned above for security reasons. We accept the assignment. The obligation mentioned in paragraph 4 (2) applies also for the assigned claims.
    c) The customer is authorized to assert the claims assigned to us. We commit ourselves not to assert the claim as long as no nonpayment occurs, no application for insolvency proceedings were made or none other fault of financial capacity occurs. If any of the latter applies the customer is obliged to inform us about its debtors and to give us all information and do cuments to assert the claims. In that case the customer is also obliged to inform his debtors about the assignment.
    d) If the value of our securities exceeds the amount of our claims by more than 10% we resign on securities in our own choice if the customer demands.

§ 5 Period of time for deliveries or services

(1) Indicated delivery times, starting from the confirmation date of order, are non-binding, unless a fixed period or a fixed date is given in a quote or agreed in a specific contract.

(2) Terms for delivery and dates of delivery refer to the time of delivery by the third party who is in charge of transport if a shipment was agreed in a contract.

(3) Delays by circumstances which Enzymicals AG is not responsible for (force majeure, unpredictable obstacles, delay through no fault by a preliminary distributor) do not qualify for compensation.

(4) In case of framework agreements the obligation of Enzymicals AG to supply expires if the customer does not perform requests in agreed periods and quantities. Enzymicals AG is still authorized to request the takeover of goods or to claim compensation, even after expiration of the agreed period of time.

(5) If Enzymicals AG delays with a supply or service, or a supply and a service becomes unfeasible, for any reason ever, then the liability of Enzymicals AG is limited to the compensation stated in § 9 of the present terms and condition.

§ 6 Transfer of risk

(1) The delivery takes place at the risk of the customer. The risk shall pass to customer as soon as the delivery has left Enzymicals AG registered place of business.

(2) If the delivery is delayed due to circumstances, which the customer is responsible for, the risk passes over to the customer from the day of readiness of the shipment completion. Enzymicals AG is willing to insure the shipment at the expanse of the customer if requested by the customer.

§ 7 Shipping, packing, commercial sample

(1) Shipment is carried out via a transport company of our choice.

(2) The packing is calculated at lowest prices and will not be taken back.

(3) In case of abandonment of commercial samples by Enzymicals AG to the customer, the customer is obligated to use these samples exclusively for internal evaluation and/or test purposes. A commercial utilization or use is prohibited. In particular the customer does not have the right to sell and/or distribute these samples to third parties.

§ 8 Receipt

(1) The customer is obligated to accept contractual goods.

(2) Enzymicals AG is authorized to withdraw from the contract and/or to request compensations or to supply a similar type of products in an appropriate delivery time to agreed conditions, after setting an extension time limit of 14 days, if the customer comes into delay with receipt of goods. Any additional arising expenses are charged to the customer.

(3) The customer/recipient is committed to examine contents of shipments immediately for transport or other damages and to get possible damage confirmed, to ensure any claims.
(4) Aberrations in order quantities of up to 5% have to be accepted.
(5) Returns will only be accepted by Enzymicals AG on request with the delivery number given by Enzymicals AG.
(6) Partial deliveries are allowed, unless agreed otherwise.

§ 9 Liability

(1) Periods of time are relevant as specified in offers or catalogs or other media.
(2) The liability of Enzymicals AG on compensation is limited as follows:
    a) For damages of property up to 100,000 EURO per damaging event, but not exceeding a total amount of up to 300,000 EURO per contract;
    b) The liability for financial loss is limited to a total amount of up to 300,000 EURO per contract;
    c) claims for lost profits are excluded.
(3) If Enzymicals AG provides technical information or acts consultative and these information and consulting services are not defined in a contract in a written form, this is done without charge and without any liability of Enzymicals AG.
(4) Liability of Enzymicals AG is excluded if damages result from improper handling, particularly incorrect storage, and/or application of supplied goods and products in household and/or at humans and animals.
(5) Liability for material defects does not refer to natural wear and tear or to damage resulting from improper use.
(6) Any other claims such as conversion, reduction, reimbursement of damages as well as payments of contractual penalties are excluded except for obligatory subject to provisions of Product Liability Act.

§ 10 Warranty

(1) The warranty depends on a promptly upon delivery inspection to the product by the costumer with due care. The delivered product shall be deemed to be approved by the costumer unless the defect is notified to us in (i) case of any obvious defects within a period of one week upon delivery or otherwise (ii) within a week from the day when the defect has been identified. It is adequate to keep the term to send off the notice timely. If the customer misses this time limit our warranty is excluded in relation to the non-notified defect.
(2) Enzymicals AG assumes no liability for any statements of manufacturers or third parties (e.g. advertising statements).
(3) In general the warranty period is 12 months starting from the date of delivery.

(4) In case stability or minimum durability for an object of agreement shorter than 12 months is pointed out in a contract, warranty is only effective for the stated stability period or minimum durability period.
(5) The customer has to give an opportunity to Enzymicals AG to examine the object of agreement if the customer claims a material defect.
(6) Enzymicals AG will correct defects of products or services supplied by Enzymicals AG briefly or will provide a replacement, by Enzymicals AGs own choice. Contribution claims exist only to the legal extent.
(7) In case of products, which Enzymicals AG sells as a distributor, warranty conditions of the manufacturer are legally binding.

§ 11 Copyrights and related rights

(1) All documents of Enzymicals AG handed out to the customer by Enzymicals AG subject to the copyright of Enzymicals AG.
(2) Products supplied by Enzymicals AG are protected by intellectual properties by Enzymicals AG.
(3) The customer is only allowed to use goods/products, cost estimates, charts and other documents for the purpose according to the agreement. Any exceeding transfer to third parties or any other type of use, especially for reconstruction, is allowed only with a prior agreement of Enzymicals AG.
(5) An evaluation or a publication of an existing business relationship with Enzymicals AG is permissible only with prior agreement of Enzymicals AG.

§ 12 Intended purpose

(1) It is explicitly pointed out that all products of Enzymicals AG are intended exclusively for laboratory, research and industrial applications, and must not be used for application at/with humans and animals.
(2) It is explicitly pointed out that the absence of a hazard label does not imply that the concerning product is harmless. The customer has to consider national or international laws or regulations or property rights of third parties for a certain product, including shipping, storage, processing or trading.
(3) The customer is obligated to exempt Enzymicals AG from requirements of any kind of third parties for any reason caused by the customer, in particular acting unlawfully or incorrectly, application without necessary permission, infringe application against this general terms and conditions or any improper handling.
(4) The indemnification includes also legal costs (e.g. court fees and lawyer's fees). § 13 Place of performance, jurisdiction and commitment
(1) Place of performance and jurisdiction for all contracts is the place of business of Enzymicals AG in Greifswald.
(2) The law of the Federal Republic of Germany is legally binding only.
(3) Contract language is German.

Enzymicals®
Enzymes | Chemicals | Solutions

Enzymicals AG
Walther-Rathenau-Straße 49a
17489 Greifswald
Fon: +49(0)3834 515-47-0
Fax: +49(0)3834 515-47-3

Registered Office: Hansestadt Greifswald
Managing Director:
Dr. Ulf Menyes
Jurisdiction: Stralsund HRB 7807
Tax-ID number: DE 267570203

Deutsche Bank
BLZ: 13070024
Konto: 5115670 00
BIC DEUT DE DB ROS
IBAN DE26130700240511567000

info@enzymicals.com
www.enzymicals.com