

Agenda



General usage



Conclusion

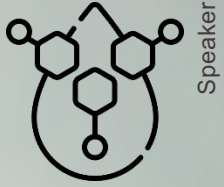


What are lipases ?



EXAMPLE

**Flavour and
baking**



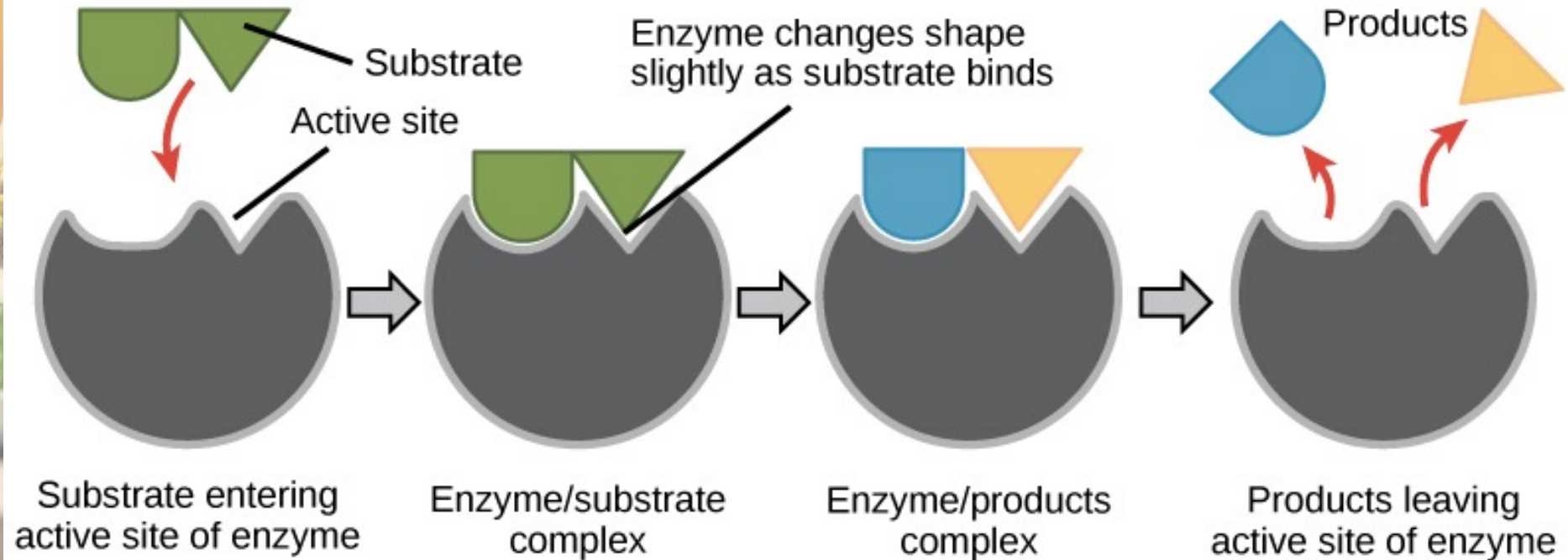
Lipases are among the most widely used enzymes in biocatalysis.

Enzymes are proteins that act as biological catalysts by accelerating chemical reactions.

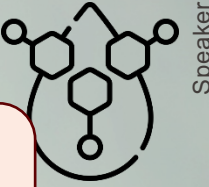
The use of enzymes as industrial catalysts is rising

Enzymes:

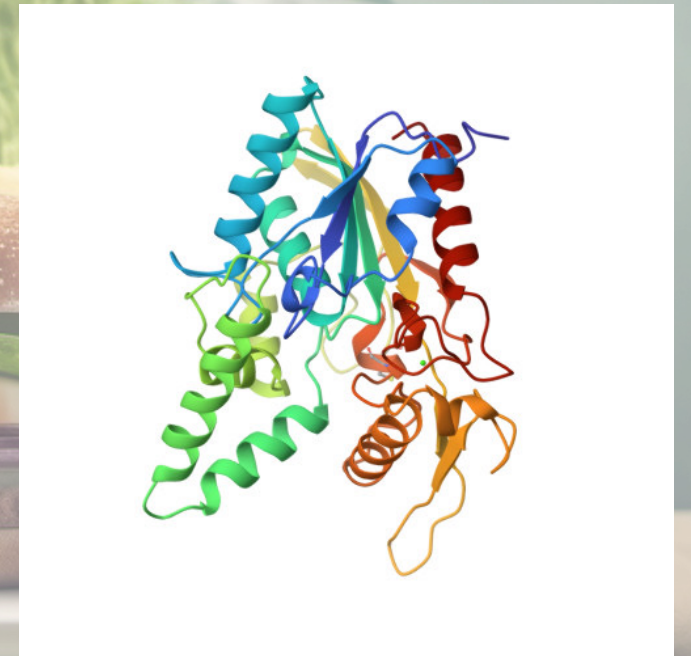
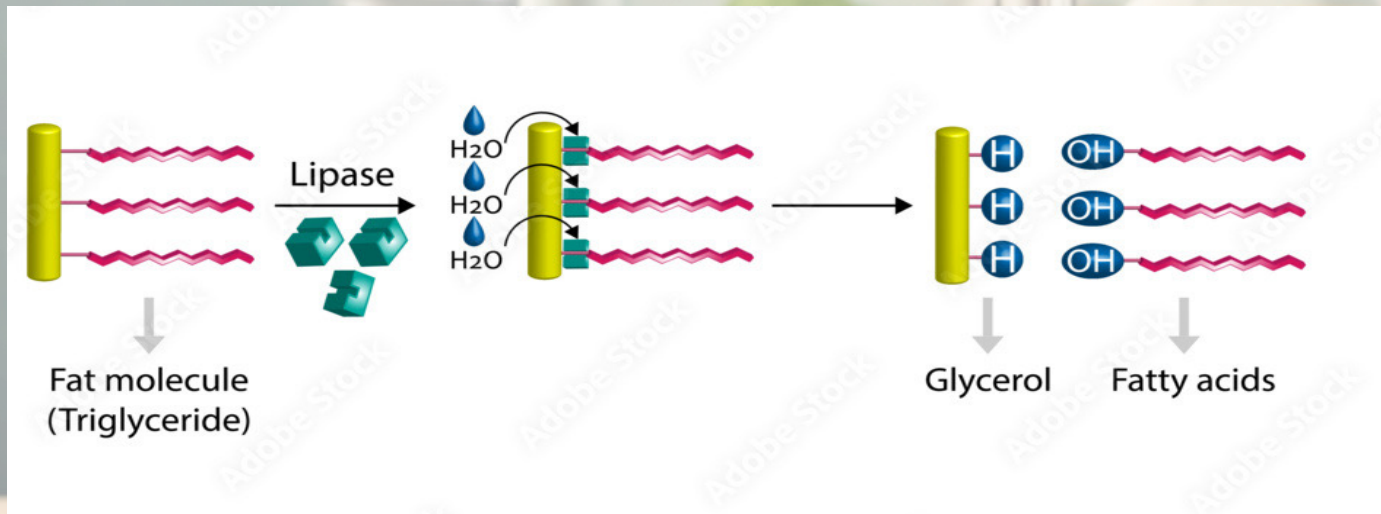
- ✓ Efficient
- ✓ Allow working in mild conditions
- ✓ Selective
- ✓ Specific



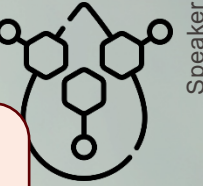
Lipases



The biological function of lipases is the hydrolysis of triglycerides to produce free fatty acids and glycerol.



- ✓ Lipases are produced by various organisms, including microorganisms, plants, and animals.
- ✓ Microbial lipases have received great attention



Lipases

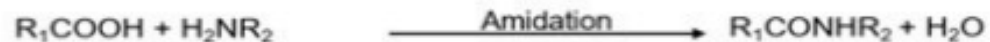
Lipases can also catalyze different reactions such as esterification, acidolysis, interesterification, transesterification, aminolysis, perhydrolysis, etc.

Hydrolysis



Synthesis

Esterification



Transesterification



Lipases are essential components in the modern industrial process due to their ability to catalyze these reactions.

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baking**

General usage

In which field are lipases used ?

Food
industry

Agri-
culture

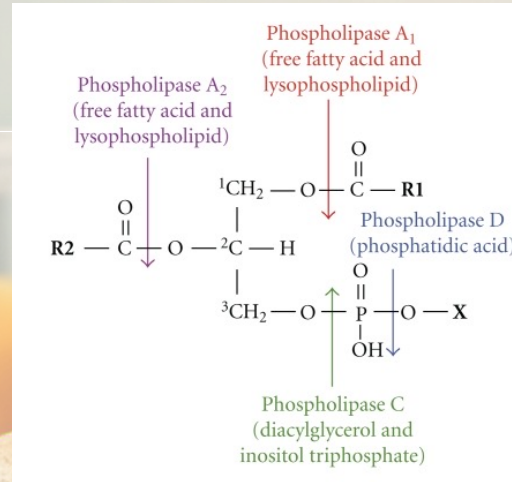
Textile

Environ-
ment

Bio-
diesel

Pharma-
ceutical

General usage



Fat and oil

Food industry

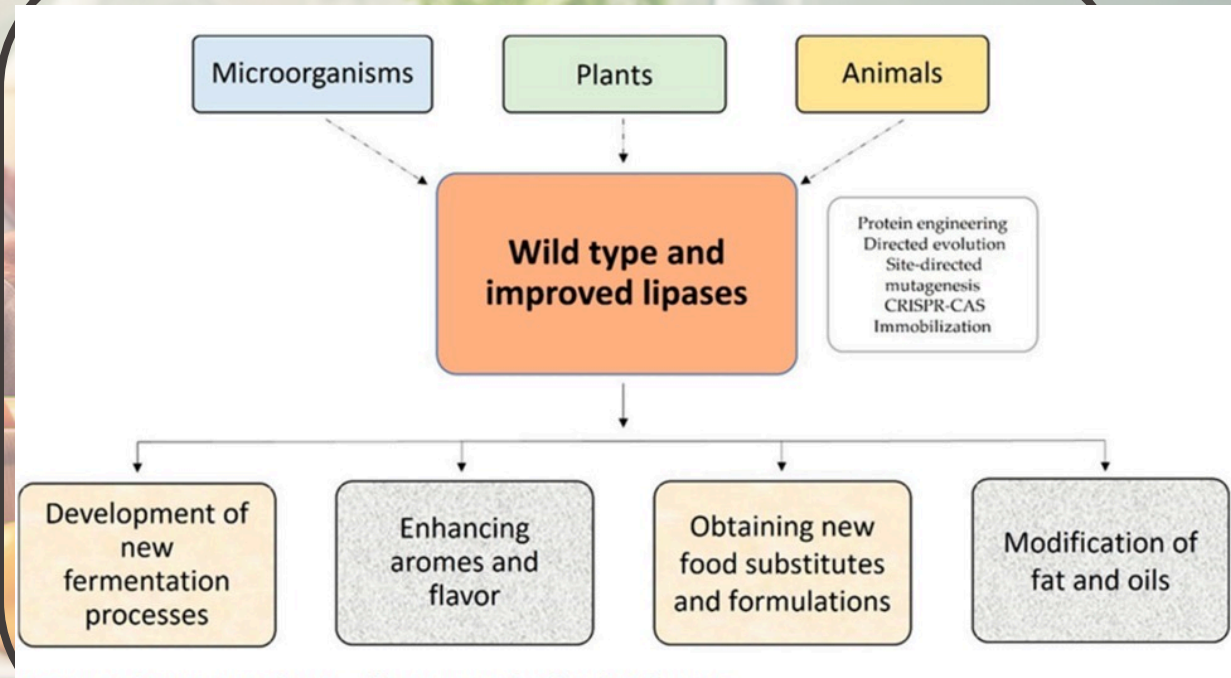
Dairy product

Coca butter analog

General usage

Tea
processing

Biosensor



Agenda



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Example:

Biotech-Based Synthesis of Flavor Esters

The production of low molecular weight flavor esters is of great importance in food Industry.

The flavor and fragrance market is expected to expand at a compound annual growth rate (CAGR) of 4.7% to \$35 billion from 2021 to 2027.

Production of Flavor esters:

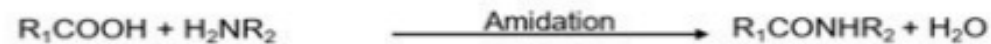
1. Natural Sources  Low Concentration, High cost 😞
2. Chemical Synthesis  Can not be labeled as “Natural”, Low Chiral Purity 😞
3. Biocatalysis  Can be labeled as “Natural”, High Chiral Purity 😊

Example:

Biotech-Based Synthesis of Flavor Esters

The significant demand for these esters has boosted the need for greener production routes and food safety

Esterification

























































































































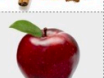






Transesterification

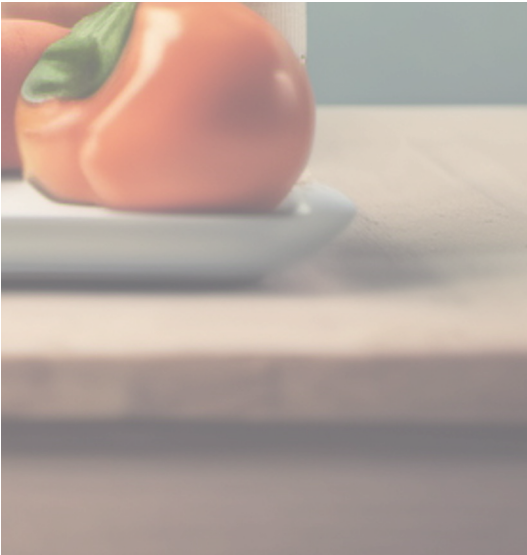


Esters
Table of esters and their smells

from the alcohol (first word)

	methyl 1 carbon	ethyl 2 carbons	propyl 3 carbons	2-methyl propyl-	butyl 4 carbons	pentyl 5 carbons	hexyl 6 carbons	benzyl benzene ring	heptyl 7 carbons	octyl 8 carbons	nonyl 9 carbons
ETHEREAL			ETHEREAL							?	
											
										?	
	ETHEREAL									?	
										?	
				ETHEREAL					?	?	
											
									?		
					?					?	
							DIFFERENT PEOPLE PERCEIVE DIFFERENT AROMAS!	?		?	
											
									?		
											?
						?	?	?	?	?	

from the carboxylic acid (second word)



Alcohol	Acyl donor
2-Phenylethanol	HCOOEt
	CH ₃ CH ₂ COOEt
	CH ₃ CH ₂ CH ₂ COOEt
	(CH ₃) ₂ CHCOOEt
	(CH ₃) ₂ CHCH ₂ COOEt
Cinnamyl alcohol	HCOOEt
	CH ₃ COOEt
	CH ₃ CH ₂ COOEt
	CH ₃ CH ₂ CH ₂ COOEt
	(CH ₃) ₂ CHCOOEt
Geraniol	(CH ₃) ₂ CHCH ₂ COOEt
	HCOOEt
	CH ₃ COOEt
	CH ₃ CH ₂ COOEt
	CH ₃ CH ₂ CH ₂ COOEt
<i>n</i> -Hexanol	(CH ₃) ₂ CHCOOEt
	(CH ₃) ₂ CHCH ₂ COOEt
	HCOOEt
	CH ₃ COOEt
	CH ₃ CH ₂ COOEt
Isoamyl alcohol	CH ₃ CH ₂ CH ₂ COOEt
	(CH ₃) ₂ CHCOOEt
	(CH ₃) ₂ CHCH ₂ COOEt
	HCOOEt
	CH ₃ COOEt



Ester main flavour property

Floral-apricot
 Floral-peach
 Plum-pear
 Floral-rose
 Fruity-berry
 Balsam-green
 Floral-sweet
 Fruity-spicy
 Fruity-floral
 Apple-banana
 Rose-apple
 Rose
 Rose-lavender
 Fruity
 Fruity-apricot
 Rose-apricot
 Rose-apple
 Apple
 Fruity-pear
 Earthy-metallic
 Apricot-pineapple
 Green-sweet
 Green-fruity
 Black currant
 Banana-pear
 Pineapple-apricot
 Fruity
 Sweet-fruity
 Sweet-fruity



Example: Baking

Main purposes of lipase

Make dough smoother	Increase product volume	Improve stability of the dough	Improve the softness	Release pigment contained in the flour
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Lipases used

LIP100: hydrolyzed triglycerides in flour to increase the softness and whiteness of the bread.	LIP400: hydrolyzed phospholipids in flour to increase the stability of the dough and give bigger volume.	LIP500: contains both phospholipase and triglyceride lipase
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1. <https://labinsights.nl/en/article/role-and-application-of-lipase-in-bakery-products#:~:text=There%20are%20three%20main%20lipases,more%20commonly%20used%20baking%20enzymes>, visited on 14.03.24
2. <https://www.yimingbiotechnology.com/products/lipase/> visited on 14.03.24
3. <https://en.angel yeast.com/blog/enzymes/application-of-enzyme-baking-enzyme-in-bread.html> visited on 14.03.24
4. <https://bakerpedia.com/ingredients/lipase/> , visited on 14.03.24

Example: *Baking*

Main purposes of lipase

Make dough smoother	Increase product volume	Improve stability of the dough	Improve the softness
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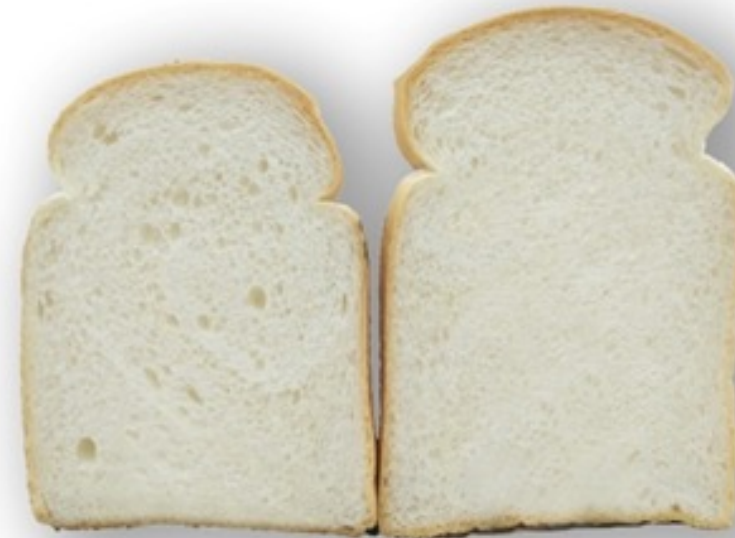


Lipases used

LIP100: hydrolyzed triglycerides in flour to increase the softness and whiteness of the bread.

LIP400: hydrolyzed phospholipids in flour to increase the stability of the dough and give bigger volume.

LIP500: contains both phospholipase and triglyceride lipase



control

Lipase
LIP400

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What are lipases ?



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baking



Conclusion

Applications in a broad range of fields/industries

New products with high added value in the food and nutraceutical industry.

Big Marketplace with high expected growth rates

Improved organoleptic properties

Lipases are the most applied enzyme family to produce flavor and fragrances.

In food nutrition, mostly used in dairy product



Questions ?





Find the flavour !

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- Ben Akacha, N., & Gargouri, M. (2015). Microbial and enzymatic technologies used for the production of natural aroma compounds: Synthesis, recovery modeling, and bioprocesses. *Food and Bioprocesses Processing*, 94(October 2014), 675–706. <https://doi.org/10.1016/j.fbp.2014.09.011>
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 - Reyes-Reyes, A. L., Barranco, F. V., & Sandoval, G. (2022). and Nutraceutical Industry. *Catalysis*, 12(960), 1–24.