9. COMPOUNDS INFLUENCING FOOD AROMA

sensory quality
organoleptic properties

perception

• olphactoric	smell	odorous compounds
• gustative	taste	gustatory compounds
• visual	vision	colour compounds (colourants)
• auditorial	hearing	
• haptic	tactile	

perception of smell + perception of taste = perception of aroma
odorous compounds + gustatory compounds = aroma compounds

ODOROUS COMPOUNDS

key components (book 2, tab. 8.1)
composition of citrus essential oils (kniha2. tab. 8.20), spices (book 2, tab. 8.21)
stimuli thresholds (book 2, tab. 8.22, 8.23, 8.24)

olphactoric perception
~ 10 000 compounds, ~ 50 – 1000 different compounds in individual foods

properties
- low polarity or non-polar compounds
- little soluble and unsoluble in water
- volatile

main groups
hydrocarbons, alcohols, ethers, carbonyl compounds (aldehydes, ketones), acetals (ketals), acids, functional derivatives of acids (esters, lactones), phenols, *S*- a *N*-aliphatic compounds, *O*-, *S*-, *N*-heterocycles

formation
- primary compounds
  bound as glycosides, esters
  free
- secondary compounds
  enzymatic reactions (damage of tissues on storage and processing)
  chemical reactions (storage, processing)

  non-enzymatic browning reactions
  fermentation processes
  oxidative reactions
  thermal reactions (Maillard reaction)

off-flavours
- processing (undesirable fermentation, preservation, thermal operation)
- storage (microbial contamination, reaction of components, oxidation, packaging material)

factors influencing aroma perception

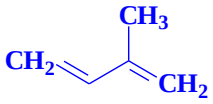
- thresholds of perception
  stimuli threshold
  treshold of recognition

key components of aroma (book 2, tab. 8.1)

- synergism, antagonism of compounds
- sensitivity of individuals
  age, sex, physiological and pathological conditions
  adaptation
  anosmia

hydrocarbons
primary compounds

- terpens (derivatives of isoprene)



2-methylbuta-1,3-diene

secondary compounds

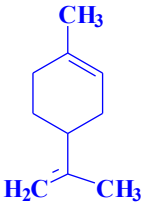
- products of oxidation (fatty acids) (book 2, tab. 8.2)
- products of decarboxylation (acids)
- products of dehydration (secondary alcohols, sterols)
- products of pyrolysis (different compounds)

aliphatic

- hexane — (*Z*)-11-hydroperoxyoctadec-9-enoic acid)
- nonadecane — surface wax of fruits and vegetables (apple)

alicyclic

- (*R*)-limonene — citrus essential oil



aromatic and polycyclic aromatic (PAU)

- benzene, toluene, xylene, benzo[*a*]pyrene — contaminants

alcohols
primary compounds

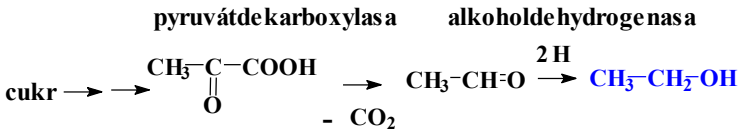
- terpens (derivatives of isoprene)

secondary compound

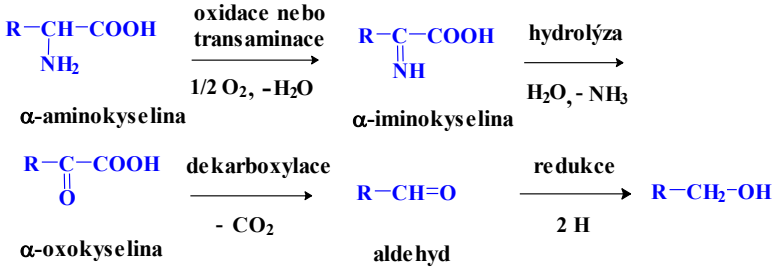
- products of esters hydrolysis (methanol)
- products of fermentation (ethanol, fusel oil alcohols)

aliphatic saturated

- methanol — hydrolysis of pectin
- ethanol — sugar fermentation

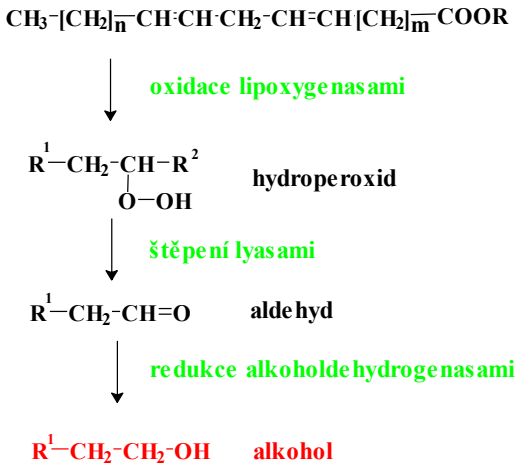


- higher alcohols
  fusel oil (book 2, tab. 8.3)



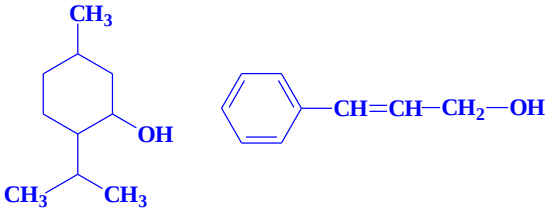
aliphatic unsaturated

oxidation of higher fatty acids



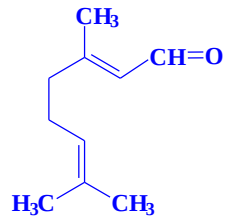
terpenic and aromatic alcohols

- menthol — mint, chewing gum
- cinnamyl alcohol — cinnamon



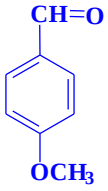
aldehydes
sensory properties (book 2, tab. 8.5)
primary compounds

- terpenes

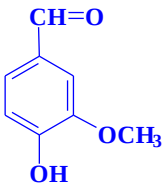


citral and (geranial)
citrus essential oils

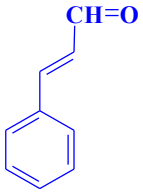
- other primary compounds
  aniseed, badyan, vanilla, cinnamon



anisaldehyde



vanillin;



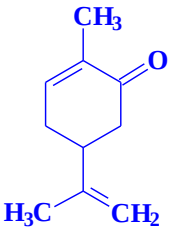
cinnamaldehyde

secondary compounds

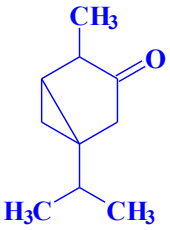
- products o Strecker degradation of amino acids
- oxidation products of fatty acids (book 2, tab. 8.4)

ketones
primary compounds

- terpenes



carvone
caraway



thujone
wormwood (absinthism)

secondary compounds

- products fatty acids β-oxidation — methylketones
- products of saccharides degradation — diketones

aroma of butter

acids and their functional derivatives

acids

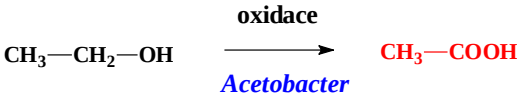
content (book 2, tab. 8.8, 8.9, 8.10, 8.11)
primary compounds

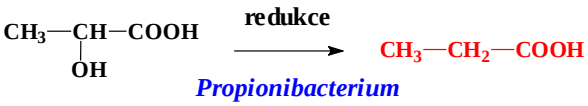
- aromatic acids — aromatic and gustatory compounds
- hydroxycarboxyl acids — gustatory compounds

secondary compounds

- fermentation products (book 2, tab.8.7)

formic, acetic, propionic, higher acids





- products of saccharide degradation
  formic, acetic

esters

sensory properties (book 2, tab. 8. 14)
content (book 2, tab. 8.13)
primary and secondary compounds

main compounds:

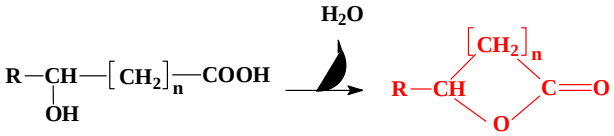
acetic acid	ethanol
formic acid	methanol
propionic acid	butanol
butyric acid	isoamylalkohol
isobutyric acid	(mono)terpenes

fruity and flower aroma

alcoholic beverages	ethyl acetate
beer	~ 30 mg/l
wine	10-260 mg/l
apple acetates, butyrates	
banana isoamylacetate	
pineapple ethyl-3-(methylthio)propionate	

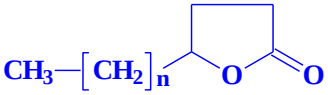
lactones

primary and secondary compounds



γ-hydroxyl acids → γ-lactones (butano-4-lactones)
δ-hydroxyl acids → δ-lactones (pentano-5-lactones)

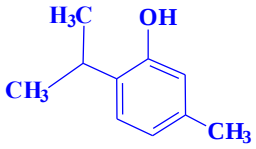
aromatic hydroxy acids → cumarins, phthalides



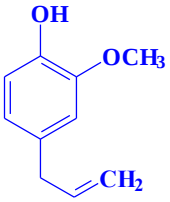
γ-nonalactone n = 4 coconut aroma
γ-decalactone n = 5 peaches aroma
γ-dodecalactone n = 7 butter aroma

phenols

content (book 2, tab. 8.16)
primary compounds
essential oils



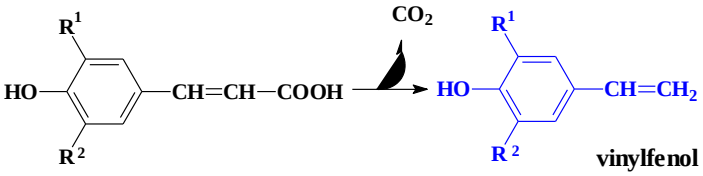
thymol
thyme



eugenol
clove

secondary compounds

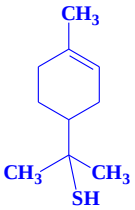
- decarboxylation of phenolic acids
- lignin degradation



sulphur containing compounds

primary compounds

- essential oils

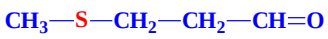


p-meth-1-en-8-thiol
grapefruit

secondary compounds

♦ degradation products of sulphur-containing compounds

sulphur amino acids



methional
boiled potato

diallyldisulfide
garlic

glucosinolates

allylisothiocyanate
mustard, horse radish

nitrogen containing compounds

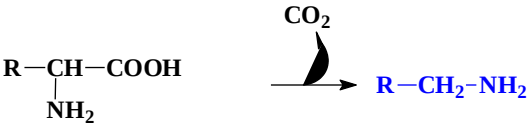
primary and secondary compounds

- decarboxylation products of amino acids

- transformation products of other compounds

amines, biogenic amines

precursors (book 2, tab. 8.19
content (book 2, tab. 8.18)

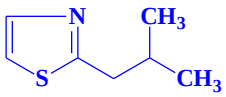


trimethylaminoxide trimethylamine

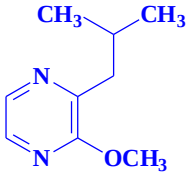
heterocyclic compounds

O-, *S*-, *N*-heterocycles

primary compounds



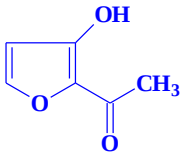
2-isobutylthiazole
tomato



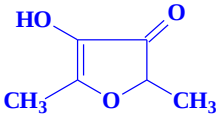
2-isobutyl-3-methoxypyrazine
bell pepper

secondary compounds

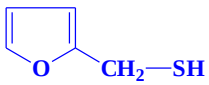
- products of Maillard reaction
- products of other reactions



isomaltol,

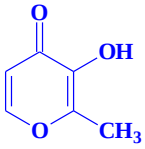


furaneol,

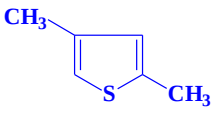


furfurylthiol

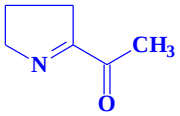
(caramel, strawberry and pineapple fruit, coffee)



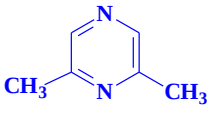
maltol,



2,4-dimethylthiophene,



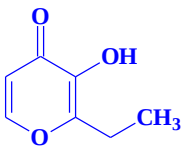
2-acetyl-1-pyrroline,



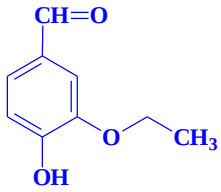
2,6-dimethylpyrazine

(caramel, fried onion, bread, chocolate and nuts)

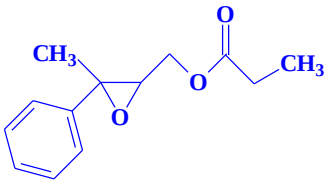
synthetic compounds



ethylmaltol
caramel



ethylvanillin (bourbonal)
vanilla sugar



ethyl-3-fenyl-3-methylglycidate
strawberry (candies)