10. COMPOUNDS INFLUENCING FOOD TASTE

perception of gustation

4 (5) basic tastes

♦ sweet	end of tongue
♦ salty	upper surface of tongue
♦ acid	sides of tongue
♦ bitter	root of tongue, roof of the mouth
♦ umami	whole oral cavity

♦ further perceptions
adstringent taste, ….

properties
polar, water-soluble, non-volatile

formation
♦ primary compounds
♦ secondary compounds
enzymatic reactions (damage of tissues on storage and processing)
chemical reactions (storage, processing)

off-taste

factors influencing taste perception
• thresholds of perception
stimuli threshold
threshold of recognition

Sweet compounds

classification
according to origin
♦ natural
♦ synthetic, identical with natural
♦ modified natural and synthetic

according to importance in nutrition (energy value)
♦ nutrients (source of energy)
♦ non-nutrients (they are not source of energy)

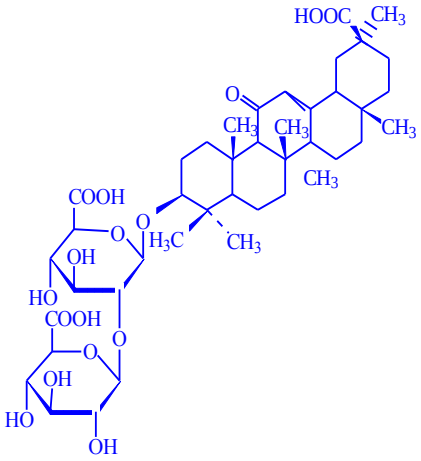
according to possibility to influence the blood sugar level
♦ contraindicated to diabetes
♦ without any influence

according to influence on caries
♦ cariogenic
♦ non-cariogenic

artificial sweeteners
taste quality

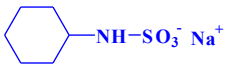
sweeteners (book 2, tab. 8.26, 8.27)

- saccharides
- natural sweet compounds

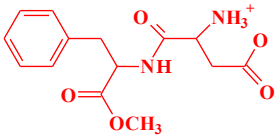


glycyrrhizine

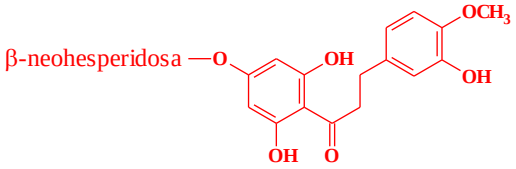
- synthetic compounds



cyklamát



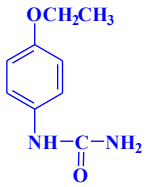
aspartam



neohesperidindihydrochalkon

sacharin

acesulfam K



dulcin

Salty compounds

Inorganic salts, mostly NaCl
thrashold concetration (book 2, tab. 8.28)
natural content of NaCl (book 2, tab. 8.29)
some salts of organic acids
taste quality, further attributes (bitter, metallic)

food classification

- with very low content — < 0,4 g/kg Na
  milk, fruits, vegetables
- with low content — 0,4-1,2 g/kg Na
  meat, poultry, fish
- with high content — 1,2-4,0 g/kg Na
  bread, some bakery products, pickled vegetables
- with very high content — > 4,0 g/kg Na
  some meat and fish products, olive, salty condiments

Acidic compounds

non-dissociated carboxylic acids >>

♦ aliphatic monocarboxylic	volatile	aroma, taste,
♦ aliphatic dicarboxylic	non-volatile	taste
♦ aliphatic hydroxy acids	non-volatile	taste
♦ alicyclic	non volatile	taste
♦ aromatic	some non-volatile	aroma, taste

threshold concentration (book 2, tab.8.30)
mineral acids, H_3O^+ (pH)
taste quality, further attributes (fruity)

food classification

♦ very sour	pH < 4,0	fruits
♦ little sour	pH 4,0-6,5	vegetables (fruits), cereals
♦ neutral	pH > 6,5	meat, milk, egg

fruits	citric, malic, quinic, ascorbic
vegetables	citric, malic, oxalic
meat	lactic
milk (vegetables) fermented products	lactic

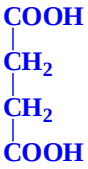
apple unripe	quinic
apple ripe, pulp	malic
apple ripe, skin	citric, malic

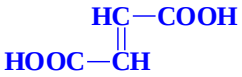
aliphatic monocarboxylic acids

formic	side product of fermentation, degradation of saccharides	preservative compound
acetic	acetic acid fermentation (*Acetobacter*), vinegar	preservative compound
propionic	propionic acid fermentation (*Propionibacterium*)	preservative compound

aliphatic dicarboxylic acids

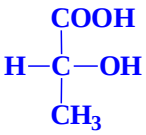
oxalic	metabolisms	antinutritive compound
succinic	metabolisms	
fumaric, (*E*)-but-2-enic	metabolisms	



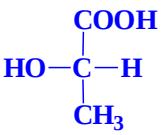


aliphatic hydroxyacids

lactic — milk fermented products (*Lactobacillus* and others), meat



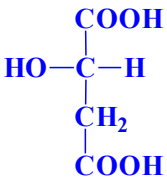
D-(-)-lactic
(*R*)-2-hydroxypropionic



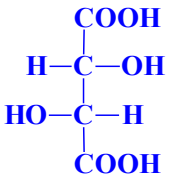
L-(+)-lactic
(*S*)-2-hydroxypropanic

milk fermented products	0,5-1,0 %
sauerkraut	1,5-2,5 %
sour olive	0,8-1,2 %
meat	0,2-0,8 %

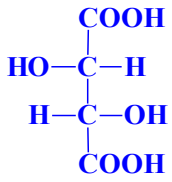
L-malic acid fruits, vegetables, additives (acidulant)



tartaric acid fruits, vegetables, additives (acidulant)



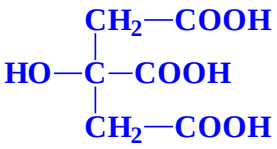
L-tartaric, (2*R*,3*R*)-tartaric, L-threaric

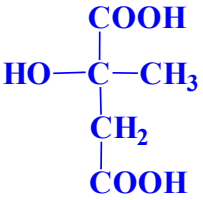


D-tartaric

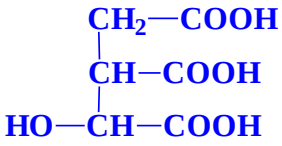
grapy acid (racemic mixture, racemate, K-H salts = tartar), mesotartaric (erythraric)

citric acid fruits, vegetables, additives (acidulant)





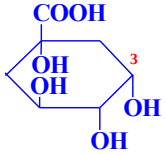
L-citromalic



D-isocitric

alicyclic acids

L-quinic fruits, vegetables (free, depsides)

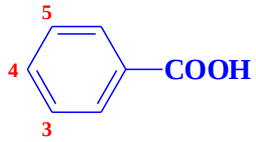


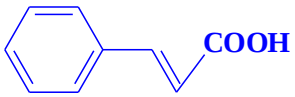
aromatic acids

fruits, vegetables, cereals, (free, esters, glycosides,)

seeds germination inhibition, antibacterical properties
sensory properties (phenols, non-enzymatic browning reactions)

benzoic acid, cinnamic acid and derivatives





	benzoic	cinnanic
4-OH	*p*-hydroxybenzoic	*p*-cumaric
3,4-diOH	protocatechuic	caffeic
4-OH, 3-MeO	vanillic	ferulic
4-OH, 3,5-diMeO	syringic	sinapic
3,4,5-triOH	gallic	

benzoic, *p*-hydroxybenzoic	food preservative
caffeic	substrate oxidoreductases
vanillic	component of alkaloids
gallic	component of tannins

apple, potato, coffee (chlorogenic = caffeic + quinic)
dates (dactylipheric = caffeic+ shikimic)

Bitter compounds

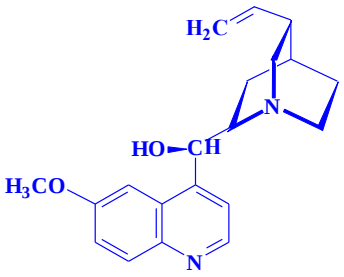
primary compounds
- ♦ characteristic compounds of plants

secondary compounds
- ♦ formation during processing and storage
  (reaction products, metabolites of microorganisms)

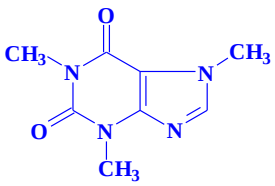
threshold concentration (book 2, tab.8.31)

additives

alkaloids
quinine (true alkaloids, quinolinic alkaloids), tonic water
caffeine (protoalkaloids, purine alkaloids)
coffee, tee, cocoa, maté, guarana, cola drinks

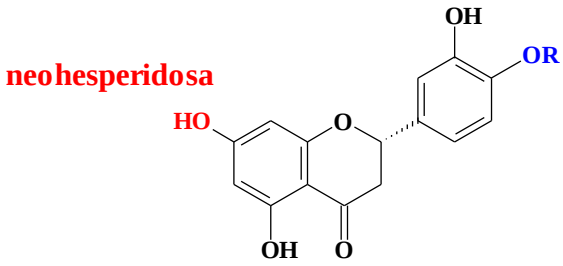


quinine



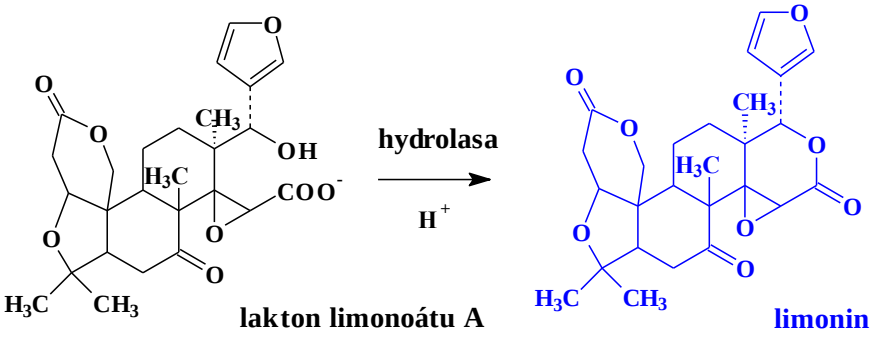
caffeine

fruits
grapefruits (bitter oranges)
flavonoids (flavanones)

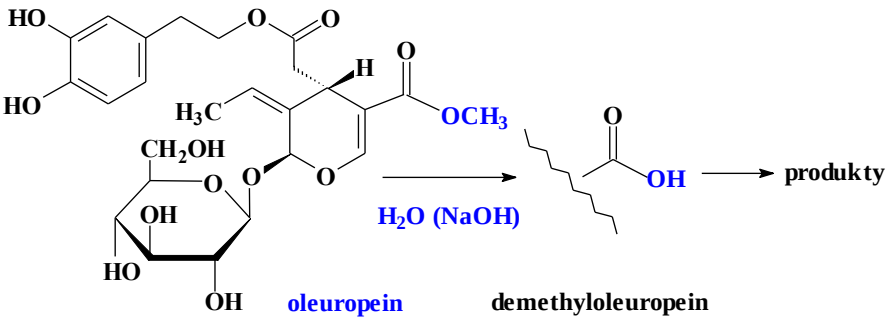


naringin = naringenin (R = H) + neohesperidose, α-L-Rha-(1→2)-β-D-Glc
neohesperidin = hesperetin (R = CH_3) + neohesperidose

oranges
terpenes (limonoids)
production of orange juices

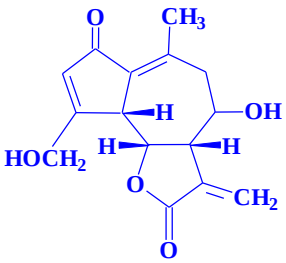


olive
phenols

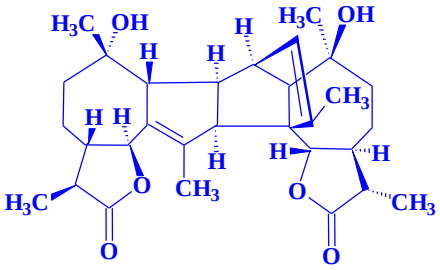


vegetables
lettuce, endive, chicory (lactucin)

spices and other plant materials
wormwood (absinthin)



lactucin



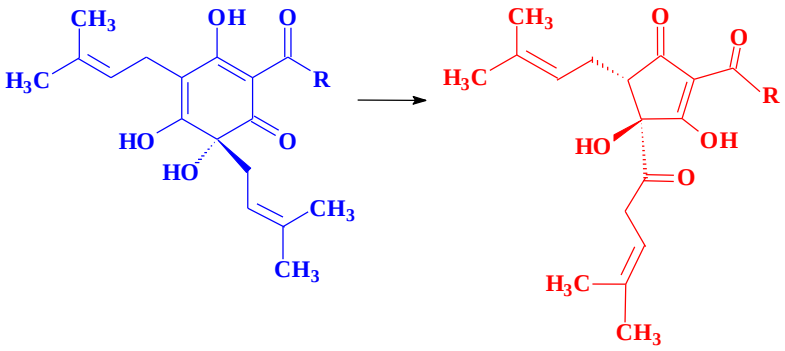
absinthin

hops
derivatives phloroglucinol (1,3,5-benzenetriols)
bitter acids (18 % dry matter)
content (book 2, tab. 8.32)

- α-bitter acids (homologues humulone)
- β- bitter acids (homologues lupulone)

beer
isobitter acids

- iso-α-bitter acids (isohumulone)
- iso-β- bitter acids (isolupulone)



humulon, R = $CH_2CH(CH_3)_2$ **isohumulon**

Adstringent compounds

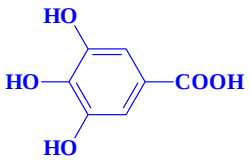
perception = protein interaction of saliva with polyphenolic compounds → denaturation (loss of protective role)

tannins

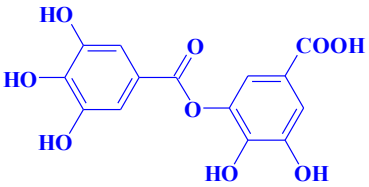
- hydrolysed — polymers of gallic acid esters; additives, little in food
- condensed — polymers of flavan-3-ols (3,4-diols); food (fruits, wine)

hydrolysed tannins

- gallotannins

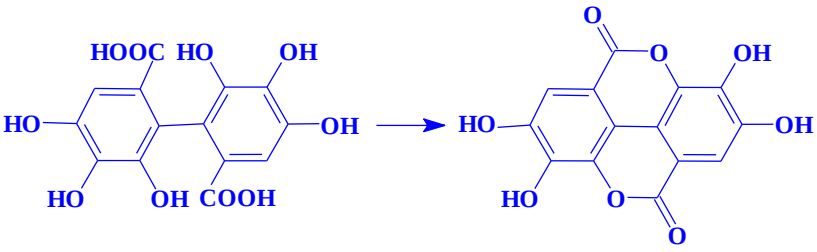


gallic acid



m-digallic acid (depside)

- ellagotannins



hexahydroxybiphenylic acid (C-C dimer) ellagic acid (lactone)

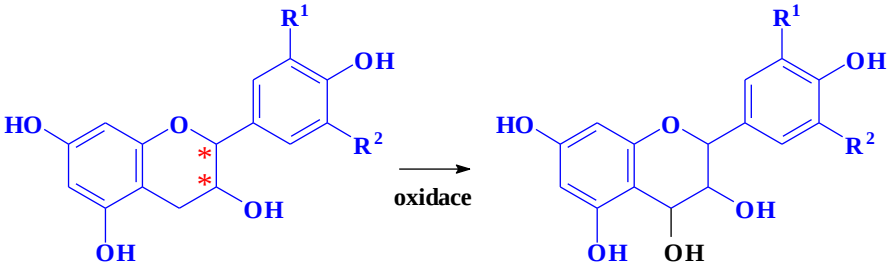
gallotannins
Chinese tannin
mixture of galloylesters and *m*-digalloylesters D-glucose
elimination of turbidity caused by proteins (vinegar, beer, wine)

ellagotannins

condensed tannins (proanthocyanidins, flavolans)

dimers and higher oligomers (2-10 unites)
- flavan-3-ols (catechins)
- flavan-3,4-diols (leucoanthocyanidines)

monomers do not have the properties of tannins
oxidised oligomers are coloured

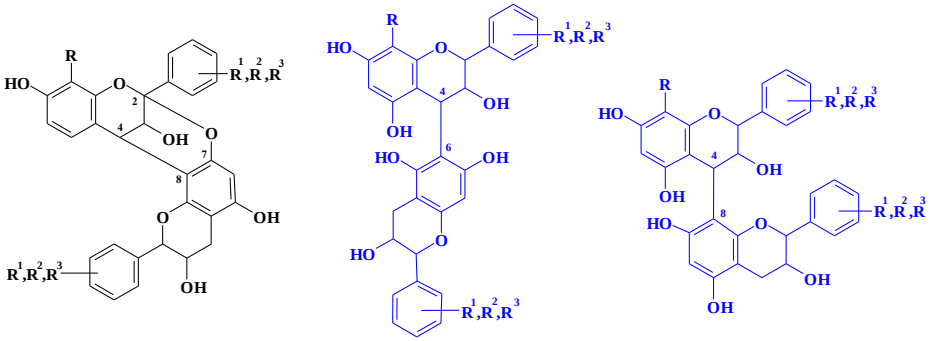


afzelechins (R^1 = R^2 = H)	*p*-hydroxybenzoic	leucopelargonidin
catechins (R^1 = H, R^2 = OH)	protocatechuic	leucocyanidin
gallocatechins (R^1 = R^2 = OH	gallic	leucodelphinidin

geometric isomers
- H2 a H3 *trans* = catechins, gallocatechins
- H2 a H3 *cis* = epicatechins, epigallocatechins

esters with gallic acid
- catechingallates
- gallocatechingallates

examples
fruit and wine tannins



type A (C-4→C-8, C-2→O→C-8) type B (C-4→C-6) type B (C-4→C-8)

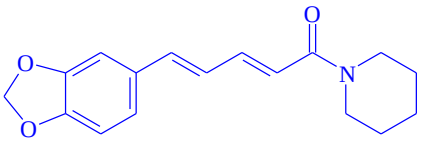
tea tannins
non-enzymatic browning reaction

Bitter compounds

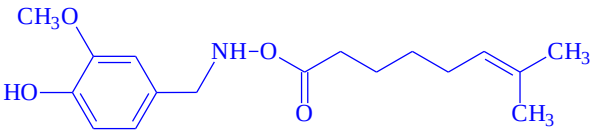
primary compounds
- ♦ characteristic components of plants

secondary compounds
- ♦ enzymatic reactions

alkaloids

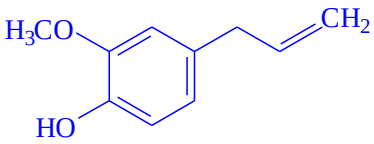


true alkaloids: piperine (black pepper)

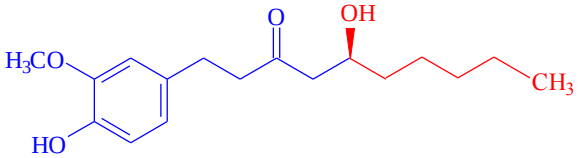


protoalkaloids: capsaicin (bell pepper, chilli)

phenols

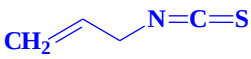


eugenol (clove)



gingerol (ginger)

isothiocyanates



allylisothiocyanate (mustard, horse radish)