

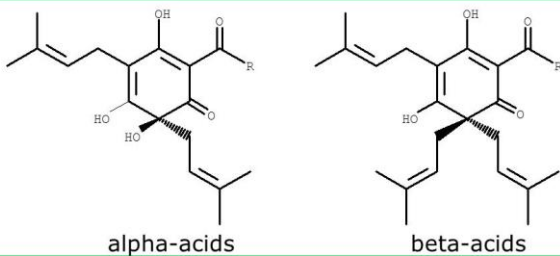
# The ingredients of hops

water  
sugars  
amino acids  
salts



chlorophyll  
cellulose  
proteins  
pectins

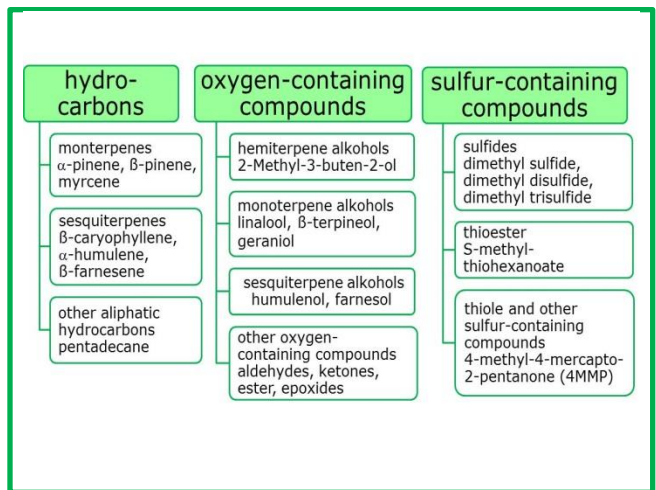
## bitter substances



	alpha-acids	beta-acids
R=CH <sub>2</sub> CH(CH <sub>3</sub> ) <sub>2</sub>	n-humulone	n-lupulone
R= CH(CH <sub>3</sub> ) <sub>2</sub>	cohumulone	colupulone
R= CH(CH <sub>3</sub> )CH <sub>2</sub> CH <sub>3</sub>	adhumulone	adlupulone
R= CH <sub>2</sub> CH <sub>2</sub> CH(CH <sub>3</sub> ) <sub>2</sub>	prähumulone	prälupulone
R= CH <sub>2</sub> CH <sub>3</sub>	posthumulone	postlupulone

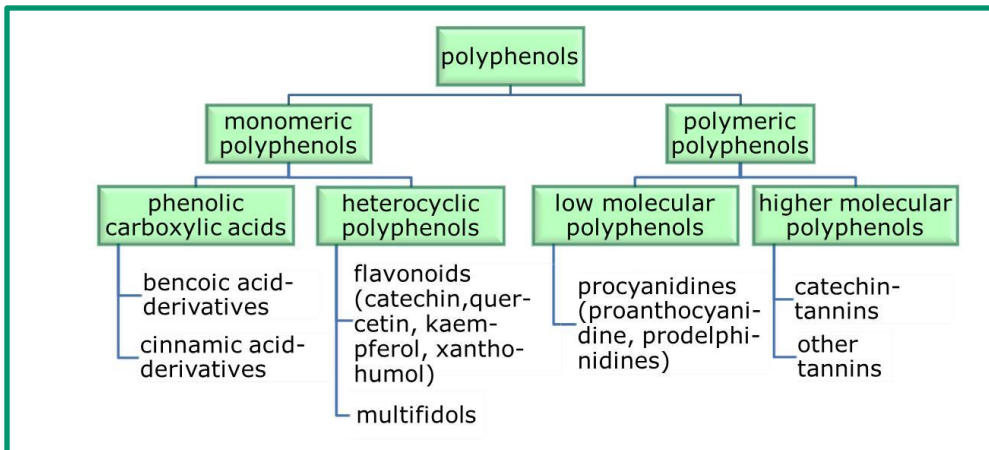
- conductometric titration
- titration (EBC 7.4, 7.5)
- HPLC (EBC 7.7)
- NIR-spectroscopy

## essential oils



- steam distillation,
- gaschromatography-mass spectrometry, (300-400 single compounds)

## polyphenols



- spectral photometry (total polyphenols, flavonoids)
- HPLC (single compounds)