EUCAARI

WP 2.4: Regional aerosol source apportionment and long range transport

Task 2.4.1: Source apportionment of organic aerosols using tracers

Description of work *-University of Aveiro (Portugal) and University of Pannonia (Hungary)*

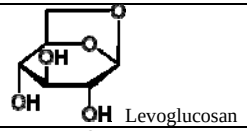
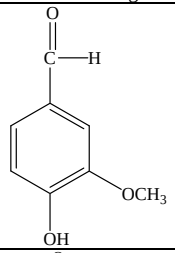
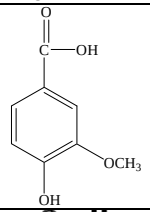
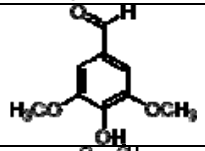
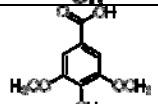
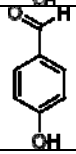
To avoid problems related to detection limits for some important organic aerosol tracers at minor concentrations, it is recommendable to have, at least, ≈ 850 μg of OC in each filter part. If this mass is not present in the filters, the alternative is to extract together various samples to obtain average concentrations.

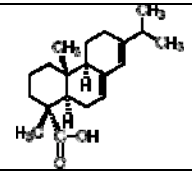
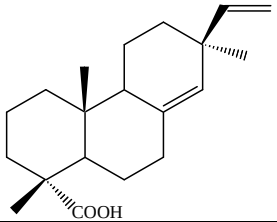
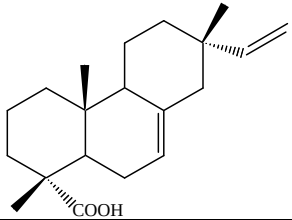
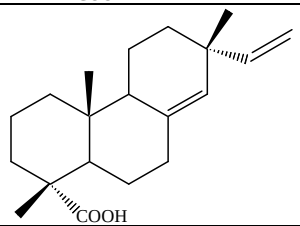
Filters for organic analysis should be sent to the University of Aveiro, where they are solvent extracted and the total organic extract is divided into 5 different classes of increasing polarity by flash chromatography in silica gel. The five major organic classes are: aliphatics, PAH, carbonyls, hydroxyl compounds and sugars+acids. The two more polar organic extracts (hydroxyl compounds and sugars+acids) are sent to Veszprem for posterior derivatization and GC-MS analysis.

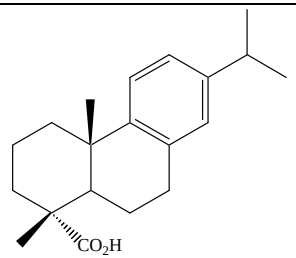
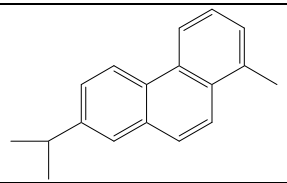
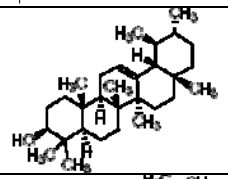
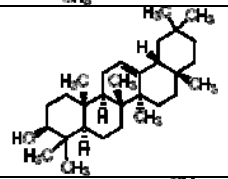
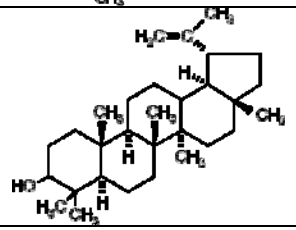
▸ List of organic tracers

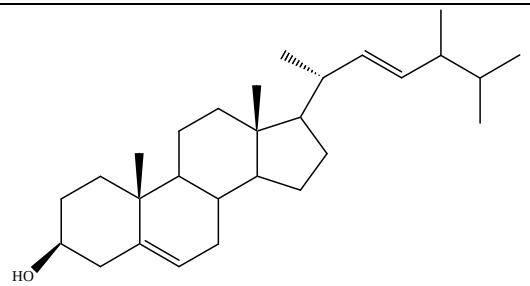
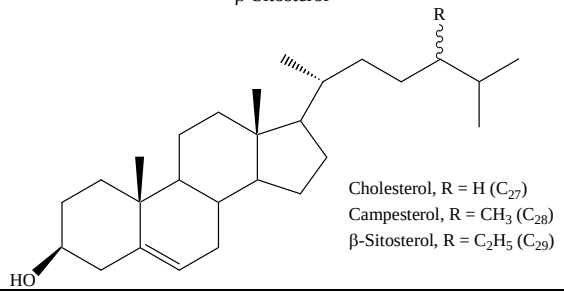
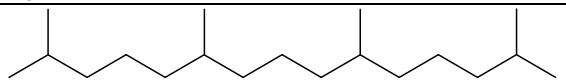
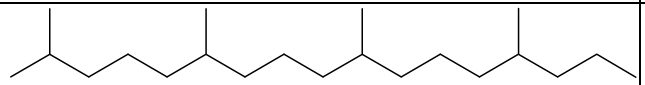
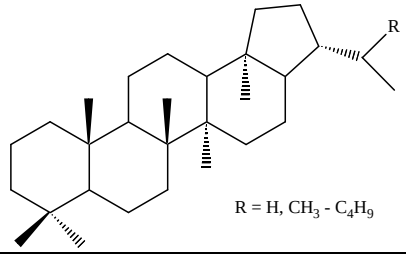
Compounds	***Major source***	***Emission process***
n-Alkanes, C_{15}-C_{20} (odd/even)	Microbial	Direct/resuspension
C_{20}-C_{37} (odd/even)	Plant waxes	Direct/biomass burning
C_{15}-C_{37} (CPI=1)	Vehicles	Exhaust
n-Alkanoic acids, C_9		
C_{15}-C_{37}	Microbial/biomass	Direct/resuspension/combustion
C_{20}-C_{36}	Higher plants	Direct/combustion
n-Alkanols, C_{14}-C_{36}	Biomass	Direct
n-Alkanedioic acids, C_6-C_{28}	Various	Photo-oxidation/combustion
Wax esters	Plant waxes	Biomass combustion/direct
Methoxyphenols	Biomass with lignins	Combustion
Levoglucosan	Biomass with cellulose	Combustion

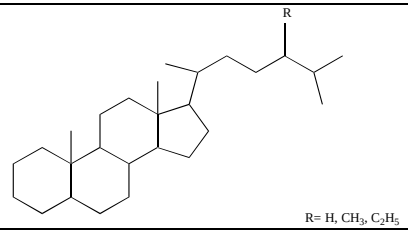
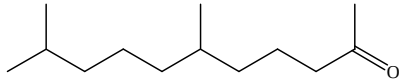
Galactosan	Biomass with cellulose	Combustion
Mannosan	Biomass with cellulose	Combustion
Cholesterol	Meat/algae	Cooking/direct
Phytosterols	Higher plants	Combustion/direct
Triterpenoids	Higher plants	Combustion/direct
Diterpenoids (resin acids)	Higher plants (gymnosperms)	Combustion/direct
Hopanes/steranes	Petroleum	Vehicle exhaust and others
UCM	Petroleum	Vehicle exhaust and others
PAH	Ubiquitous	Pyrogenic processes

Chemical group	***Molecular markers***	***Molecular structures***	***Source***
Monosaccharide derivatives	Levoglucosan	 Levoglucosan	Biomass with cellulose
	Galactosan		Biomass with cellulose
	Mannosan		Biomass with cellulose
Methoxyphenols	Vanillin		Conifers
	Vanillic acid		Conifers
	Syringaldehyde		Angiosperm
	Syringic acid		Angiosperm
	p-Hydroxybenzoic acid		Gramineae

Diterpenoids	Abietic acid		Conifers
	Pimaric acid		Conifers
	Iso-pimaric acid		Conifers
	Sandaracopimaric acid		Conifers

	Dehydroabietic acid		Conifers
	Retene		Conifers
Triterpenoids	α-Amyrin		Angiosperm
	β-Amyrin		Angiosperm
	Lupeol		Angiosperm
Phytosterols	β-Sitosterol		All biomass sources

	Stigmasterol	 β-Sitosterol 	All biomass sources
	Campesterol		Gramineae
Sterols	Cholesterol		Meat cooking; algae
Aliphatic compounds	Pristane		Fossil fuel Combustion
	Phytane		Fossil fuel Combustion
	Hopanes		Fossil fuel Combustion

	Steranes		
Ketone	6,10,14 - Trimethylpentadecan-2-one		Biogenic origin; Degradation product from phytol of chlorophyll
Unsaturated fatty acids	9-Octadecenoic acid (oleic acid)	$CH_3(CH_2)_7CH=CH-(CH_2)_7COOH$	Microbial sources; vegetation emissions; meat cooking operations; marine emissions
	9,12-Octadecadienoic acid (linoleic acid)	$CH_3(CH_2)_4CH=CHCH_2CH=CH(CH_2)_7COOH$	
	Hexadecenoic acid (palmitoleic acid)	$CH_3(CH_2)_5CH=CH-(CH_2)_7COOH$	
	Hexadecanoic acid (palmitic acid)	$CH_3(CH_2)_{14}COOH$	Meat cooking preparation; vegetation emissions
	Octadecanoic acid (stearic acid)	$CH_3(CH_2)_{16}COOH$	

Besides those compounds listed in the table, some SOA products may be analysed by Aveiro and Veszprem, such as:

- nopinone and pinonaldehyde (Univ. Aveiro)
- tetrols, pinic and pinonic acids (Univ. Veszprem).

Taking into account that most of the SOA compounds are polar, probably most of them will be present in the extracts sent to Veszprem. If you are interested in some particular SOA products, you must contact G. Kiss and specify what compounds you want, in order to obtain the appropriate standards and calibrate the GC-MS.