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DETERMINATION OF COENZYME Q10 and Q9 IN VEGETABLE OILS

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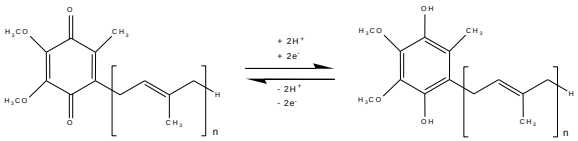
INTRODUCTION

The French Institute for Fats and Oils (ITERG) coordinates an European project which aim is a better knowledge and control of active micro-nutrients content in edible oils of great consumption, in order to contribute positively and significantly to the improvement of the nutritional status of population. Among the different micro-nutrients studied, CoQ10 has a real interest for its effects on human health. However, only few studies have assessed contents of CoQ10 in vegetable oils, so the available information about its analysis and content in these samples is scarce. Then, the objective of this survey was to develop and optimize a simple and fast analytical method for quantifying CoQ9 and CoQ10 in vegetable oils.

CHEMICAL STRUCTURES

Ubiquinones (Coenzymes Q or CoQn) are a group of lipid-soluble benzoquinones involved in electron transport in the mitochondrial respiratory chain. The ubiquinone structures are based on the 2,3-dimethoxy-5-methyl-6-poly-isoprenyl-1,4-parabenzoquinone nucleus with a variable number of isoprene units in the side chain. The ubiquinones are designated by numbers representing the number of isoprene units in the side chain. Naturally occurring members are the CoQ6-CoQ10, and the differences in their properties are due to the length of the side chain.



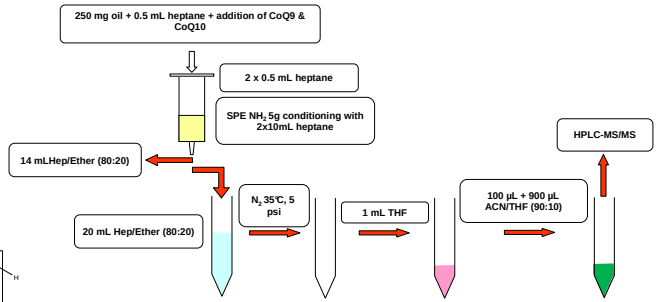
Ubiquinone (oxidized structure) — Ubiquinol (reduced structure)

n=9 for CoQ9; n=10 for CoQ10

HPLC ANALYSIS

- Dionex Ultimate 3000 series, vacuum degasser for the mobile phase solvents, ternary pumping unit, auto-sampler.
- Triple quadrupole mass spectrometer TSQ Quantum Ultra (Thermo Finnigan) operating in SRM mode, Xcalibur software.
- Selective reaction monitoring mode: two scan events (m/z 794.5 → m/z 779.5 and m/z 862.5→ m/z 847.5) with fragmentation energy of 17 %.
- Atmospheric pressure chemical ionization interface (APCI) running in negative mode.
- Vaporizer temperature of 314 ºC.
- Xterra MS RP C18 HPLC column (50mm x 2.1mm x 3.5µm) + guard column (10 x 2.1 mm).
- 20 µL injected.
- Auto-sampler & column temperature at 20ºC.
- Mobile phase : acetonitrile/acetone:methanol:isopropanol.
- Flow rate: 200 µL/min.

SAMPLE PREPARATION



HPLC MOBILE PHASE

Time (min)	% A	% B	% C
0.0	0	90	10
7.0	0	90	10
7.5	50	40	10
12.5	50	40	10
13.0	0	90	10
18.0	0	90	10

A: ACN/Acetone (1:1) B: MeOH C: IsoProp

CoQn QUANTIFICATION

Spiking experiments revealed significant signal suppression due to matrix effect of the final extract so the use of external standard quantification was not possible.

After having checked the linear response of CoQ9 and CoQ10 in all the final extracts, it was decided to use the "standard addition approach" for quantification: addition of known amounts of the target compounds in the sample and calculating a subsequent linear regression to know the initial concentration.

AKNOWLEDGEMENTS

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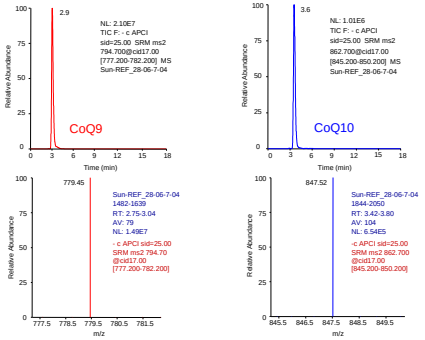
CHROMATOGRAMS OF A REFINED SUNFLOWER OIL



RESULTS

Several oils issued during the Optim'oils European project were analyzed.

Oils		CoQ9 (mg/kg)	CoQ10 (mg/kg)
Rapeseed	Crude by hexane extraction	18	114
	Crude by heat pression	3	38
	Crude by cold pression	2	14
	Refined	12	76
Soja	Crude by hexane extraction	22	119
	Crude by heat pression	15	74
	Crude by cold pression	9	53
	Refined	21	120
Sunflower	Crude by hexane extraction	109	9
	Crude by heat pression	36	0
	Crude by cold pression	24	1
	Refined	93	12

CONCLUSIONS

A new sensitive and selective method has been developed for the quantification of the total coenzyme Q9 (CoQ9) and coenzyme Q10 (CoQ10) concentration in vegetable oil samples. The method was successfully applied to sunflower, soybean and rapeseed oils.