

Supporting information for:

An Overview of Analytical Methods for Quantitative Determination of Coenzyme Q10 in Foods

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Table S1. Centralizing table of extraction methods used.

Extraction method	Sample weight/Reagents and materials used	Reference
Direct extraction method	Sample weight: 1-4 g Reagents: 0.9% sodium chloride solution, ethanol/hexane (1:5, <i>v/v</i>), sodium sulfate anhydrous, hexane	Weber et al., 1997
	Sample weight: 1 g Reagents: 0.15 M sodium chloride solution (35 mL), ethanol (20 mL), <i>n</i> -hexane (100 mL), sodium sulfate anhydrous, 2-propanol (5 mL)	Mattila et al., 2000
	For vegetable samples Sample weight: 2 g Reagents: 0.15 M sodium chloride solution (5 mL), ethanol (18 mL), <i>n</i> -hexane (60 mL), 2-propanol (2 mL) Sample filtration: 0.2 µm PTFE membrane filter, Lida	Mattila and Kum-pulainen, 2001
	For animal origin samples Sample weight: 7 g Reagents: ethanol (18 mL), <i>n</i> -hexane (60 mL), 2-propanol (2 mL) Sample filtration: 0.2 µm PTFE membrane filter, Lida	Mattila and Kum-pulainen, 2001
	Sample weight: 10 mg Reagents: 0.15 M sodium chloride solution (200 µL), ethanol (200 µL), <i>n</i> -hexane (1500 µL), 2-propanol (200 µL)	Purchas et al., 2004
	Sample weight: 1 g Reagents: 0.15 M sodium chloride solution (5 mL), 0.1 M sodium dodecyl sulphate (5 mL), anhydrous ethanol (2 mL), hexane (10 mL), 2-propanol (1 mL) Sample filtration: 0.45 µm PTFE membrane filter	Souchet and Laplante, 2007
	Sample weight: 2 g Reagents: 0.15 M sodium chloride solution (5 mL), ethanol (18 mL), <i>n</i> -hexane (60 mL), 2-propanol (2 mL) Sample filtration: 0.2 µm PTFE membrane filter	Ercan and El, 2011
	Sample weight: 1 g Reagents: Hanks' balanced salt solution (20 mL), ethanol (6.5 mL), <i>n</i> -hexane (20 mL), 2-propanol (2.5 mL) Sample filtration: 0.2 µm surfactant free cellulose acetate filters	Tobin et al., 2014
	Sample weight: 1 g Reagents: 0.15 M sodium chloride solution (20 mL), ethanol (9 mL), <i>n</i> -hexane (30 mL), acetone (2.5 mL)	Román-Pizarro et al., 2017
	Sample weight: 0.05 g Reagent: 2-propanol (7-12 mL)	Kubo et al., 2008
	For oils extracted by enzymatic hydrolysis and oils extracted using SCO₂ 600 g CO₂/h+5% EtOH Sample weight: unspecified amount Reagent: 2-propanol (unspecified volume)	Laplante et al., 2009

Extraction method	Sample weight/Reagents and materials used	Reference
	Sample weight: 0.05-0.1 g Reagents: 2-propanol (2-3 mL)	Stiff et al., 2011
	Sample weight: 10-60 mg Reagents: 2-propanol (1500 µL), saline solution (150 µL), hexane (500 µL), methanol/ethanol/propanol (100:95:5, <i>v/v/v</i>) (60 µL)	Niklowitz et al., 2013
	Sample: 50 mg Reagents: nitrogen-saturated ethanol/water (95:5, <i>v/v</i>) PBS solution (pH 6.5) (26.5 mL)	Li et al., 2016
Ultrasonic extraction method	Sample weight: 2.0 g Reagents: liquid nitrogen, anhydrous ethanol (60 mL), hexane (unspecified volume) Extraction time: 15 min	Zu et al., 2006
Saponification-extraction method	For vegetable samples Sample weight: 0.2 g Reagents: 2% ascorbic acid solution (2 mL), methanol (5 mL), aqueous potassium hydroxide solution (50 g KOH + 50 mL H ₂ O) (0.5 mL), 10% sodium chloride solution (7 mL), <i>n</i> -hexane (65 mL), 5% sodium chloride solution (20 mL), ethanol (5 mL), <i>n</i> -hexane/2-propanol (1:1, <i>v/v</i>) (2-5 mL) Sample filtration: 0.2 µm PTFE membrane filter, Lida	Mattila and Kum-pulainen, 2001
	For animal samples Sample weight: 2 g Reagents: 2% ascorbic acid solution (2 mL), methanol (5 mL), potassium hydroxide solution (50 g KOH + 50 mL H ₂ O) (0.5 mL), 10% sodium chloride solution (7 mL), <i>n</i> -hexane (65 mL), 5% sodium chloride solution (20 mL), ethanol (5 mL), <i>n</i> -hexane/2-propanol (3:7, <i>v/v</i>) (2 mL) Sample filtration: 0.2 µm PTFE membrane filter, Lida	Mattila and Kum-pulainen, 2001
	Sample weight: 1 g Reagents: 5% aqueous pyrogallol solution (5 mL), 10% sodium hydroxide solution (5 mL), methanol (10 mL), 10% sodium chloride solution (10 mL), <i>n</i> -hexane (65 mL), 5% sodium chloride solution (20 mL), ethanol (5 mL), 2-propanol (1 mL) Sample filtration: 0.45 µm PTFE syringe filter, Whatman	Pyo, 2010
	Sample weight: 50 g Reagents for saponification: distilled water (50 g), pyrogallol (2.5 g), methanol (70 mL), 25% aqueous potassium hydroxide solution (25 mL), petroleum ether 40-60 °C (75 mL), sodium sulfate anhydrous, ethanol (5 mL) Purification of the saponified extract over alumina (50 x 1 cm) column Separation of CoQ10 from the purified extract on silica gel F ₂₅₄ glass plate (20 x 20 cm)	Al-Faraji and Shanshal, 2010
	Sample weight: 2 g Reagents: 2% ascorbic acid solution (2 mL), methanol (5 mL), potassium hydroxide solution (50 g KOH + 50 mL H ₂ O) (0.5 mL), 10% sodium chlorine solution (7 mL), <i>n</i> -hexane (65 mL), 5% sodium chloride solution (20 mL), ethanol (5 mL), <i>n</i> -hexane/2-propanol (30:70, <i>v/v</i>) (2 mL)	Ercan and El, 2011

Extraction method	Sample weight/Reagents and materials used	Reference
	Sample weight: 0.5 g Reagents: 60% potassium hydroxide solution (2 mL), 6% ethanolic pyrogallol solution (5 mL), 96% ethanol (2 mL), 1% sodium chloride solution (15 mL), hexane/ethyl acetate (9:1, <i>v/v</i>) (15 mL), 1% 2-propanol in <i>n</i> -hexane (2 mL)	Manzi and Durazzo, 2015
	Sample weight: 35 g Reagents: 2 N ethanolic potassium hydroxide solution (35 mL), 1% ethanolic pyrogallol solution (20 mL), bidistilled water (105 mL), ethanol (10 mL), petroleum ether/diethyl ether (9:1, <i>v/v</i>) (70 mL), sodium sulfate anhydrous (5 g), 2-propanol (1 mL) Sample filtration: 0.45 µm nylon syringe filter, Agilent Technologies	Mandrioli et al., 2018
Solid-phase extraction (SPE)	Sample weight: 0.25 g Reagents: heptane (21.5 mL), heptane/ethyl ether (80:20, <i>v/v</i>) (34 mL), acetonitrile/tetrahydrofuran (90:10, <i>v/v</i>) (2 mL) 5 g of solid-phase extraction (SPE) cartridge with amino-propyl (NH ₂) adsorbents, Varian	Rodríguez-Acuña et al., 2008
Accelerated solvent extraction (ASE)	Sample weight: 1 g Reagents: Cleanert Alumina-N (3 g), absolute ethanol (19 mL) Temperature: 80°C Heat-up time: 5 min Static time: 5 min Flush volume: 60% Purge time: 1 min Number of cycles: 1 Cell volume: 10 mL Total extraction time: 16-17 min/sample Sample filtration: 0.45 µm nylon filter membrane, Phenomenex	Xue et al., 2012

Table S2. Centralizing table of quantification methods used.

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Quantification method	Reference
HPLC with UV detection	Weber et al., 1997
	Purchas et al., 2004
	Al-Faraji and Shanshal, 2010
	Stiff et al., 2011
	Ercan and El, 2011
	Tobin et al., 2014
	Manzi and Durazzo, 2015
HPLC with DA detection	Mattila et al., 2000
	Mattila and Kumpulainen, 2001
	Souchet and Laplante, 2007
	Laplante et al., 2009
	Xue et al., 2012
	Román-Pizarro et al., 2017
	Mandrioli et al., 2018
HPLC with EC detection	Mattila et al., 2000
	Niklowitz et al., 2013
HPLC/ESI-MS detection	Pyo, 2010
HPLC/ESI-MS/MS detection	Zu et al., 2006
HPLC with AEC detection	Kubo et al., 2008
HPLC/APCI-MS detection	Rodríguez-Acuña et al., 2008
CEFS detection	Román-Pizarro et al., 2017
DPV using an electrochemical workstation	Li et al., 2016

HPLC-high-performance liquid chromatography; UV-ultraviolet; DA-Diode Array; EC-electrochemical; ESI-Electrospray ionization; MS-Mass spectrometry; AEC-amperometric electrochemical; APCI-atmospheric pressure chemical ionization; CEFS-Cary Eclipse fluorescence spectrometer; DPV-differential pulse voltammetry.

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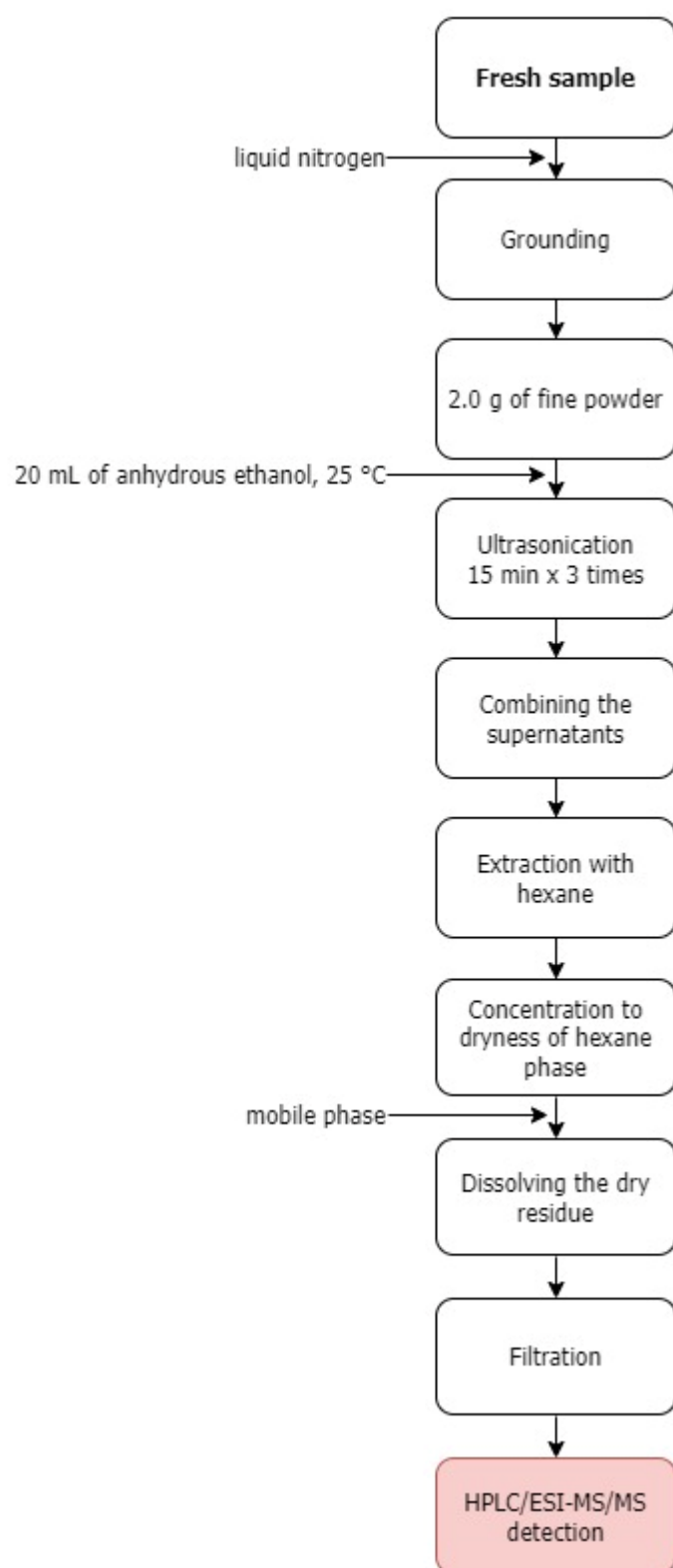


Figure S1. Workflow of the analytical method adapted from Zu et al., 2006.

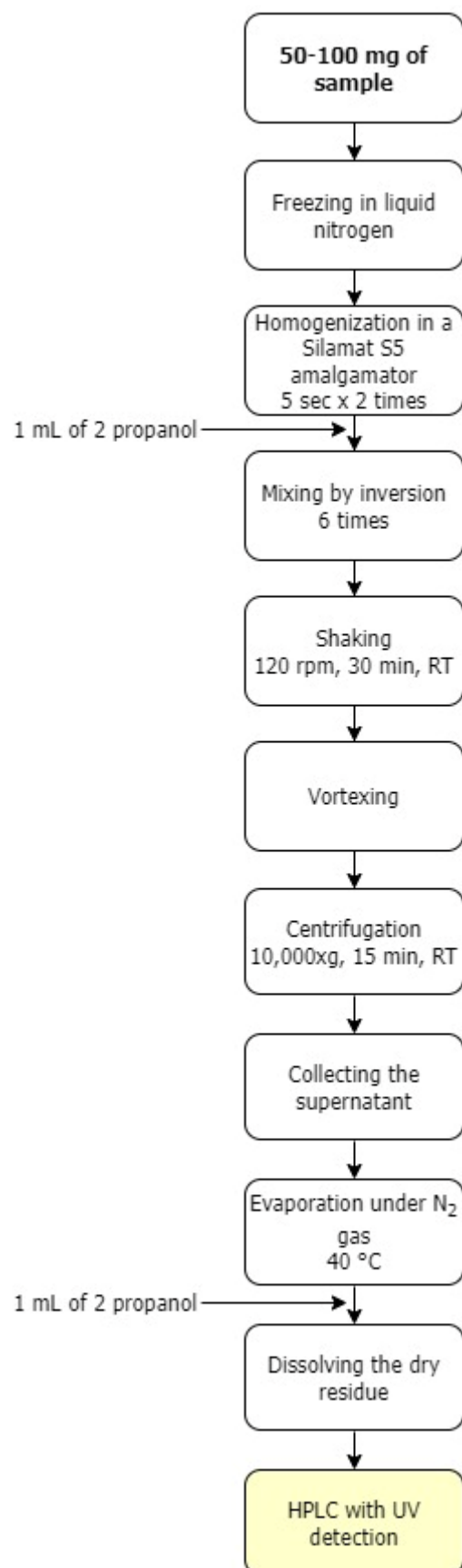


Figure S2. Workflow of the analytical method adapted from of Stiff et al., 2011.

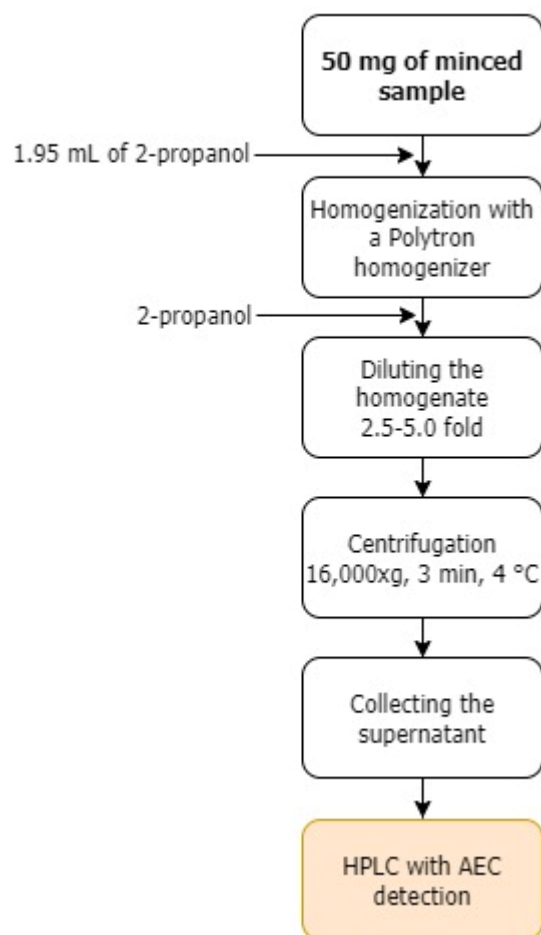


Figure S3. Workflow of the analytical method adapted from Kubo et al., 2008.



Figure S4. Workflow of the analytical method adapted from Román-Pizarro et al., 2017.

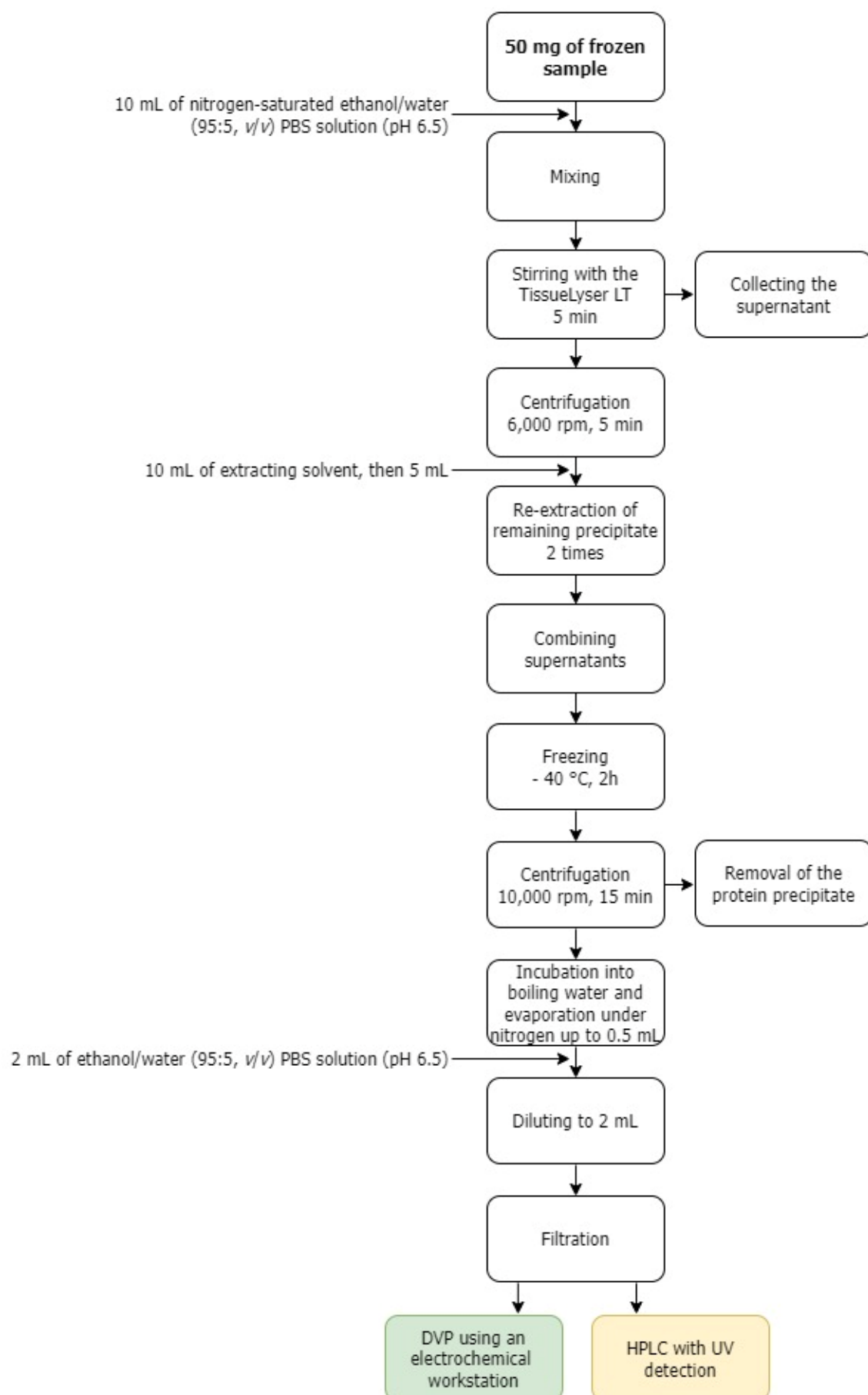


Figure S5. Workflow of the analytical method adapted from Li et al., 2016.

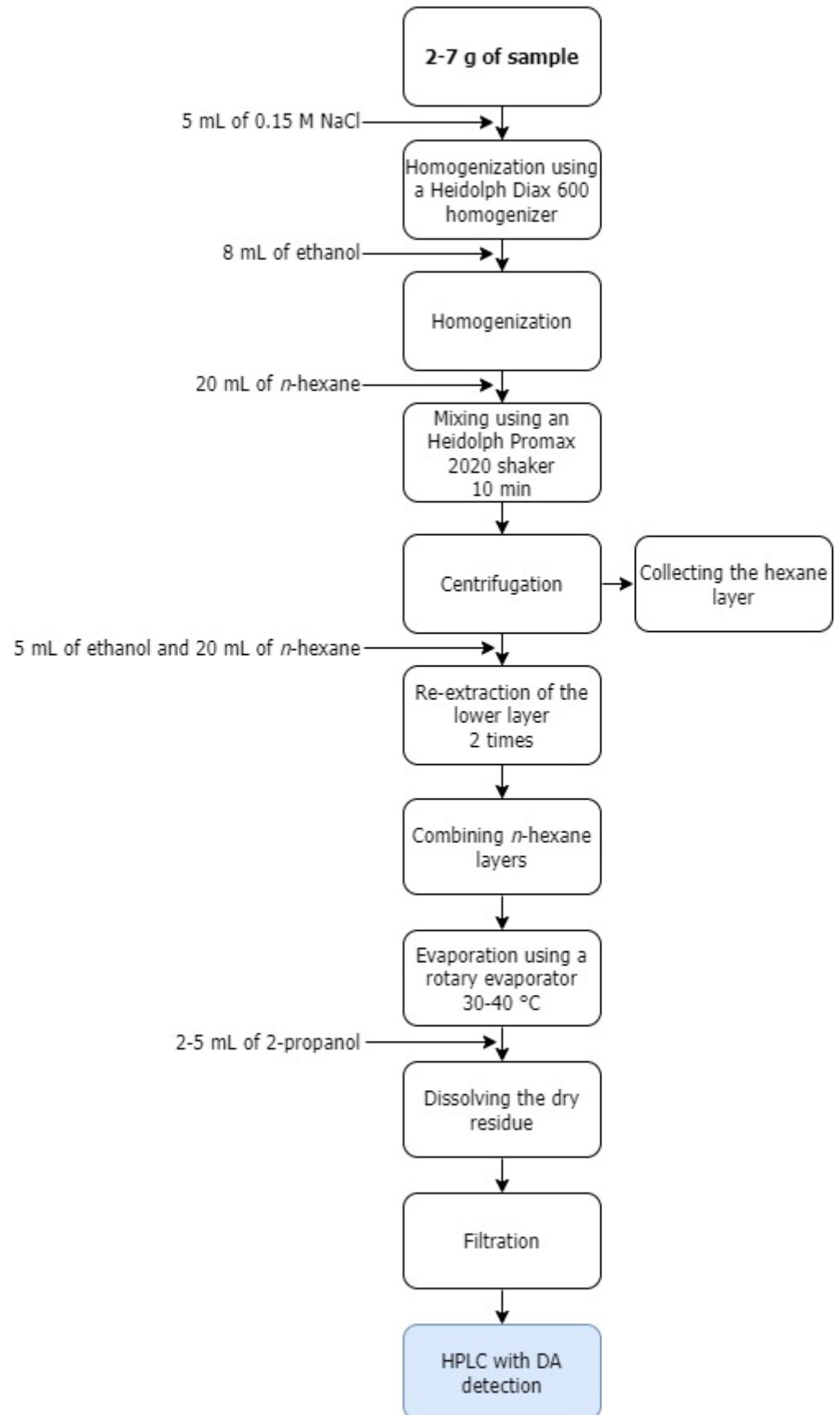


Figure S6. Workflow of the analytical method adapted from Mattila and Kumpulainen, 2001 (direct extraction method).

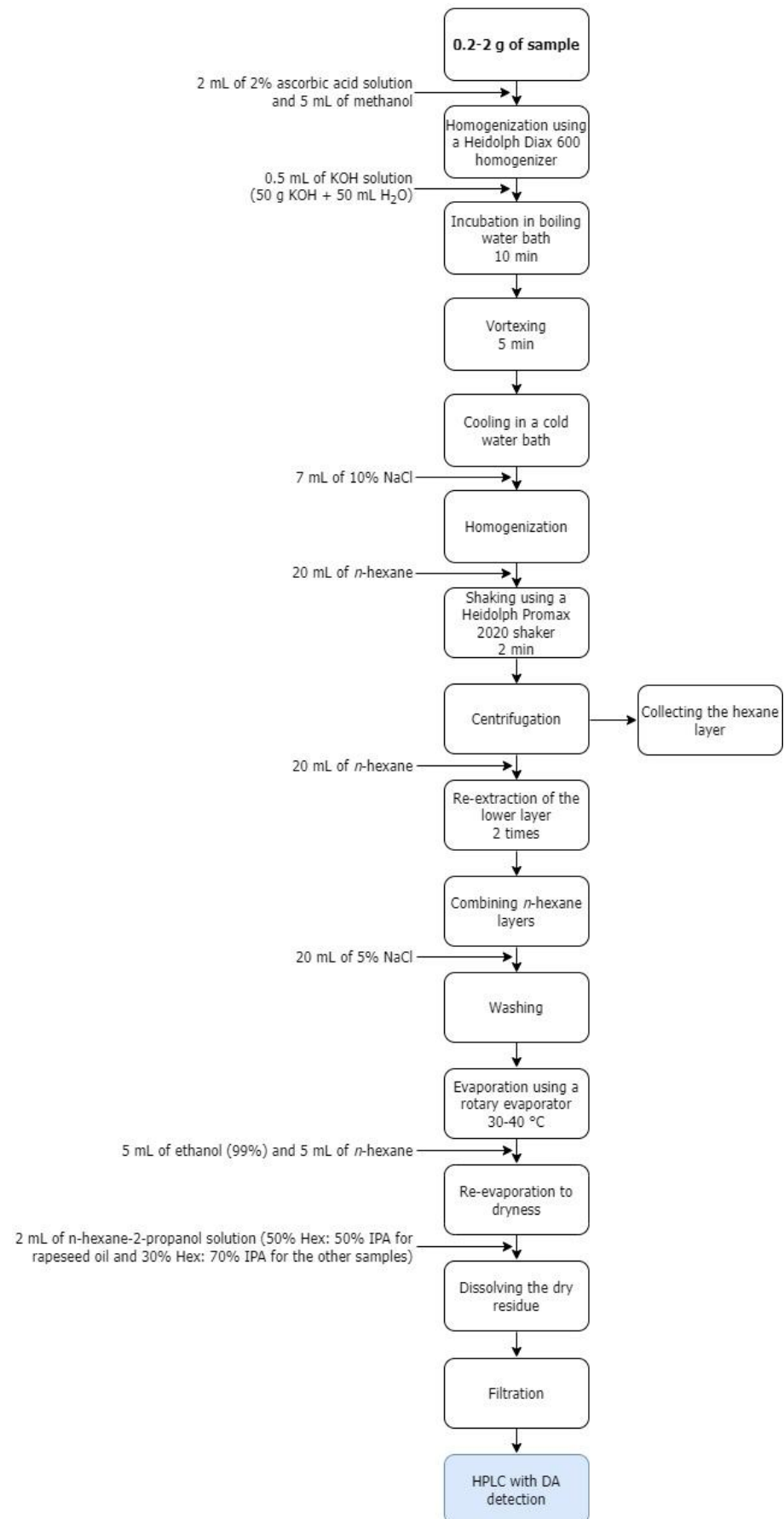


Figure S7. Workflow of the analytical method adapted from Mattila and Kumpulainen, 2001 (saponification-extraction method).

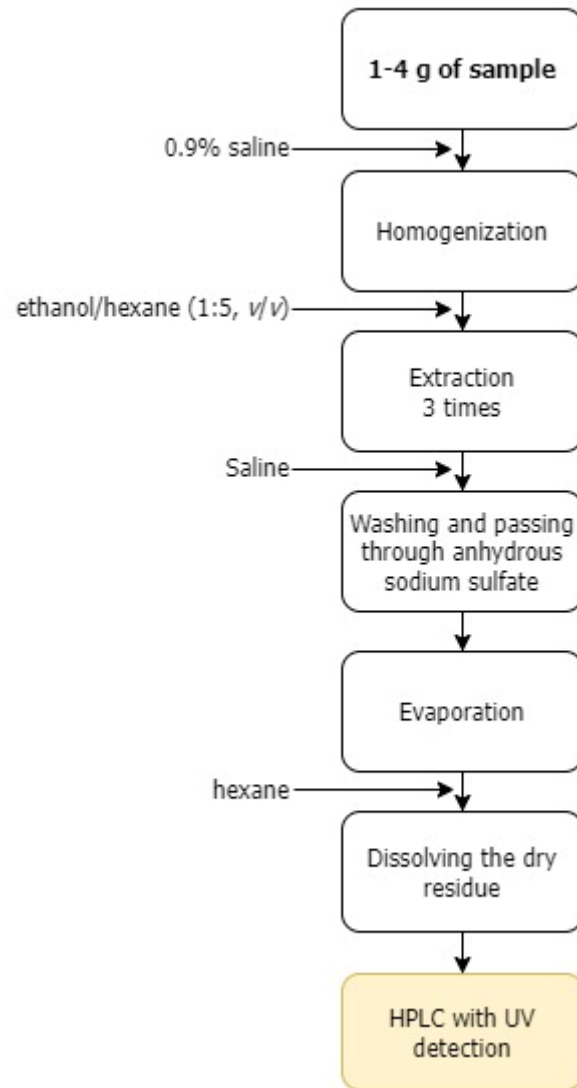


Figure S8. Workflow of the analytical method adapted from Weber et al., 1997.

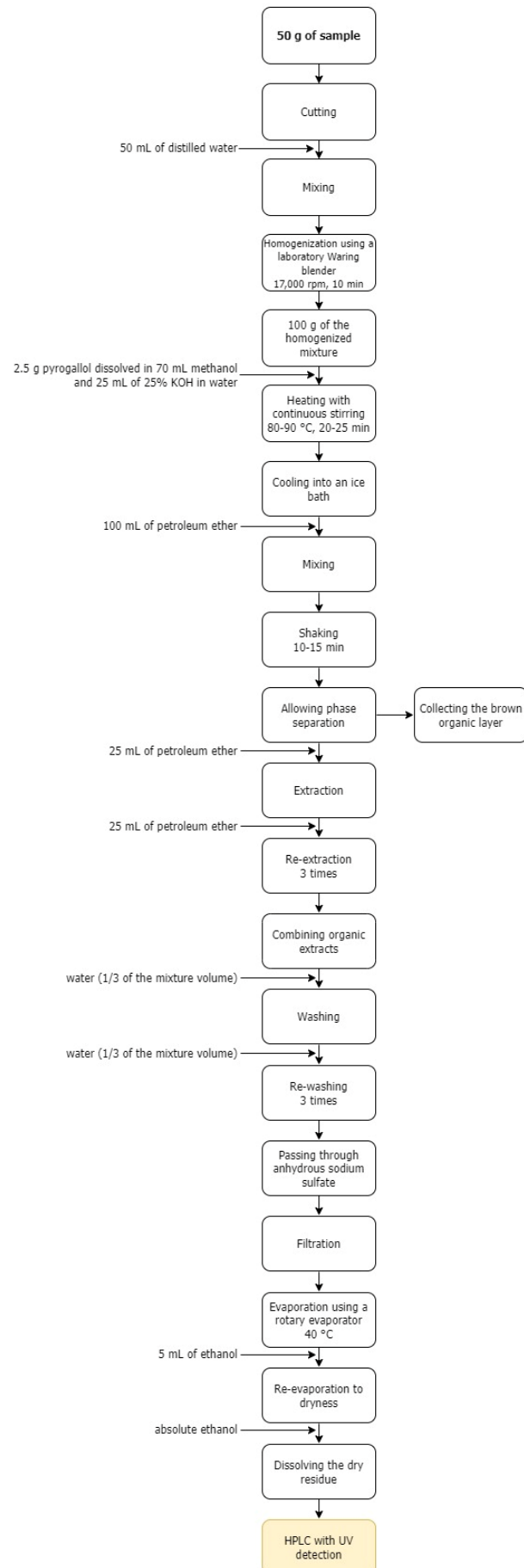


Figure S9. Workflow of the analytical method adapted from Al-Faraji and Shanshal, 2010.

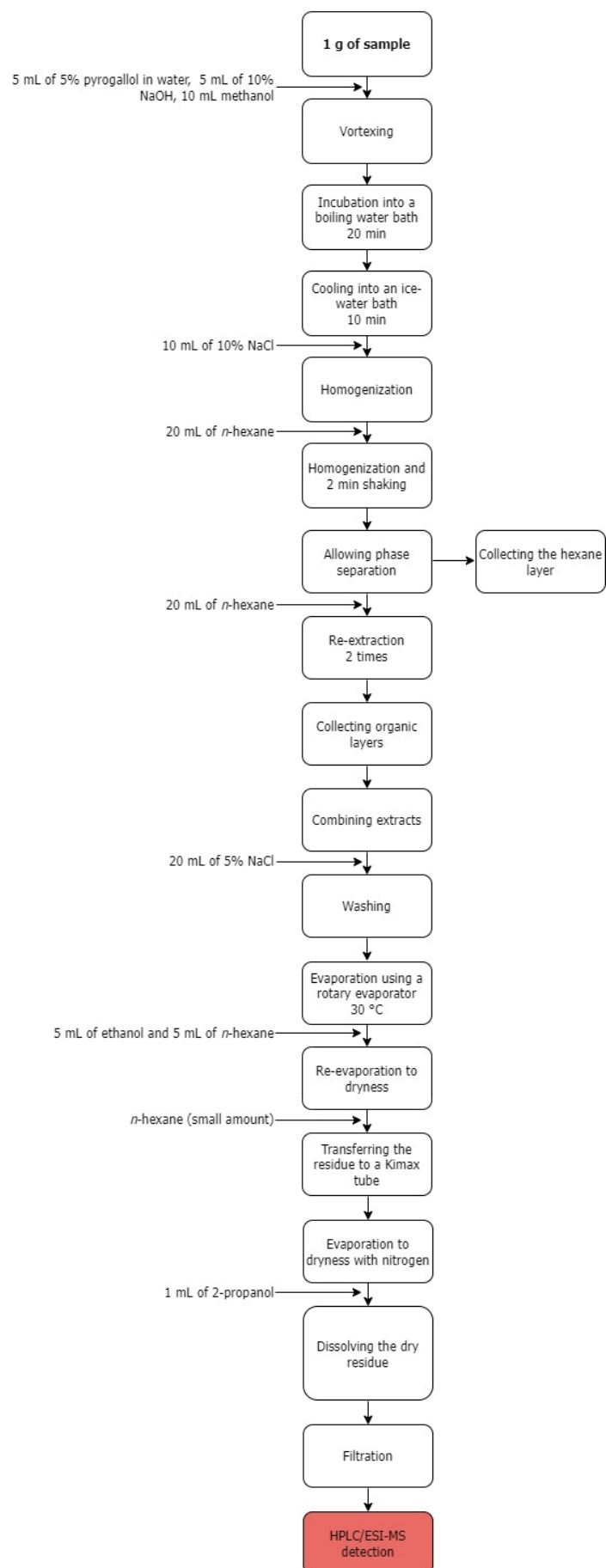


Figure S10. Workflow of the analytical method adapted from Pyo, 2010.

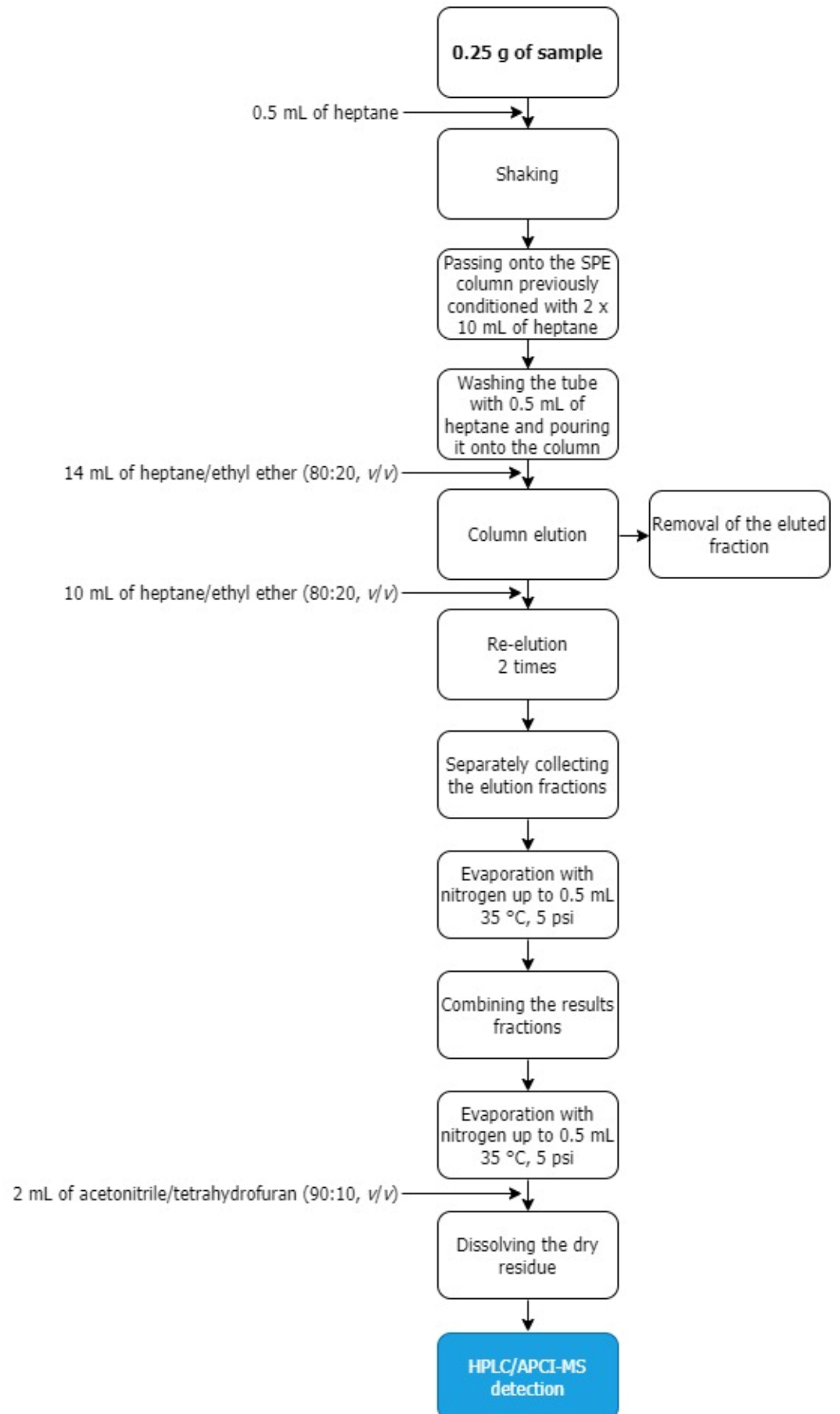


Figure S11. Workflow of the analytical method adapted from Rodríguez-Acuña et al., 2008.

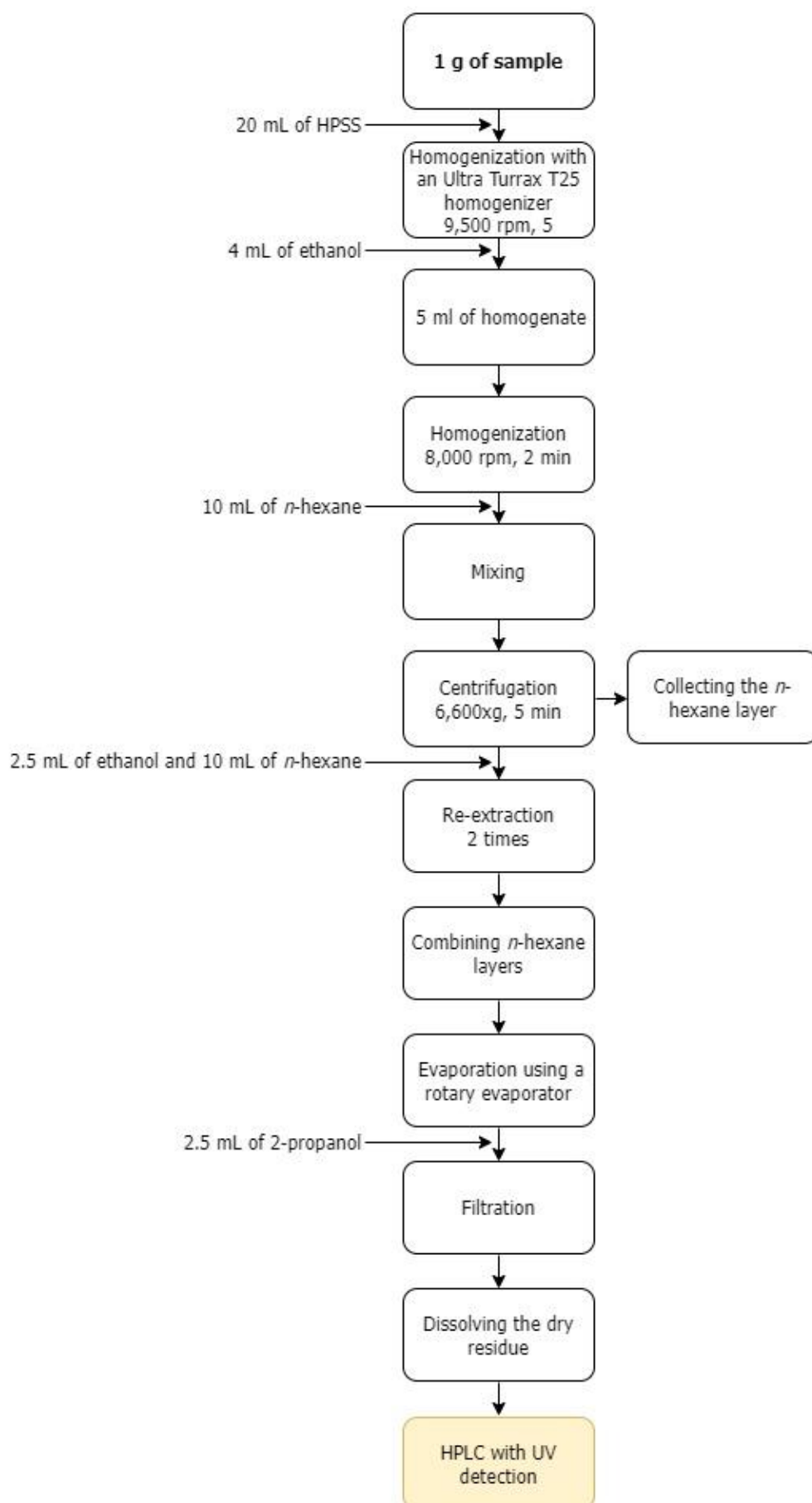


Figure S12. Workflow of the analytical method adapted from Tobin et al., 2014.

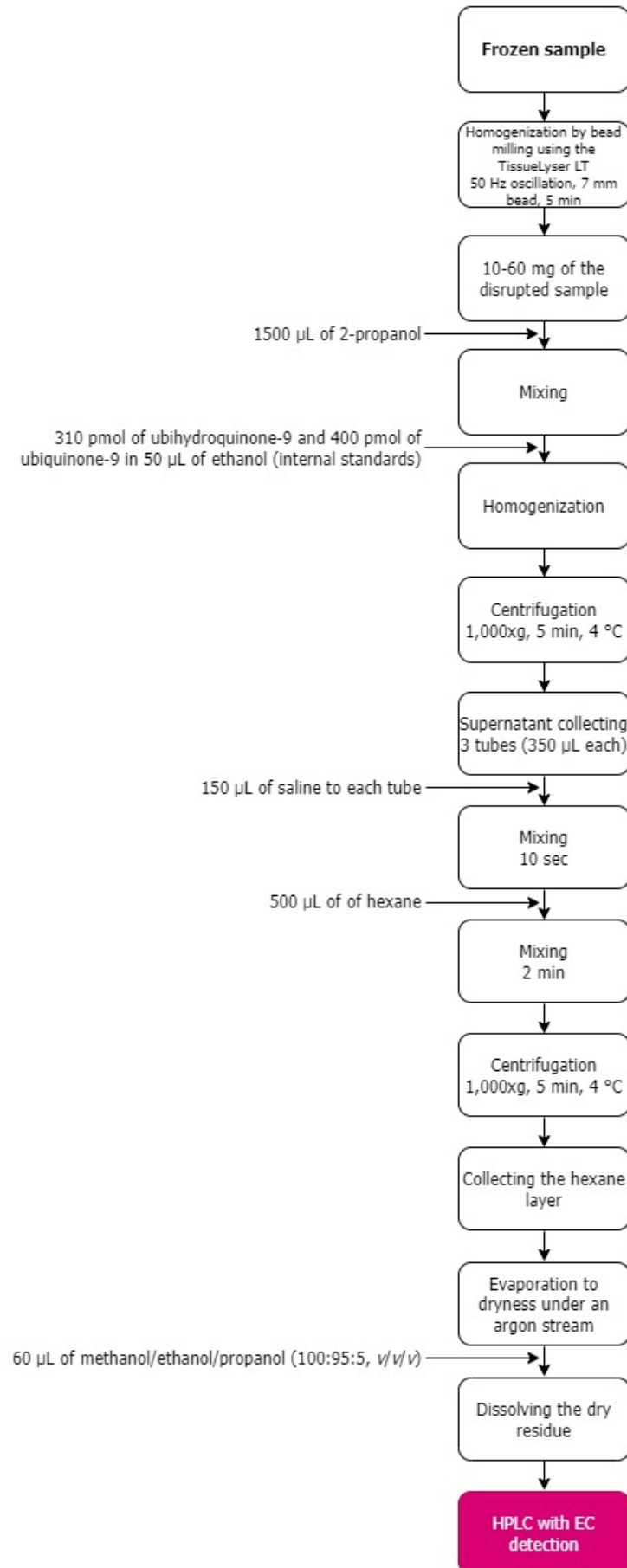


Figure S13. Workflow of the analytical method adapted from Niklowitz et al., 2013.

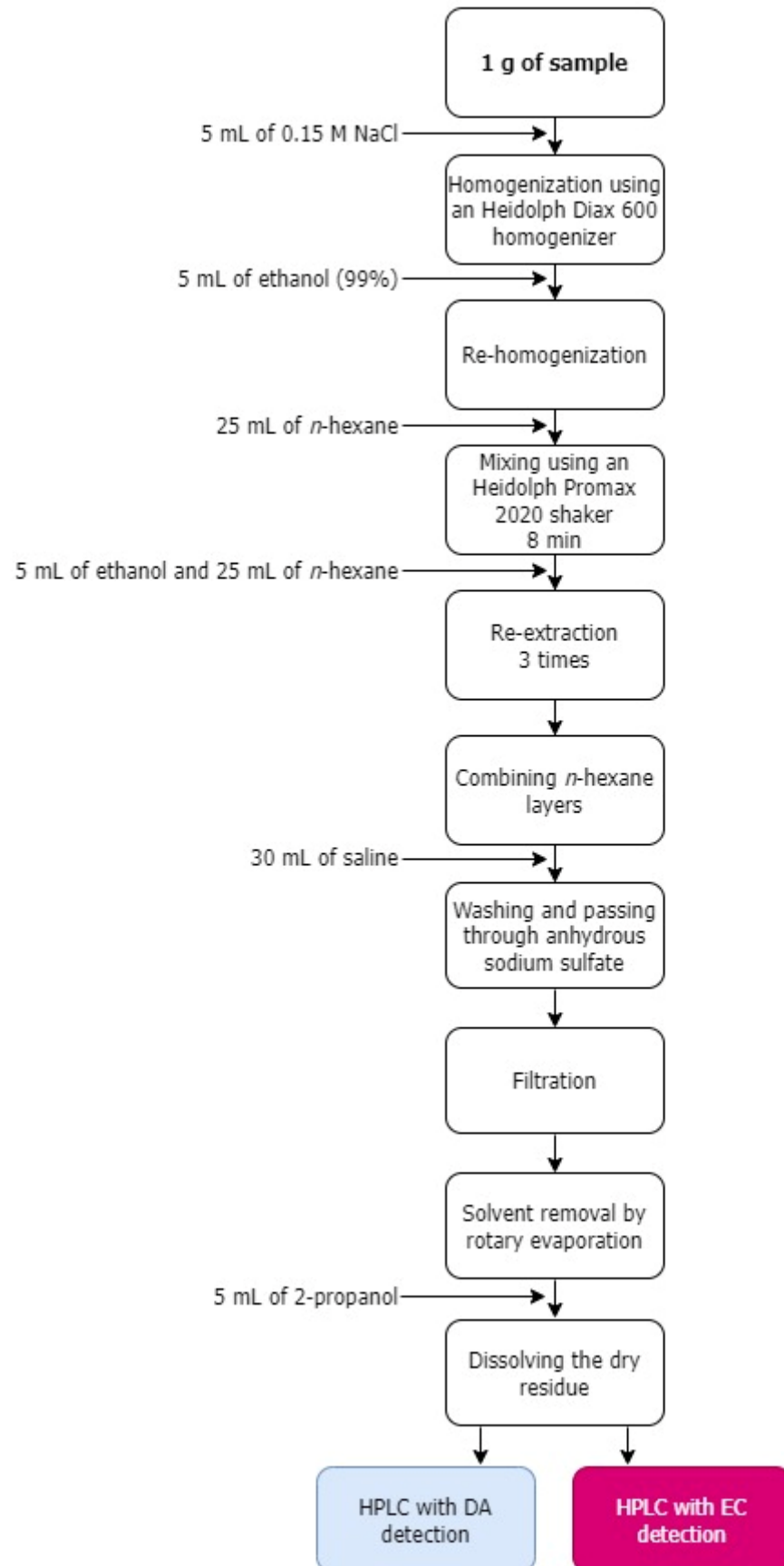


Figure S14. Workflow of the analytical method adapted from Mattila et al., 2000.

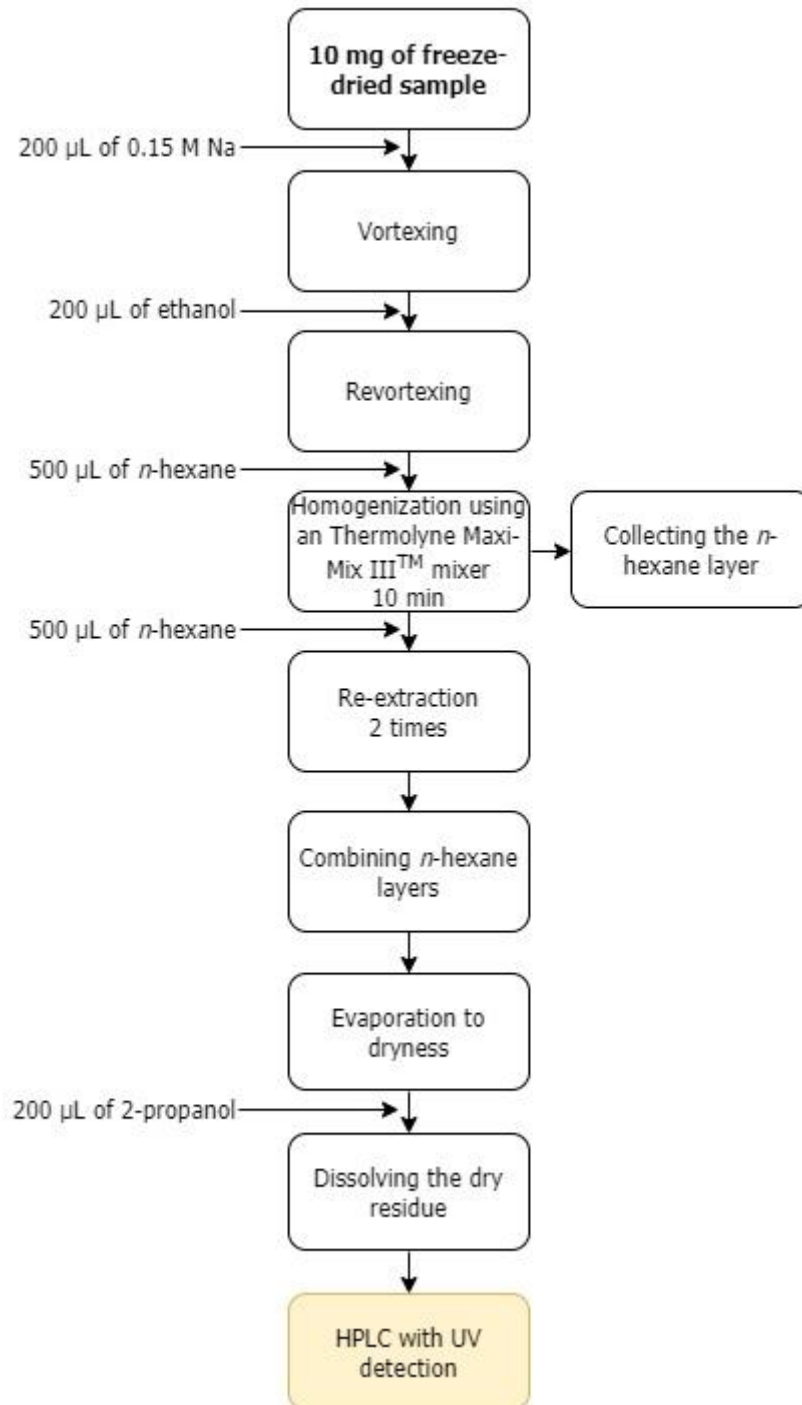


Figure S15. Workflow of the analytical method adapted from Purchas et al., 2004.

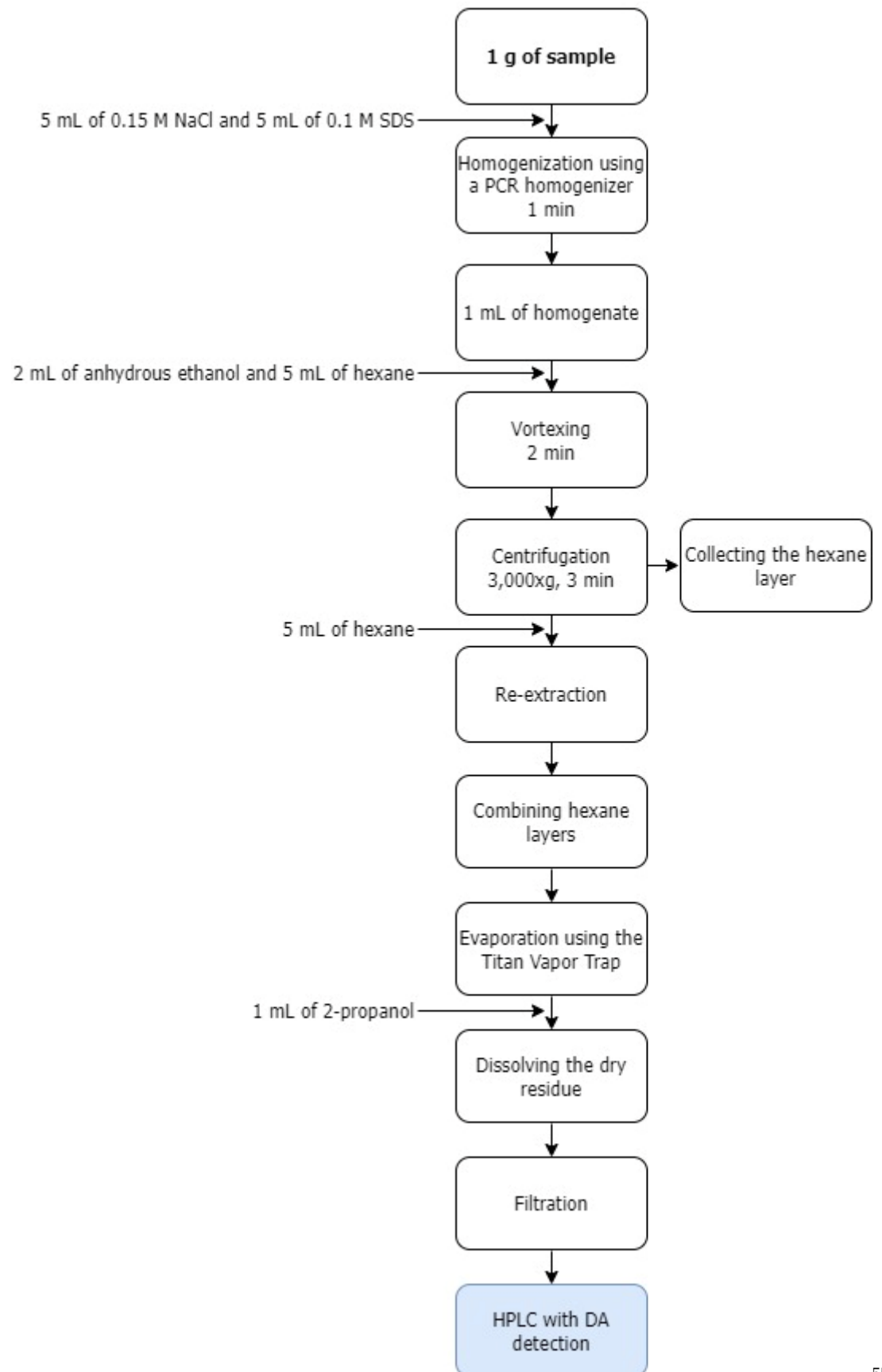


Figure S16. Workflow of the analytical method adapted from Souchet and Laplante, 2007.

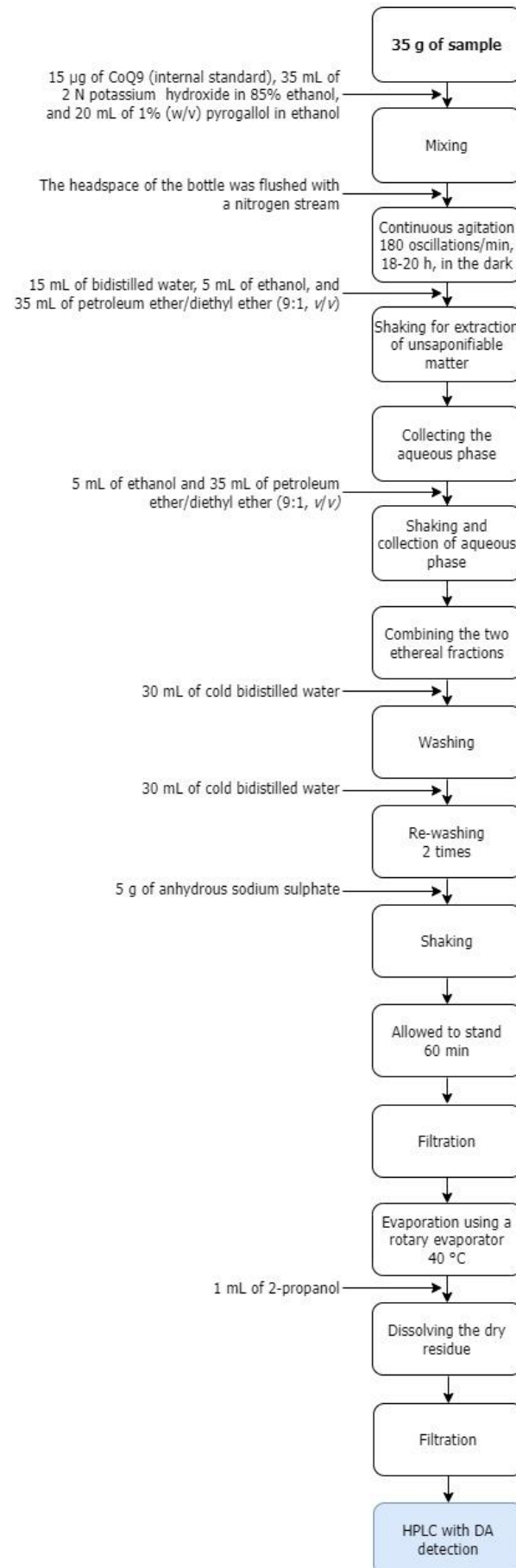


Figure S17. Workflow of the analytical method adapted from Mandrioli et al., 2018.

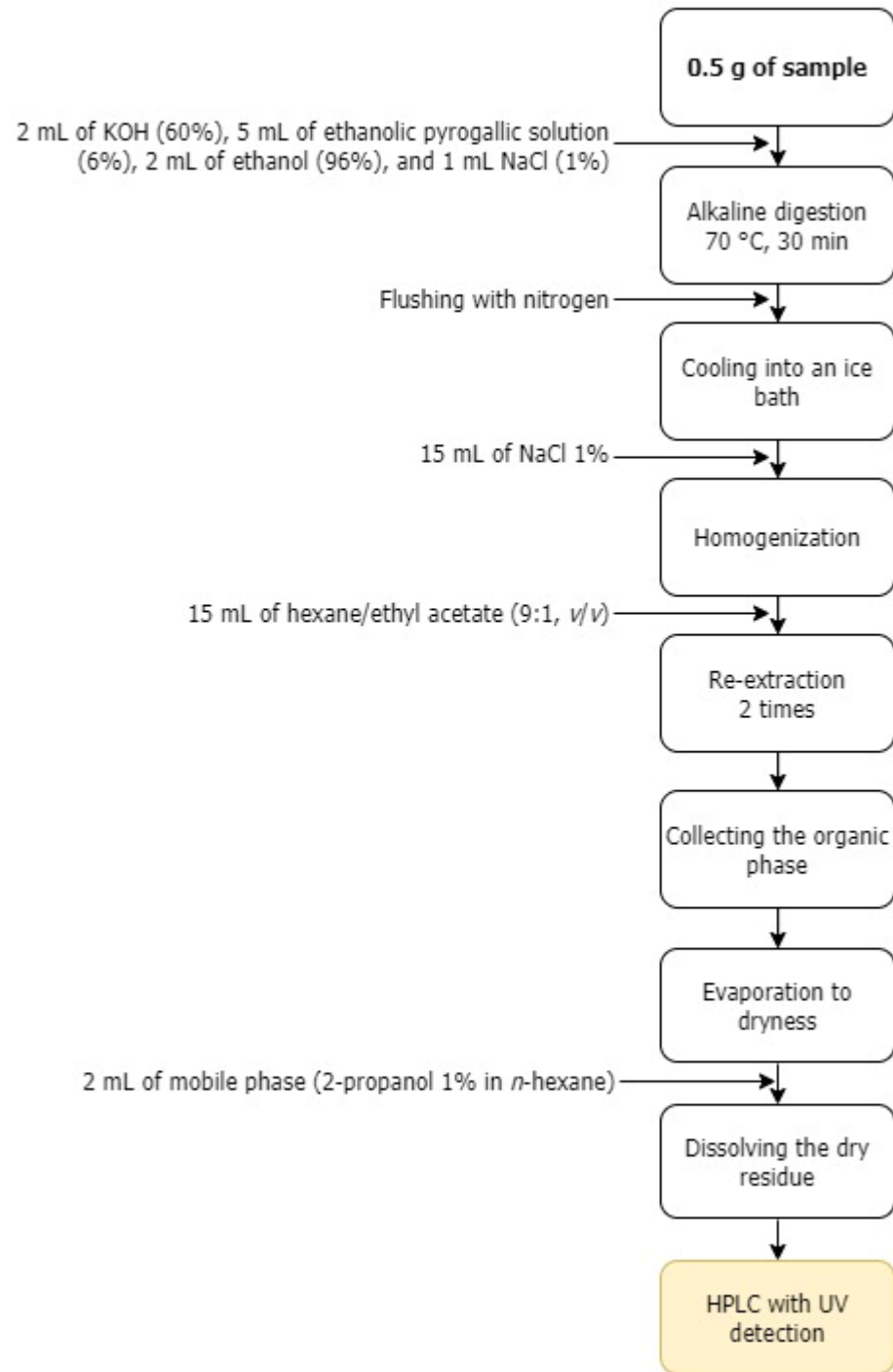


Figure S18. Workflow of the analytical method adapted from Manzi and Durazzo, 2015.

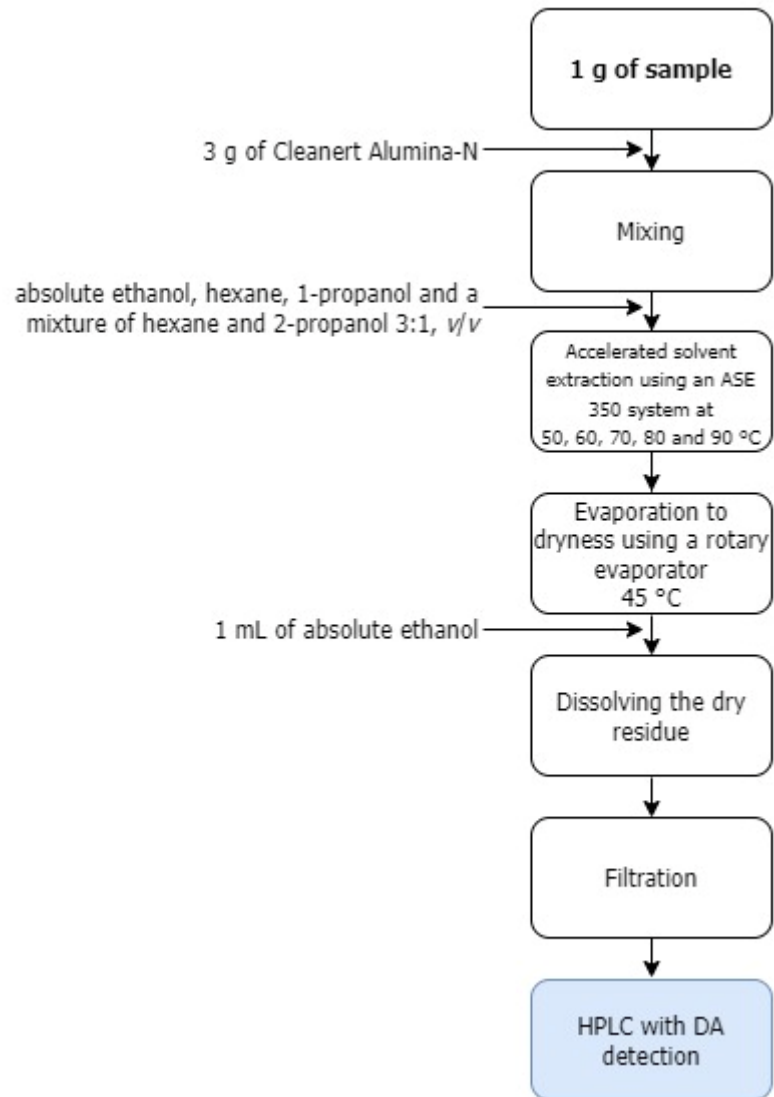


Figure S19. Workflow of the analytical method adapted from Xue et al., 2012.

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