Analysis of Total Fat

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Total Fat

- Refers to the sum of triglycerides, phospholipids, wax ester, sterols and minor amount of non-fatty materials

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Methods

- **Sum of individual triglyceride** X
- **Gravimetric methods**

Common techniques

- ➢ **Soxhlet extraction (without hydrolysis)**
- ➢ **Acid / alkaline hydrolysis**

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Soxhlet extraction Vs Acid hydrolysis

- **GB/T 5009.6-2003**

  Determination of fat in foods

  - **Soxhlet extraction**

    Crude fat including free fat (游離脂肪)

  - **Acid hydrolysis**

    Total fat including free and bounded fat (游離及結合脂肪)

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AOAC official methods

Acid hydrolysis

Method	Matrix	Solvent
963.15	Cacao products	Petroleum ether
925.12	Macaroni Product	Ether / petroleum ether
945.44	Fig bars & raisin-filled crackers	Ether / petroleum ether
922.06	Flour	Ether / petroleum ether
935.38*	bread	Ether / petroleum ether
925.32*	eggs	Ether / petroleum ether
948.15*	Seafood	Ether / petroleum ether
948.16	Fish meal	Acetone
950.54	Food dressings	Ether / petroleum ether

* Procedure similar to AOAC 922.06

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AOAC official methods

Alkaline hydrolysis

Method	Matrix	Solvent
989.05	Milk	Ether / petroleum ether
920.111*	Cream	Ether / petroleum ether
995.19	Cream	Ether / petroleum ether
945.48*	Evaporated and condensed milk	Ether / petroleum ether
920.115*	Sweet condensed milk	Ether / petroleum ether
922.09*	Malted milk	Ether / petroleum ether
932.06*	Milk powder	Ether / petroleum ether
986.25*	Milk-based infant formula	Ether / petroleum ether
933.05*	Cheese	Ether / petroleum ether
974.09*	Whey cheese	Ether / petroleum ether
952.06*	Ice cream and frozen desserts	Ether / petroleum ether

* Procedure similar to AOAC 989.05

AOAC official methods

- **Without hydrolysis (Soxhlet extraction)**

Method	Matrix	Solvent
960.39	Meat	Anhydrous ether or petroleum ether
991.36	Meat and meat products	Petroleum ether
948.22	Nuts and nut products	Ether (16h)

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AOAC official methods

Other techniques

Method	Matrix	Techniques	Solvent
938.06	Butter	Wash sample with ether or petroleum ether, fat = 100 – water -residue	
995.18	Cream	Babcock method	
989.04	Raw milk	Babcock method	
2000.18	Raw, whole milk	Gerber method	
960.26	Raw milk	Rapid detergent method	
969.16	milk	Automated turbidimetric method	
973.22	milk	Automated turbidimetric method	
972.16	milk	Mid-infrared spectroscopic method	
969.24	Fish meal	Semimicro method, extraction apparatus	$CHCl_3$
964.12	Seafood	Rapid modified babcock method	
976.21	Meat	Rapid specific gravity method	C_2Cl_4
985.15	Meat and poultry products	Rapid microwave –solvent extraction	CH_2Cl_2

Points to note

- **Soxhlet extraction**

  dried samples is required

  results may vary with the reflux rate and extraction time

- **Acid hydrolysis can produce higher results for cereal products**

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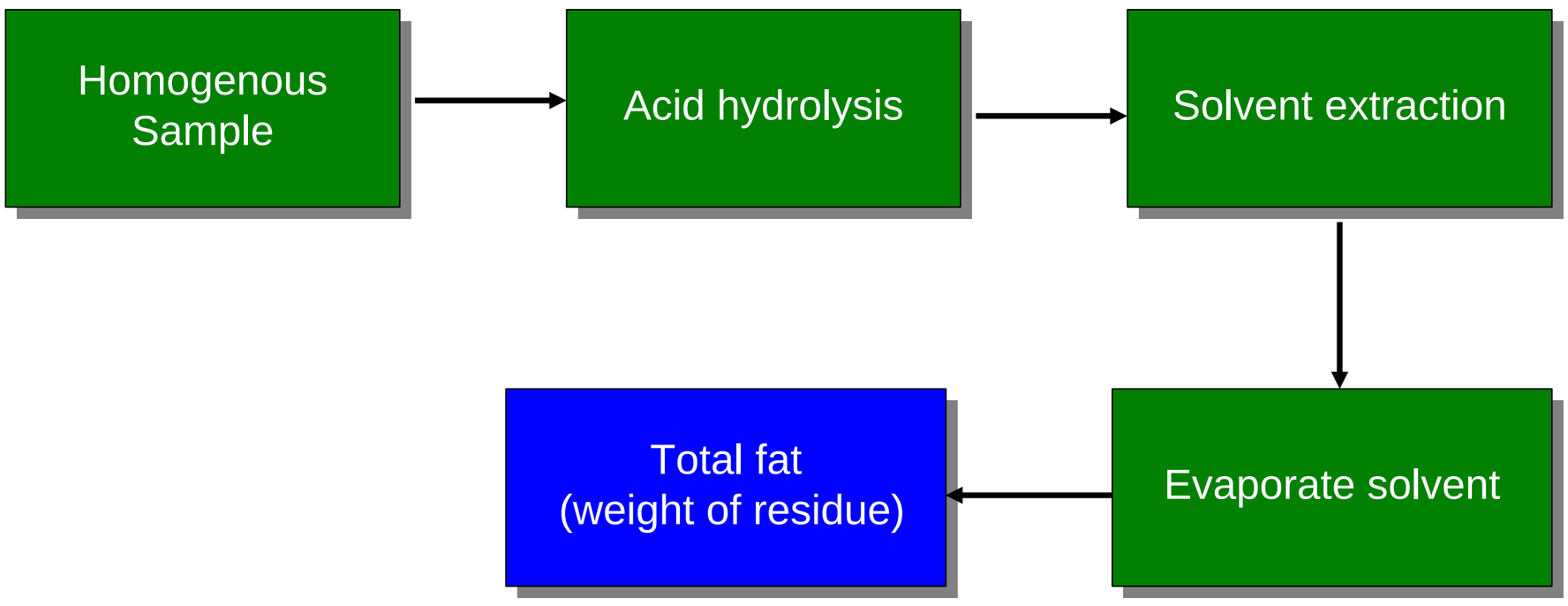
Flow chart for acid hydrolysis



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Sample preparation

- edible and non-edible portions
- water content of sample
- representative and homogenous sample
- sample size

  => Definition of “0” ≤ 0.5 g/100g

  e.g. if sample contains 0.5% fat, 1 g sample contains (1 x 0.5%) = 0.005 g of fat

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Blending

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Drying

- Freeze-dryer

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Acid hydrolysis

- **Reagent: ~ 8.3 M HCl**
- **Temp: 70 - 80 °C**
- **Time: 30 - 40 min**

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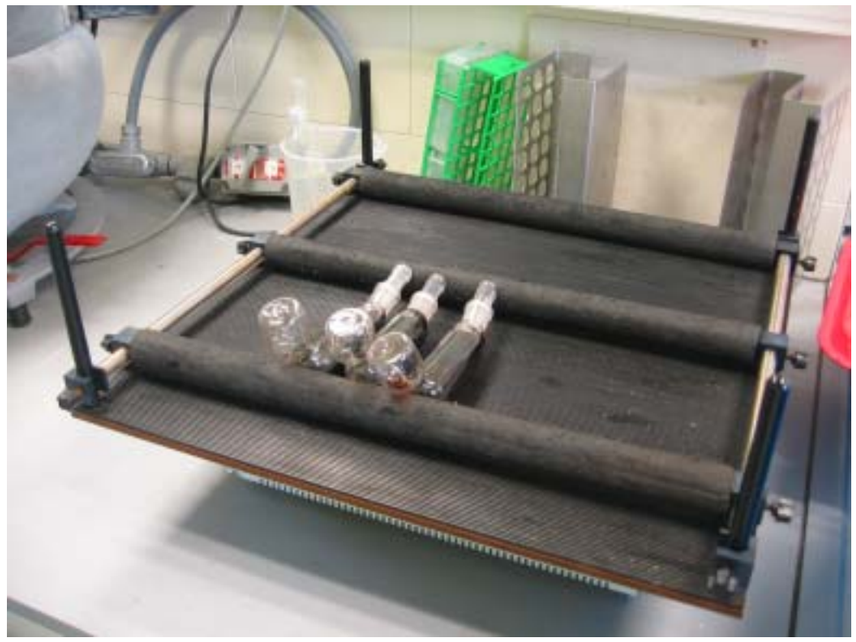
Extraction

- **Solvents: diethyl ether and petroleum ether**



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Weighing

- **Determine the weight of residue**

  Drying to constant weight

  Prolong heating may increase weight of fat, due to oxidation

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Available proficiency test

- FAPAS
- AOAC
- LGC
- AOCS

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CRM

- NIST
- BCR
- LGC/ERM

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Thank You

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