EFFECT OF DIFFERENT DEGUMMING PROCESSES ON MINOR COMPOUNDS IN CANOLA CRUDE OIL

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Introduction

Refining

Canola Crude oil → **Deodorized**

Remove

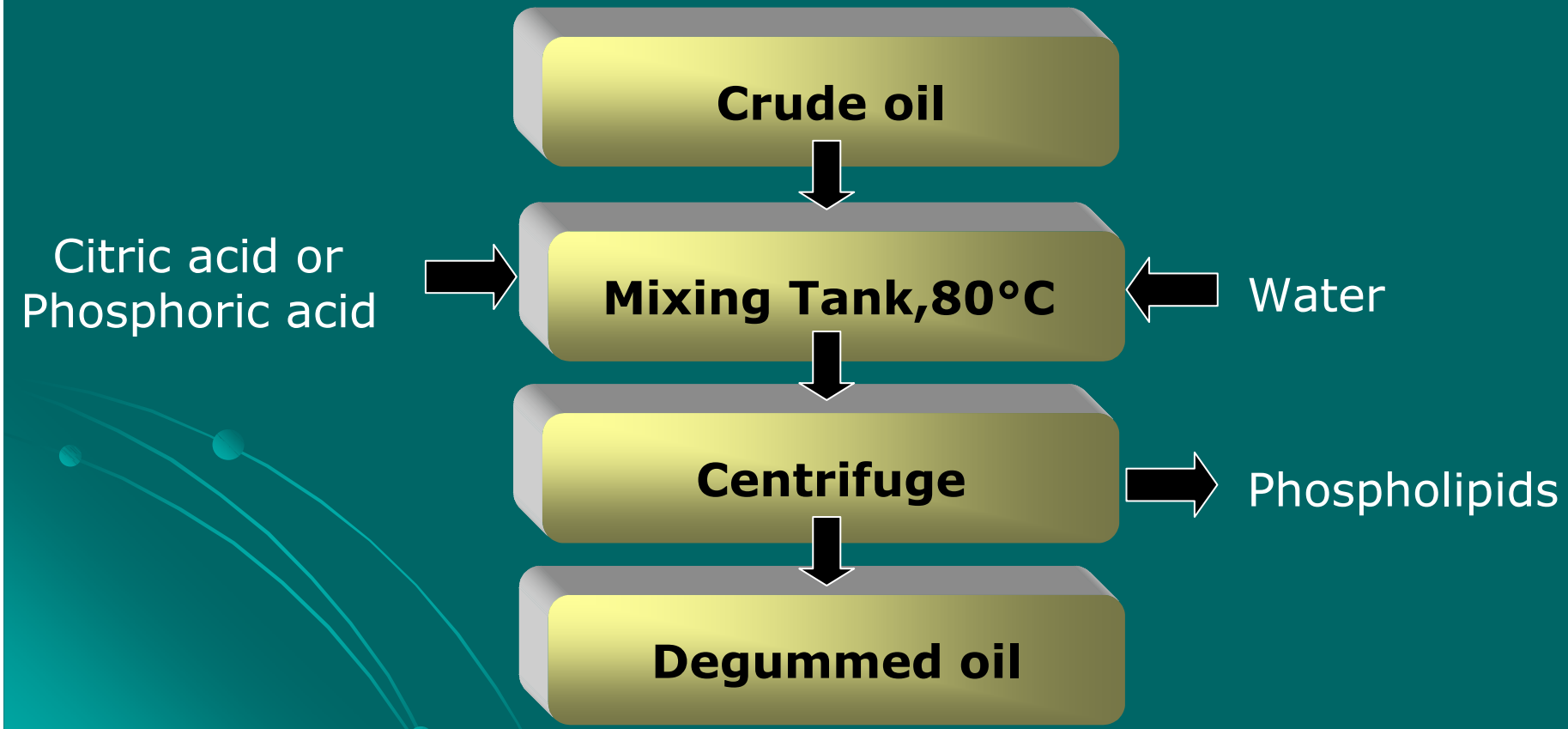
- Phospholipids
- Water
- Colored compounds
- Chlorophyll
- FFA
- Odoriferous compounds

Preserve

- Tocopherol
- Sterols

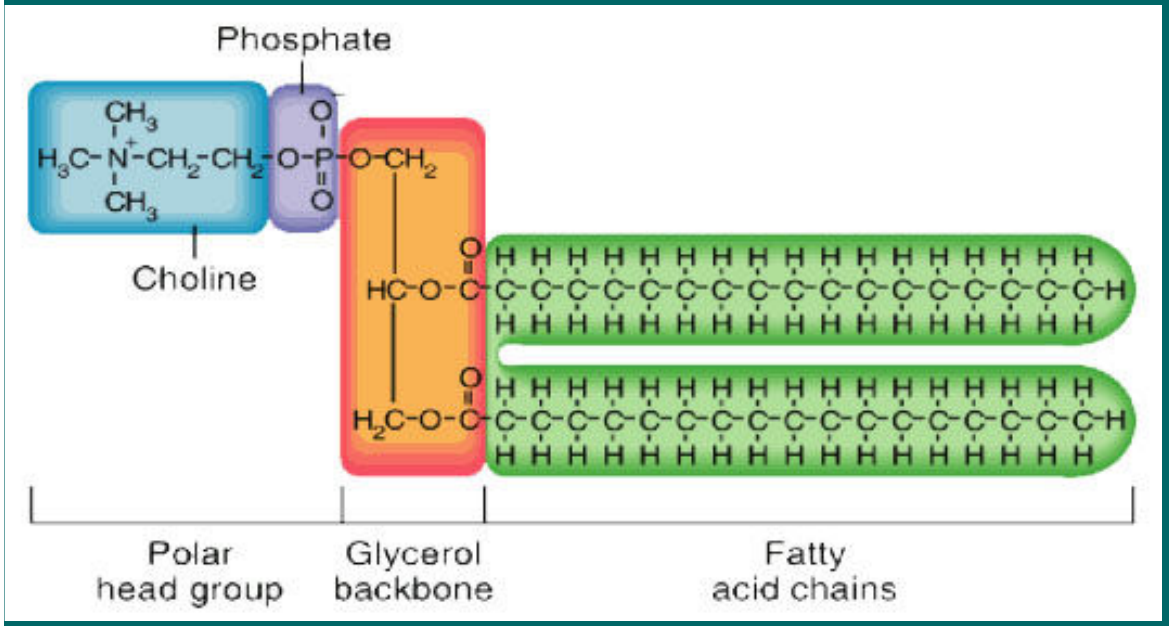
Conventional Degumming

Removal of phospholipids



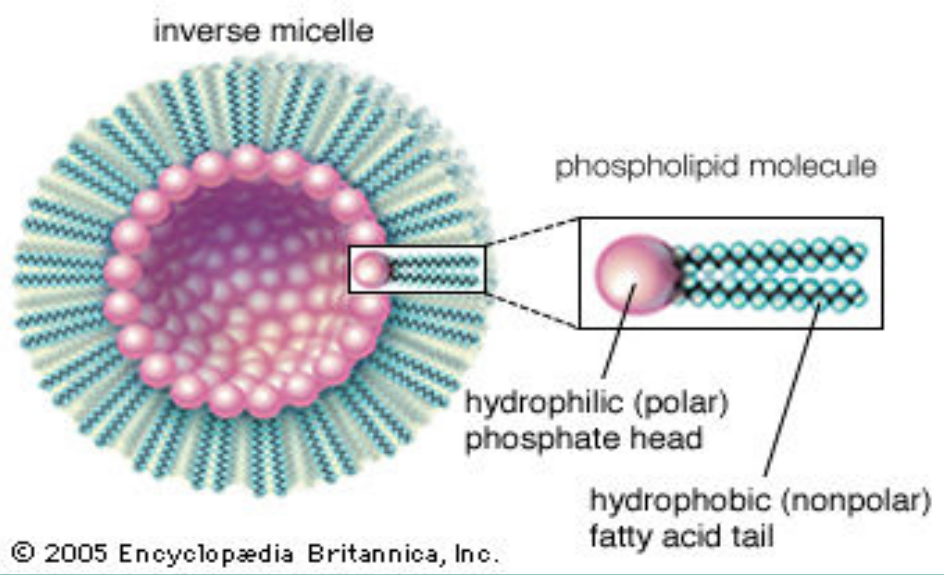
Introduction

Phospholipids



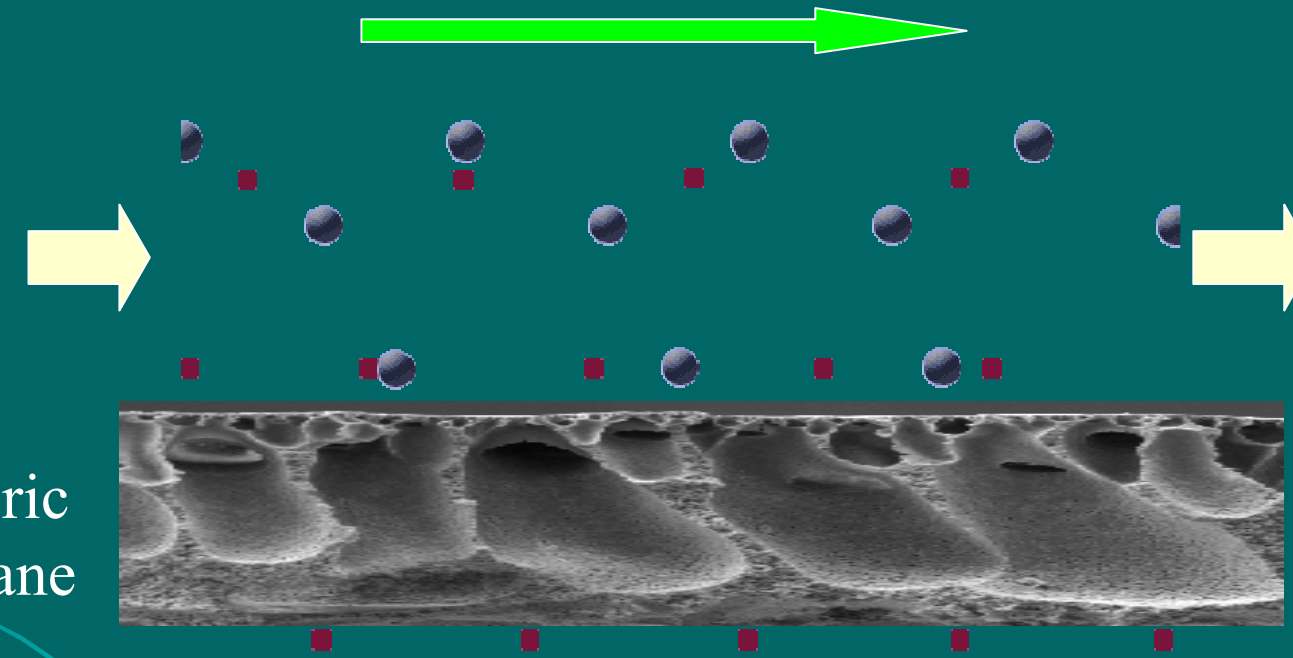
Water is added to crude oil and the polar lipids start to swell and form aggregates of high molecular weight becomming insoluble on oil

Phosholipids at presence of non polar solventes such as hexane forms inverse micelle of 20000 Da



Ultrafiltration

Cross Flow



Concetration factor = mass of feed / mass of retentate

The objective of the work

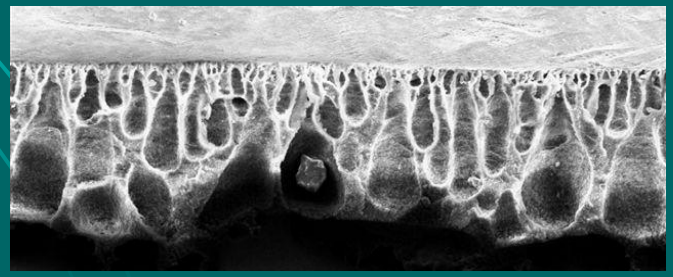
To compare the behaviour of minor compounds under different degumming processes such as:

- Conventional process
- Ultrafiltration of canola crude oil
- Ultrafiltration of miscella (crude oil+hexane)
- Microfiltration of pre-treated oil

Methodology

- Conventional degumming
  - Addition of 0.2% (w/w) citric acid solution, 1.8% (w/w) water; 80°C, 30 min in to a mixer, centrifuge.

- Ultrafiltration of crude oil
  - Polyvinylidene fluoride (PVDF 30 kDa) membrane, crude oil as feed, 40°C, cross flow pilot unit ~ 20L, 2.8 bar, tangential velocity of 6.25 m s^{-1} and concentration factor of 1.02.



Photomicrography of PVDF 30 kDa membrane amplified 1000 times

Methodology

- Ultrafiltration of miscella
  - Polyvinylidene fluoride (PVDF 30 kDa) membrane, miscella 30% (oil + hexane, w/w), 40°C, cross flow pilot unit ~ 20L, 1.6 bar, tangential velocity of 3.24 m s^{-1}.

At concentration factor of 1.34 a permeate flux of **162 L m^{-2} h^{-1}** was achieved.

Pilot Unit

Methodology

- Microfiltration of pre-treated oil
  - Pre-treatement: addition 0.3 % (w/w) of phosphoric acid (85%) and solution of NaOH (20%, w/v) to promote the neutralization of FFA.
  - Polyvinylidene fluoride (PVDF 0.45) µm membrane, 25°C, "dead end" stirred cell, 2.0 bar, 600rpm and concentration factor of 1.34.
  - Form bigger clusters, can be separated by microfiltration and this process promote a degumming and neutralization as a single Step.

Based on: Hafidi et al, Innovative Food Science and Emerging Technologies, v. 6; p. 203-212 , 2005.

"dead end" stirred cell

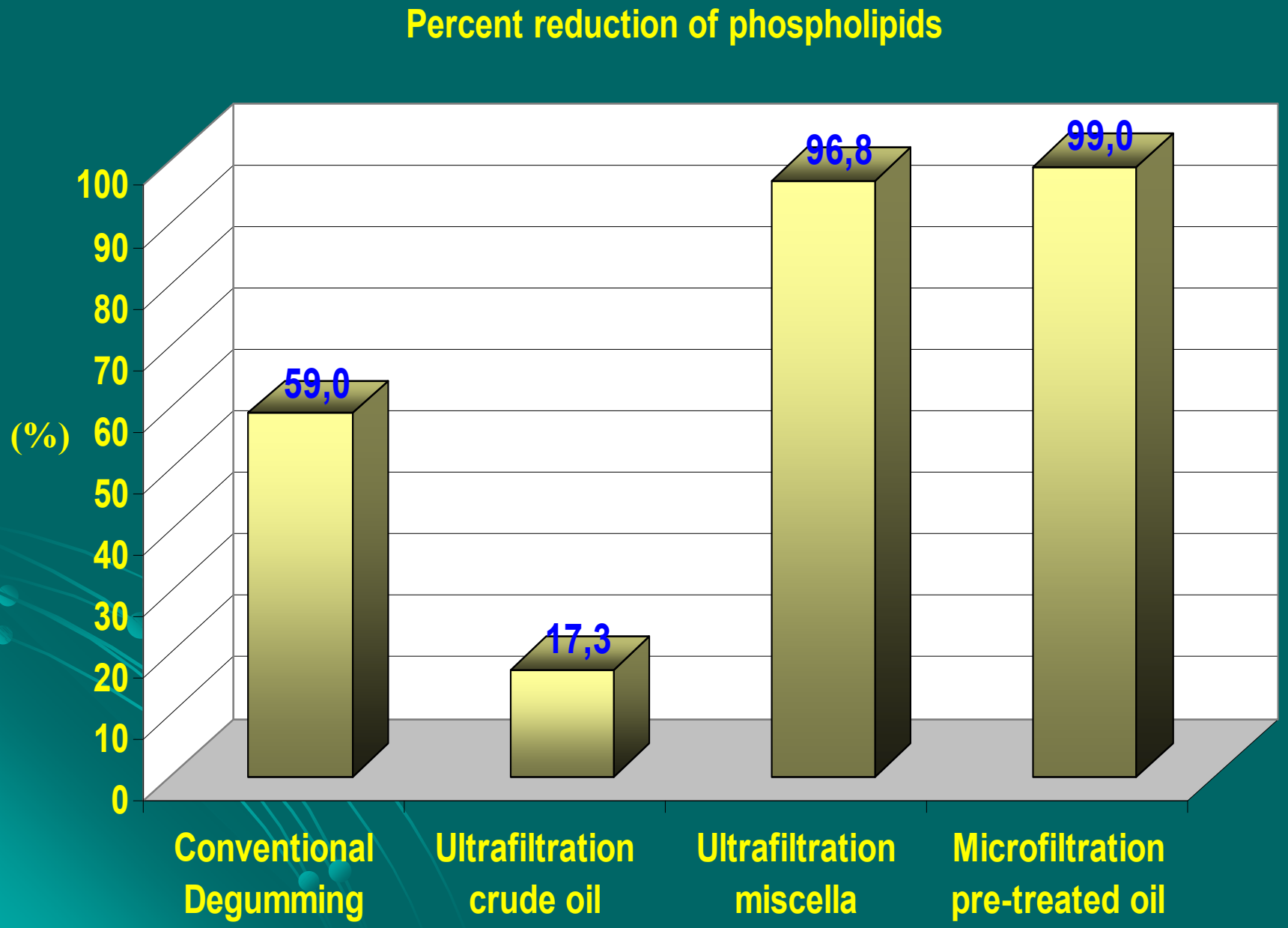
Methodology

- Analytical determinations based on

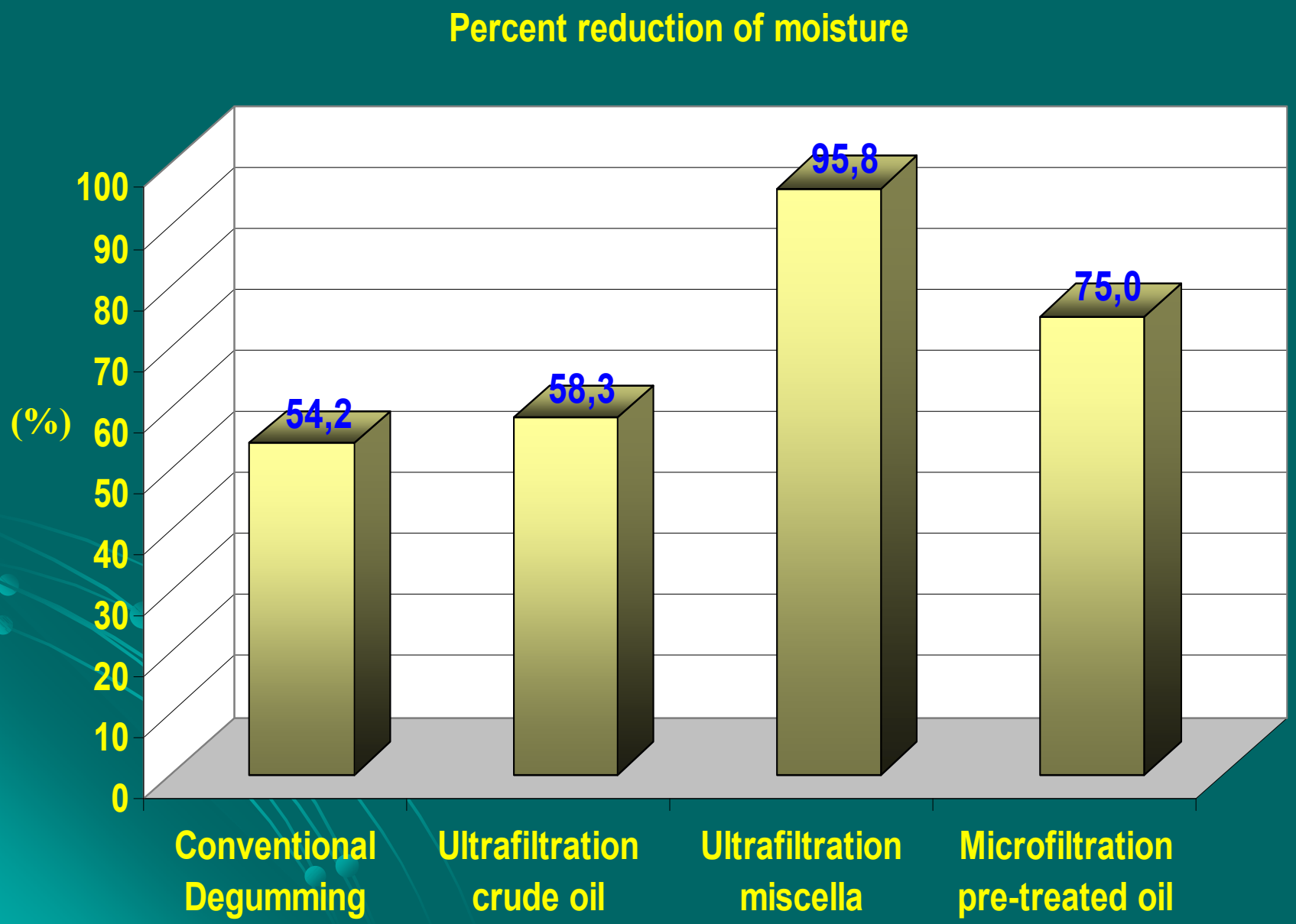
American Oil Chemists' Society (AOCS) Methods

- Crude oil characteristics:
  - Moisture: 0,24 %
  - Phospholipids: 405 (mg kg^{-1}) of phosphorus
  - Color Lovibond (Yelow / Red): 70 / 3,8
  - Chlorophyll: 12,7 (mg kg^{-1})
  - Tocopherol: 755 (mg kg^{-1})

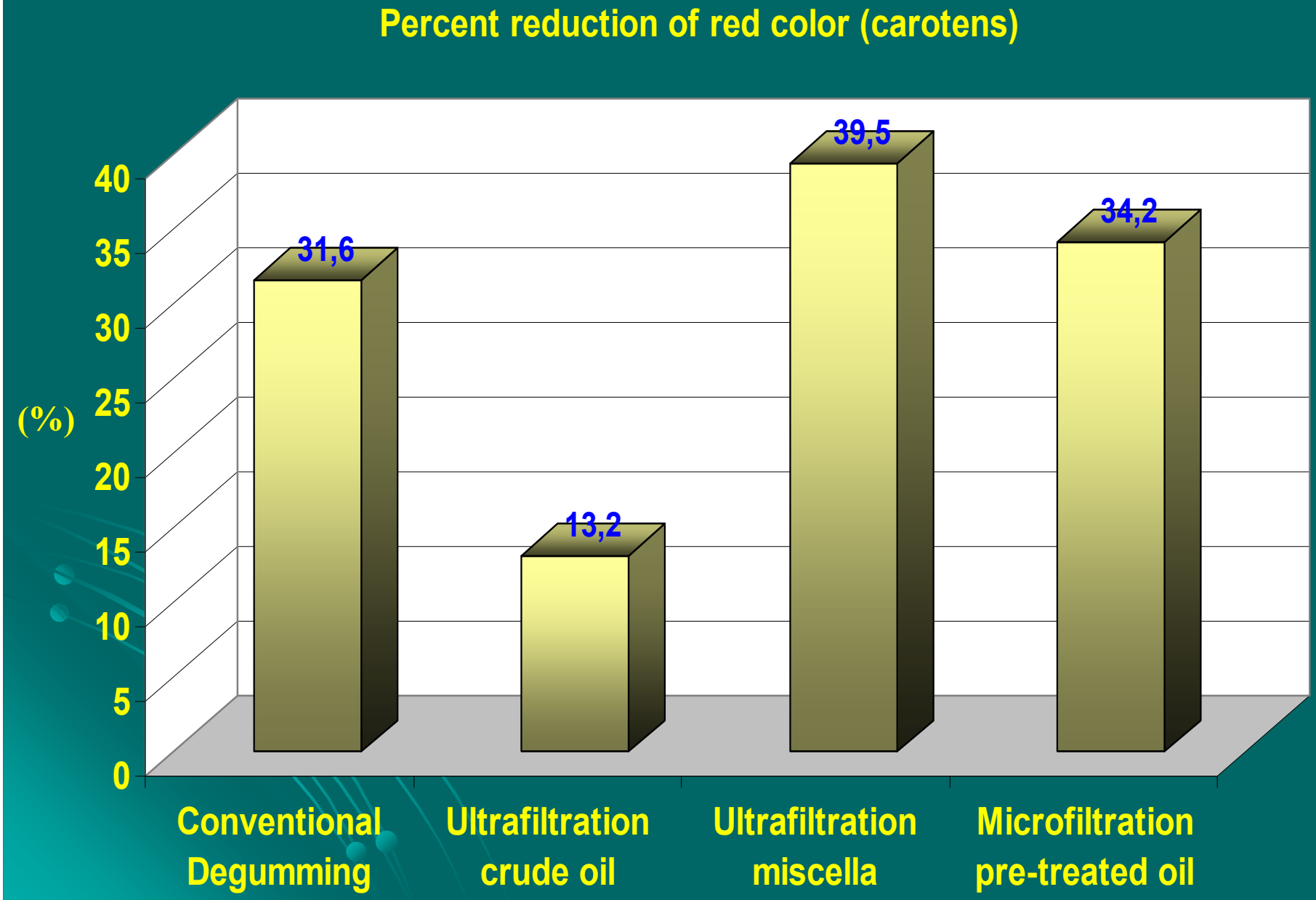
Results – Phospholipids



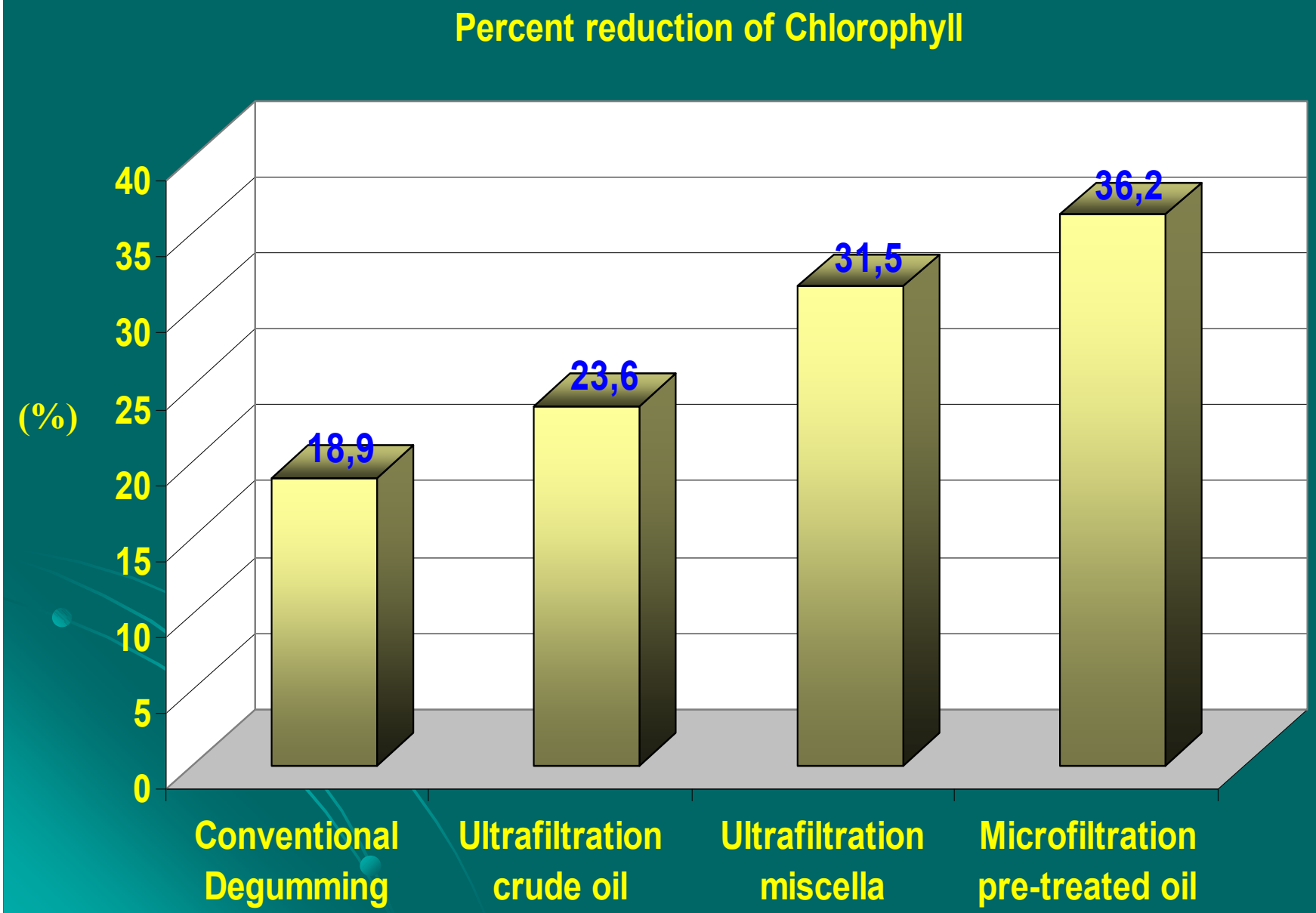
Results – Moisture



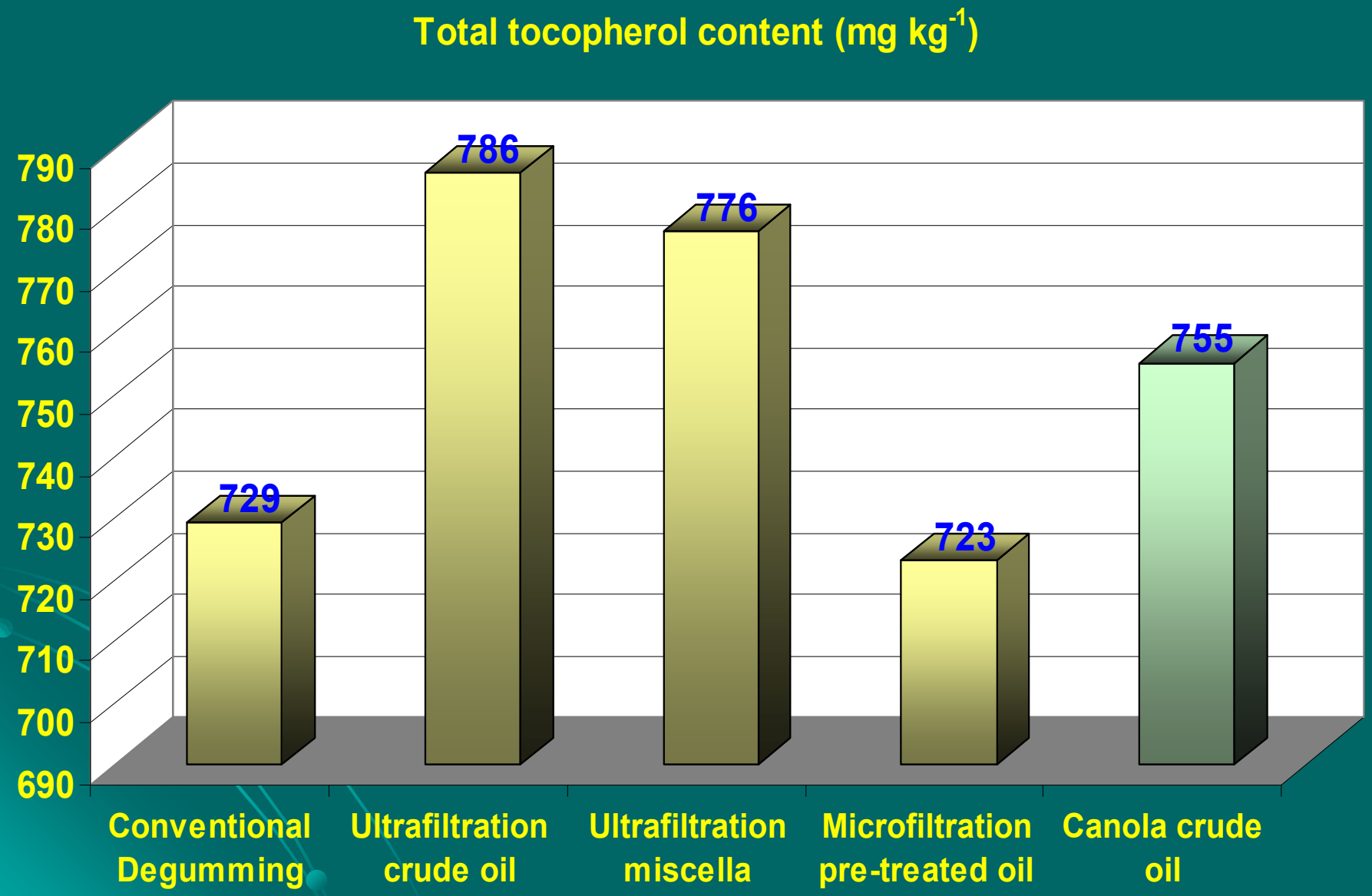
Results – Red Color (carotens)



Results – Chlorophyll



Results – Tocopherol



Conclusions

- The use of membrane process results in better retention of phospholipids, moisture, red color (carotens) and chlorophyll when comparared to conventional degumming process
- The ultrafiltration either with crude oil or miscella used as feed showed total preservation of tocopherol
- The process which uses processing aids (NaOH or phosphoric acid) such as conventional degumming and microfiltration of pre-treated oil showed lost of tocopherol

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THANK YOU!

(OBRIGADO!)

Photo: *John Woudstra*