# Status and prospects for pure plant oil as transport fuel


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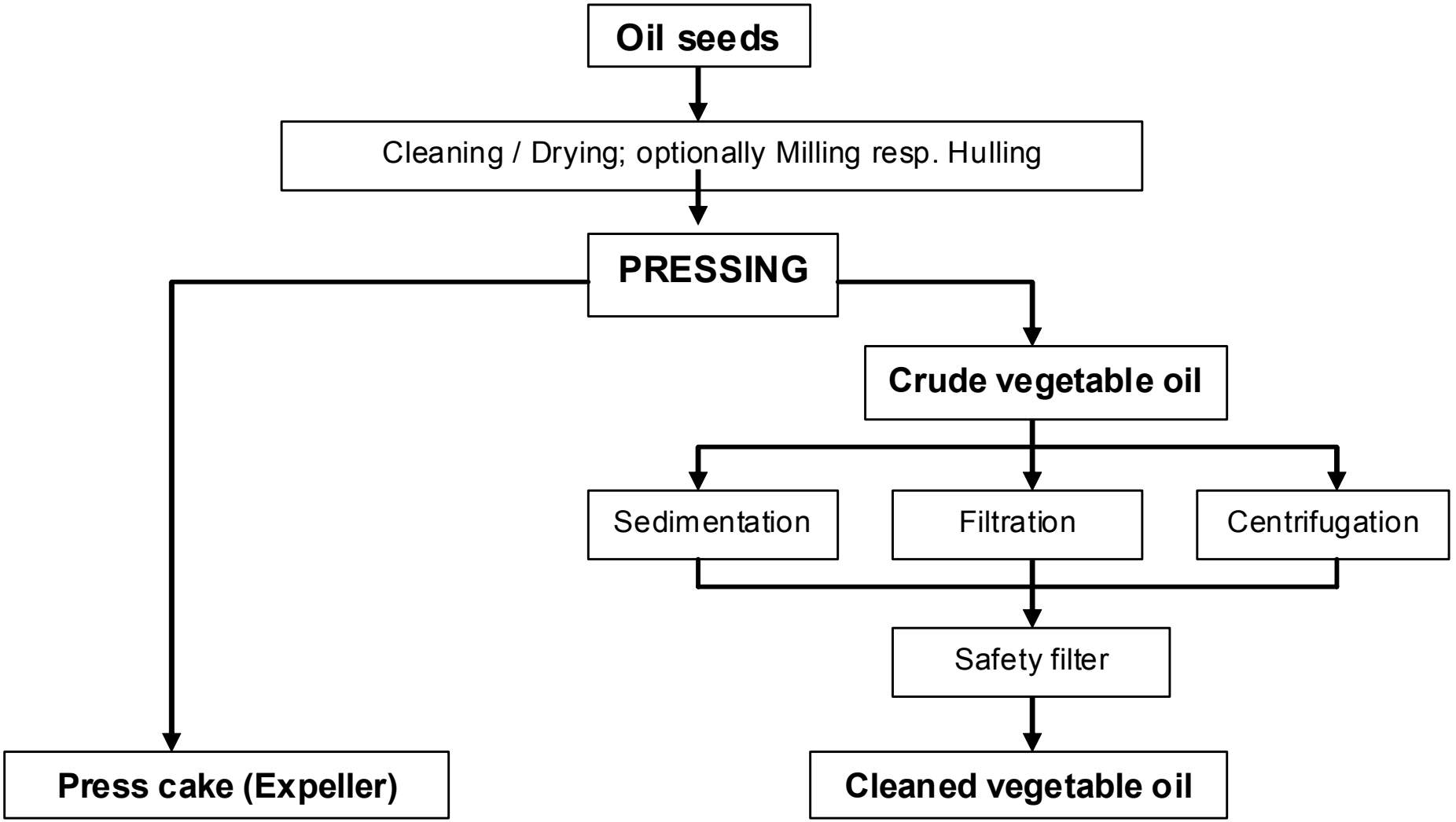
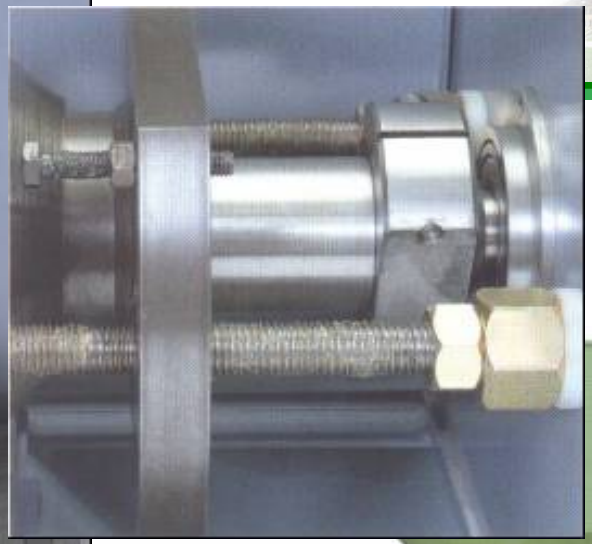
# Vegetable oil production




Widmann B., 1999

KEK SCHNECKENPRESSE KEK-P0101

Die KEK-Pot01 eignet sich speziell für die kontinuierliche Verpressung von Ölsaaten, z. B. Sonnenblumenkerne, Raps, Sesam, Mainkerne, Lein, Jojoba, etc. Mit der Pot01 Schneckenpresse können die meisten Ölsaaten ohne Vorzerkleinerung und Vorwärmung verarbeitet werden.
Diese Kaltpressung eignet sich hervorragend für vitaminreiche Endprodukte als auch für eine motorische Verwendung. Eine Einstellung auf verschiedene Saaten ist problemlos durch einzeln austauschbare Segmente durchführbar.



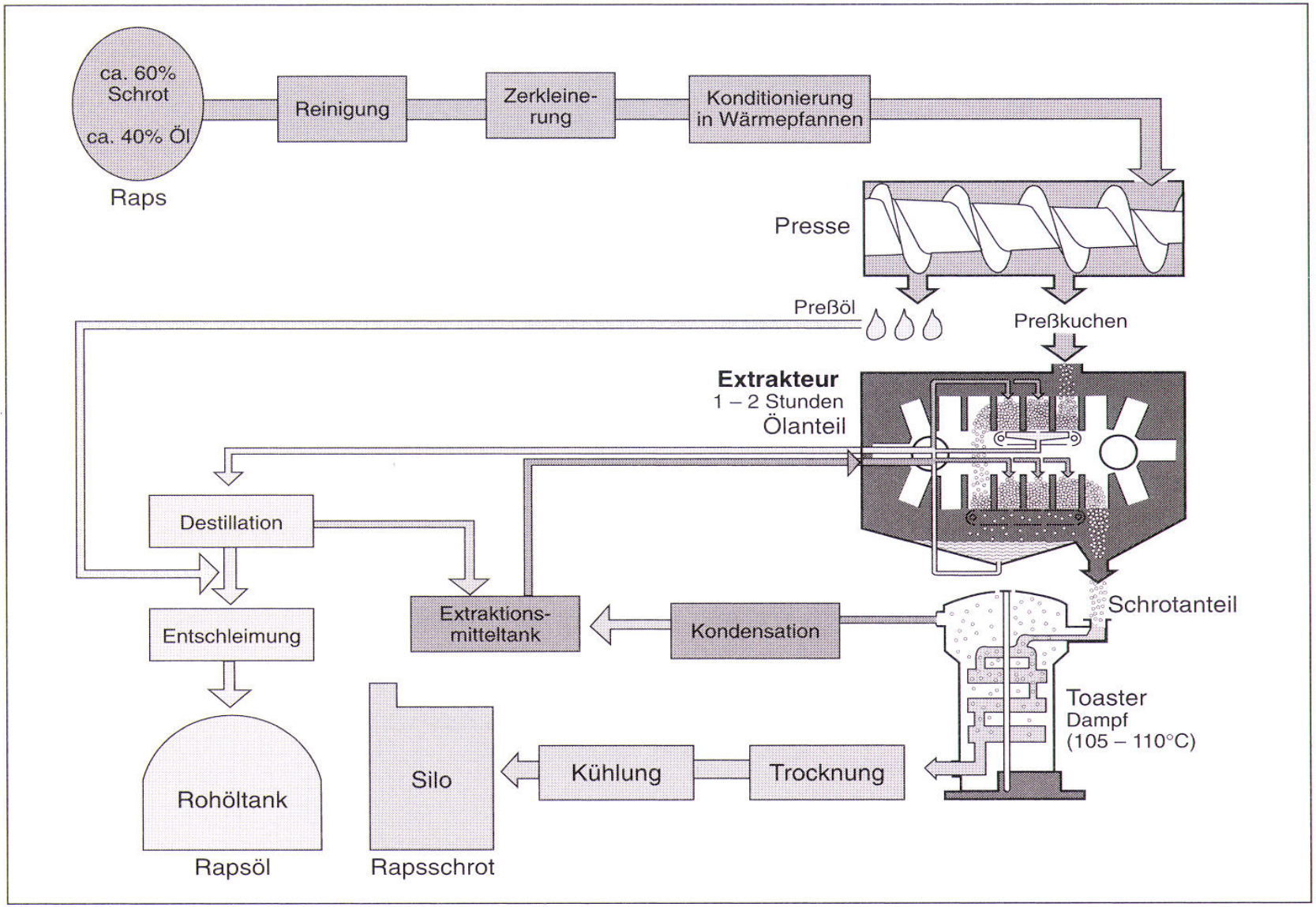
# Small scale oil press

# Vegetable oil cleaning

Plate filter

Cartridge filter

# Rapeseedoil production




Roth, Kormann:

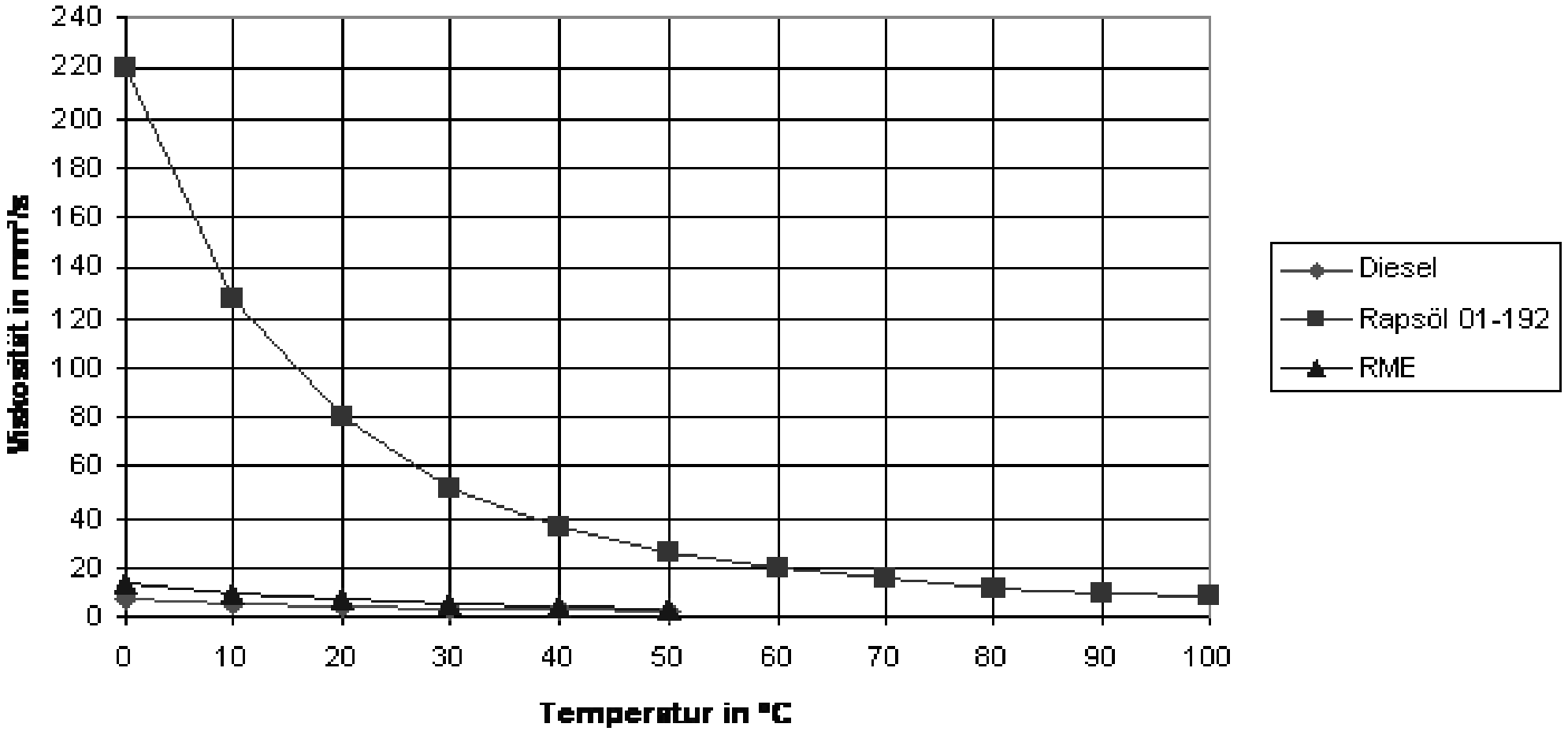
Ölpflanzen - Pflanzenöle

# Comparison of properties

## Properties of different fuels for diesel engines

| | Unit | Diesel | Rape-seedoil | Rapeseed-oilmethylester |
|---|---|---|---|---|
| Calorific value | MJ/kg | 42,4 | 37,6 | 37,2 |
| Density at 20°C | kg/dm³ | 0,83 | 0,92 | 0,88 |
| Calorific value per vol. | MJ/l | 35,2 | 34,6 | 32,7 |
| Viscosity at 20°C | mm²/s | 5 | 70 | 7,2 |
| Flashpoint P.M. | °C | > 55 | > 220 | > 100 |
| Ignitability | CN | > 51 | --- | > 51 |

# Kinematic Viscosity: DK, RO, RME



# Standardisation

## Parameters and limits for pure vegetable oil fuel

| Parameter | Unit | Öst. Kraftstoff-Verordnung, 11/2004 | DIN V 51605: 2006-07 Rapeseedoil |
|---|---|---|---|
| Density at 15°C | kg/m³ | 900 to 930 | 900 to 930 |
| Flashpoint P.M. | °C | ≥ 220 | ≥ 220 |
| Kinematic Viscosity at 40°C | mm²/s | ≤ 38 | ≤ 36 |
| Net Calorific Value | kJ/kg | ≥ 35.000 | ≥ 36.000 |
| Ignitability | --- | --- | ≥ 39 |
| Conradson Carbon Residue | % | ≤ 0,4 | ≤ 0,4 |
| Iodine Number | g I/100 g | 100 to 120 | 95 to 125 |
| Sulfur Content | mg/kg | ≤ 10 | ≤ 10 |
| Total Contamination | mg/kg | ≤ 25 | ≤ 24 |
| Acid Value | mg/KOH/g | ≤ 2,0 | ≤ 2,0 |
| Oxidation Stability | h | ≥ 5 | ≥ 6 |
| Phosphorous Content | mg/kg | ≤ 15 | ≤ 12 |
| Content of Mg & Ca | mg/kg | --- | ≤ 20 |
| Ash Content | % | ≤ 0,01 | ≤ 0,01 |
| Water Content | % | ≤ 0,075 | ≤ 0,075 |

# Standardisation

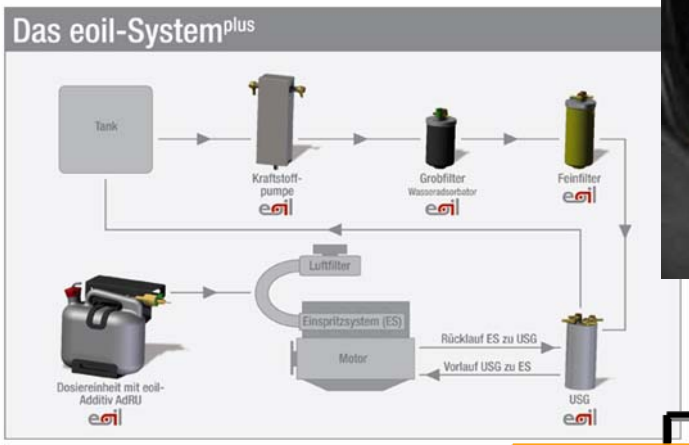
DIN 51605: 2010-09

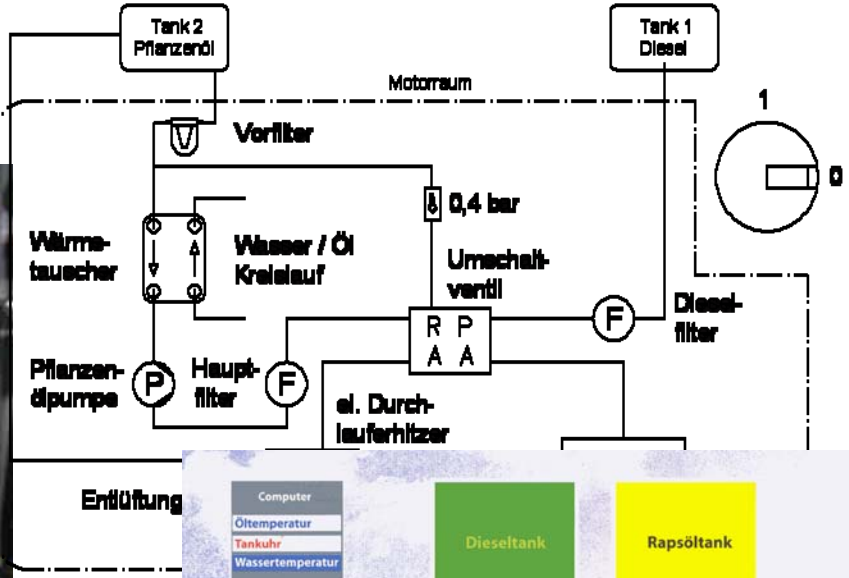
Fuels for vegetable oil compatible combustion engines - Fuel from rapeseed oil - Requirments and test methods

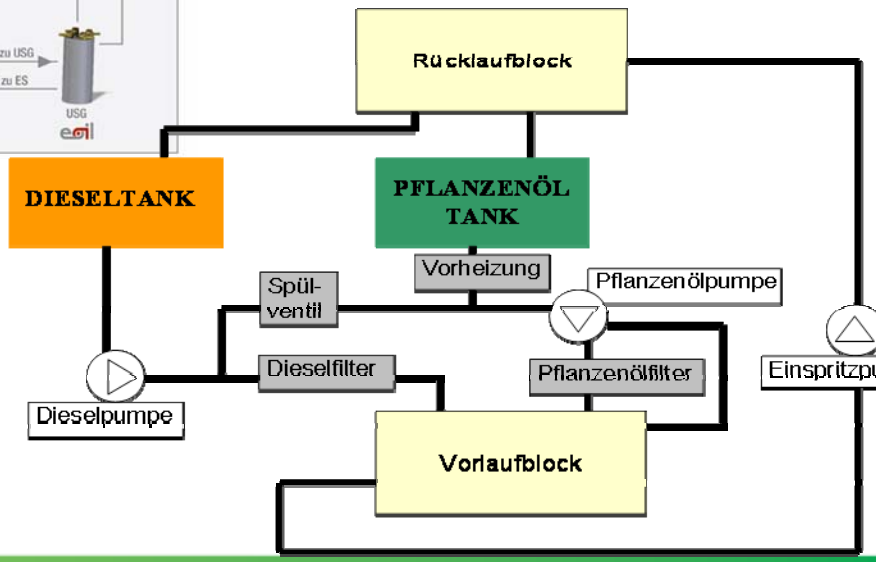
| Parameter | Unit | Limit min. | Limit max |
|---|---|---|---|
| Visual inspection | --- | free from visible contaminations and sediments and free water | |
| Density at 15°C | kg/m³ | 910,0 | 925,0 |
| Kinematic Viscosity at 40°C | mm²/s | --- | 36,0 |
| Net Calorific Value | MJ/kg | 36,0 | --- |
| Iodine Number | g I/100 g | --- | 125 |
| Acid Value | mg/KOH/g | --- | 2,0 |
| Flashpoint P.M. | °C | 101 | --- |
| Ignitability | --- | 40 | --- |
| Oxidation Stability at 110°C | h | 6,0 | --- |
| Total Contamination | mg/kg | --- | 24 |
| Sulfur Content | mg/kg | --- | 10 |
| Phosphorous Content (till 31st Dec2011 \| 1st Jan 2012) | mg/kg | --- | 12 \| 3,0 |
| Content of Mg & Ca (till 31st Dec2011 \| 1st Jan 2012) | mg/kg | --- | 20 \| 1,0 each |
| Water Content | mg/kg | --- | 750 |

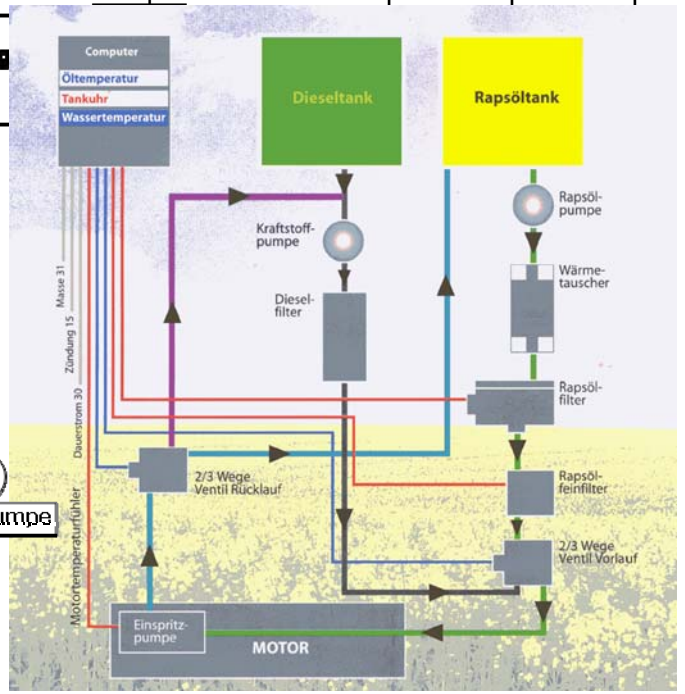
# Engine Adaptation

## Which sytem is the best?




J. Rathbauer et al., 110331, Highlights der Bioenergieforschung, Wieselburg

# Adaptation Systems and Suppliers

## One tank systems (Σ 18):

Waldland VWP 11;  Hausmann 6;  E-oil 1;

## Two tanks systems (Σ 20):

Graml 12;  Elsbett 3;  Rapstruck 1;  Jedinger 1;
Green power 1; Gruber 1; Peck 1

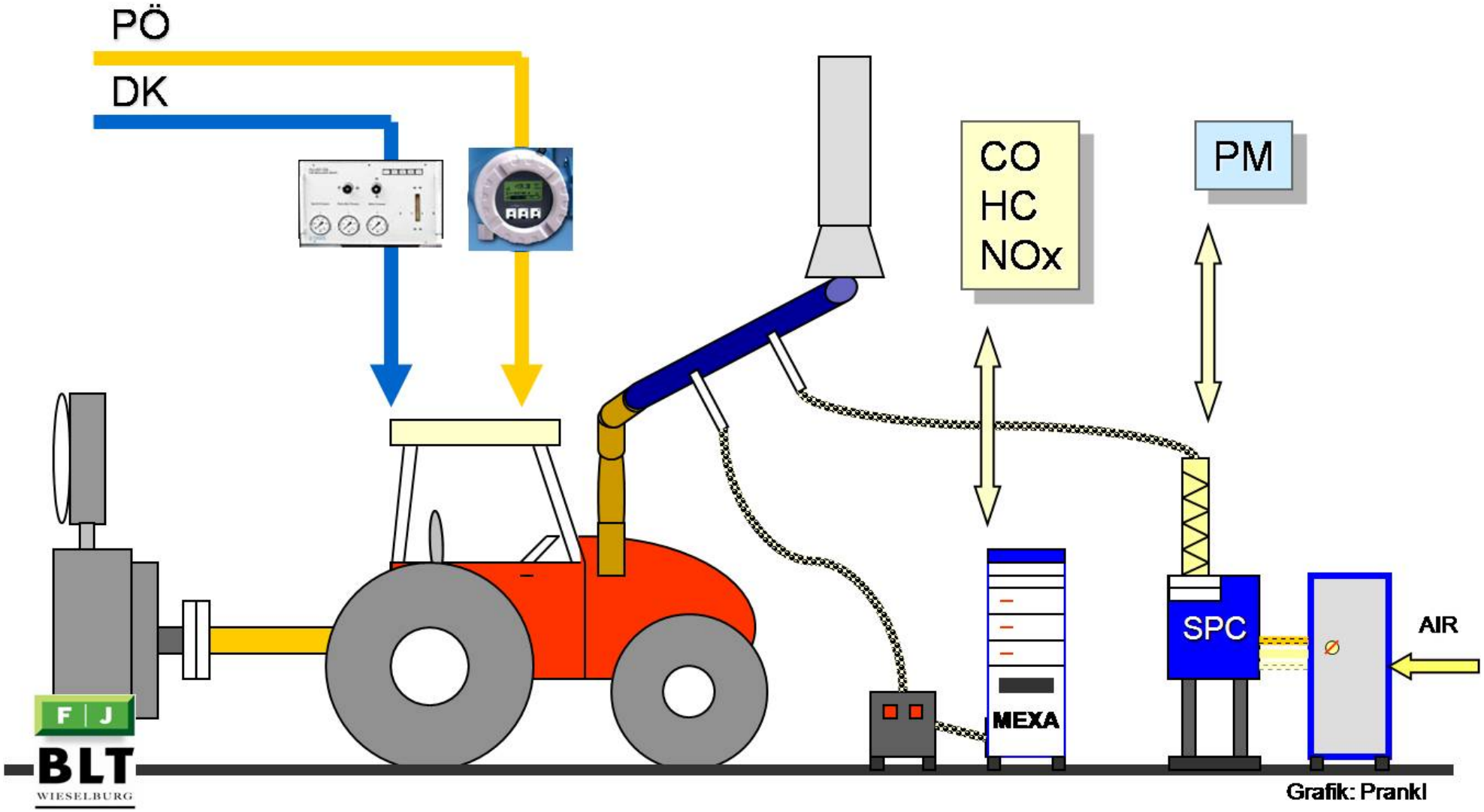
# Engine oil

## Soot and rapeseedoil content from 1-Tank-systems approx. twice the values from the 2-Tanks-systems

| 1-Tank | Soot [%] | Rapeseed-oil [%] | Rapeseed-oil [%] | Soot [%] | 2-Tanks |
|---|---|---|---|---|---|
| Average | 1,15% | 11,61% | 6,13% | 0,86% | Average |
| Median | 0,91% | 11,90% | 5,20% | 0,47% | Median |
| Maximum | 4,50% | 24,00% | 21,30% | 5,90% | Maximum |
| Minimum | 0,07% | 0,30% | 0,10% | 0,03% | Minimum |
| Number | 95 | 89 | 55 | 64 | Number |

## Fuchs´ statement: Up to 200 operating hours the engine oil quality was alright.

# Performance and Emissions



# Performance and Emissions

## Change from Diesel to Rapeseedoil:

- CO ↓ (-11%)
- HC ↓ (-50%)
- PM ↓ (-33%)
- NOx ↑ (+11%)

## Comparison final with initial results:

- CO ↑ (+22%)
- HC → (-3 … -9%)
- NOx → (-6 … -7%)

# Chances & Challenges

- Simple decentralized oil mill technology available
- Animal feed (food) and fuel production
- Transport fuel during crises
- Developing countries
- Framework conditions
- Diesel engine technology – optimisation of the emissions values for diesel fuel