



# Status and prospects for pure plant oil as transport fuel

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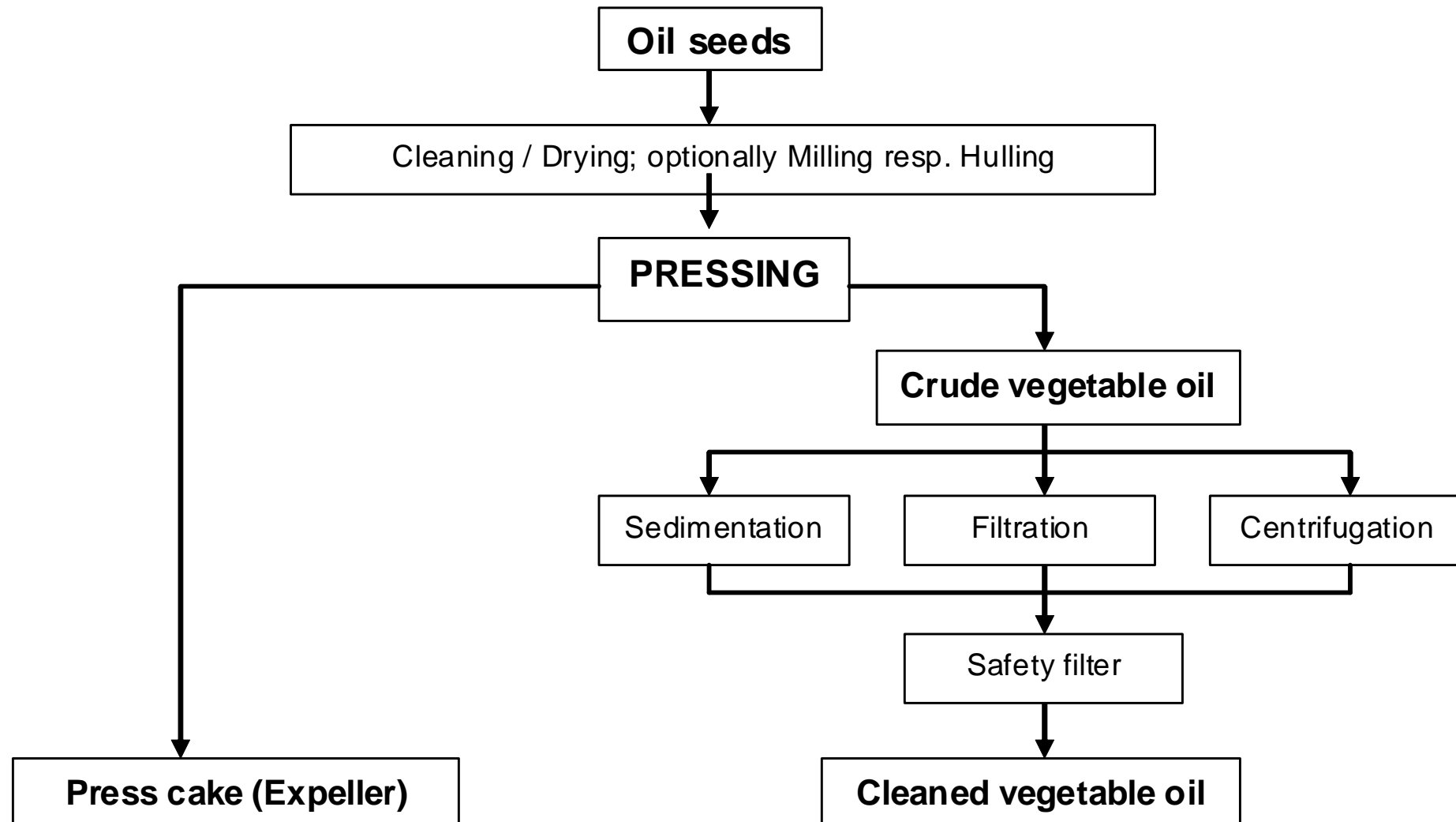
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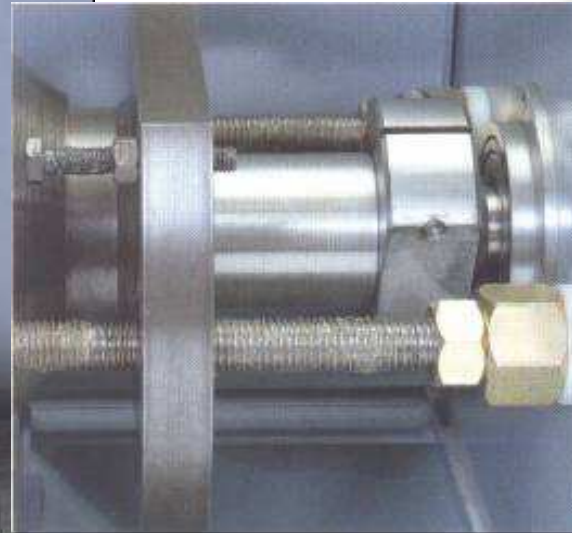
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# Vegetable oil production



Widmann B., 1999



## Small scale oil press

### KEK SCHNECKENPRESSE KEK-PD101

Die KEK-Porot eignet sich speziell für die kontinuierliche Verpressung von Ölsaaten, z. B. Sonnenblumenkerne, Raps, Sesam, Mohnkerne, Lein, Japota, etc. Mit der Porot 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.





# Vegetable oil cleaning

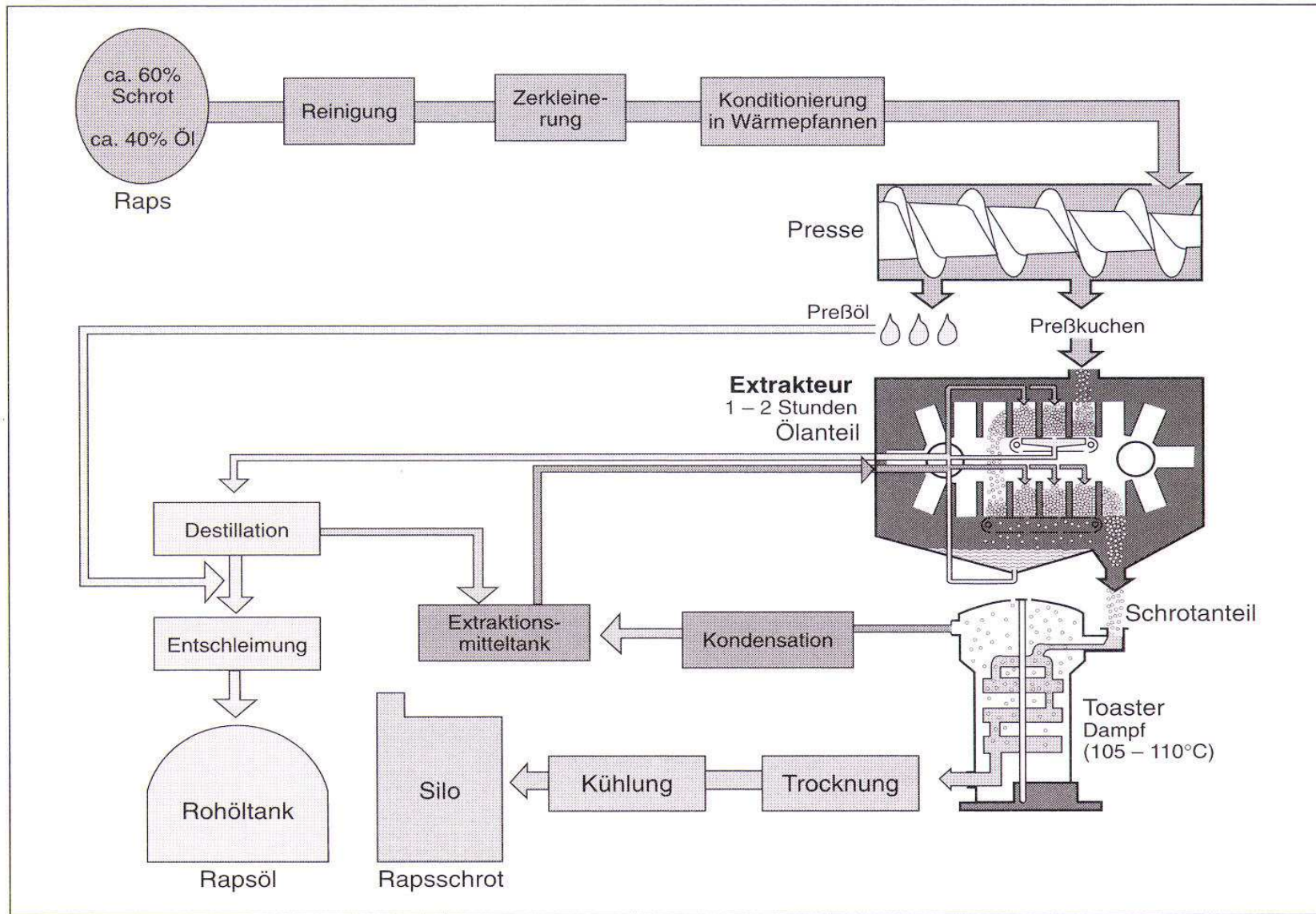


Plate filter



Cartridge filter

# Rapeseedoil production



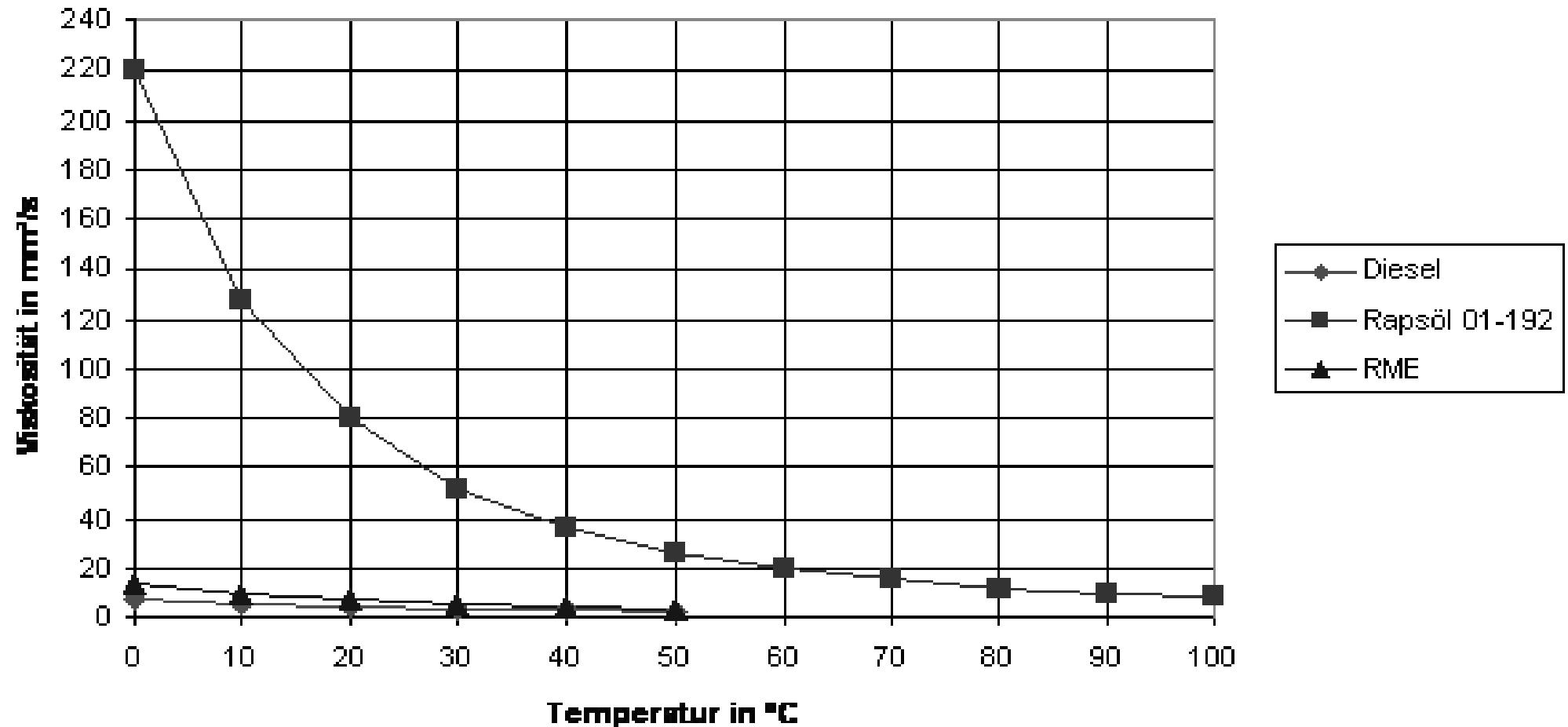
Roth,  
Kormann:  
Ölpflanzen -  
Pflanzenöle



## 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/dm <sup>3</sup>	0,83	0,92	0,88
Calorific value per vol.	MJ/l	35,2	34,6	32,7
Viscosity at 20°C	mm <sup>2</sup> /s	5	70	7,2
Flashpoint P.M.	°C	> 55	> 220	> 100
Ignitability	CN	> 51	---	> 51

# Kinematic Viscosity: DK, RO, RME







## 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/m <sup>3</sup>	900 to 930	900 to 930
Flashpoint P.M.	°C	≥ 220	≥ 220
Kinematic Viscosity at 40°C	mm <sup>2</sup> /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 - Requirements and test methods

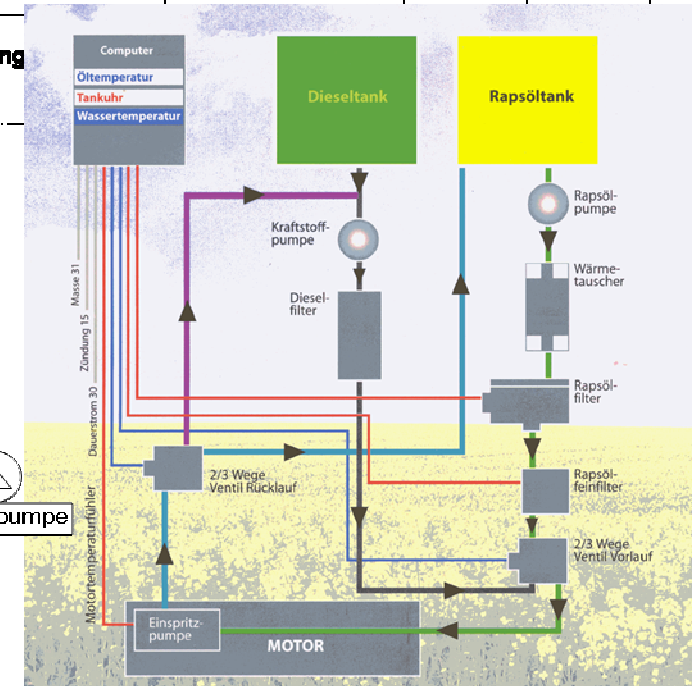
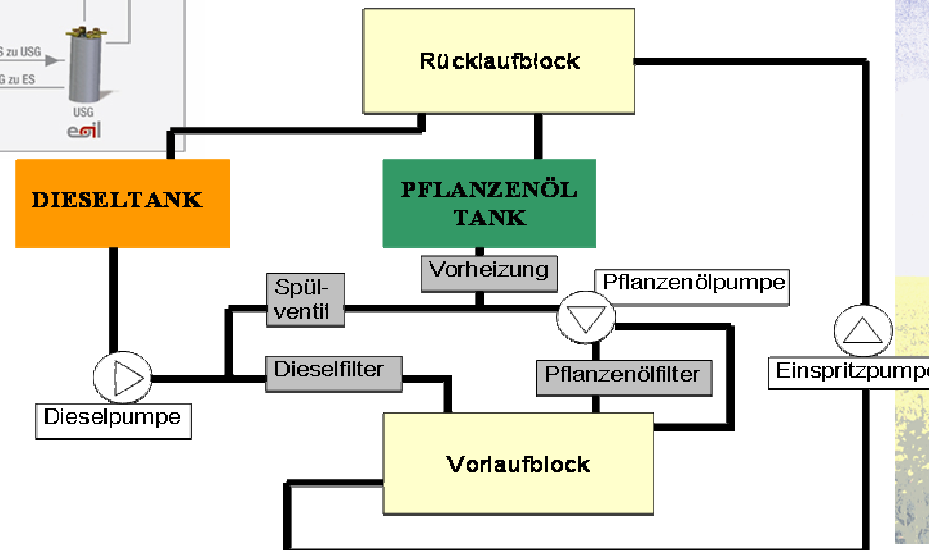
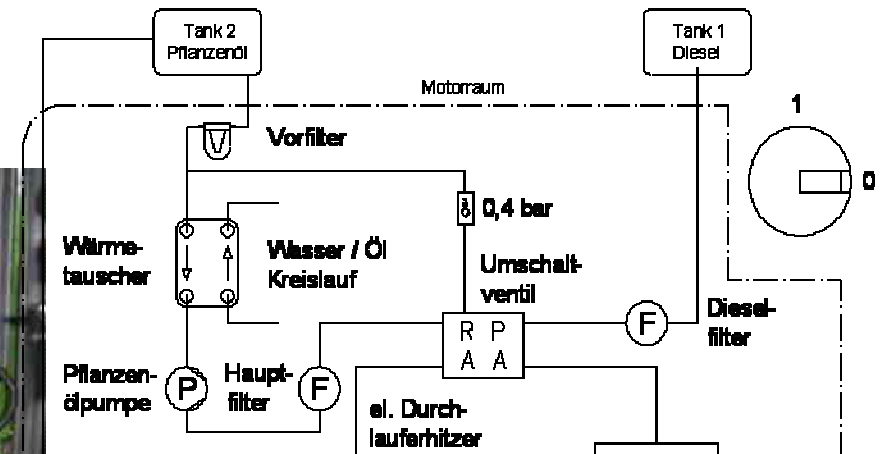
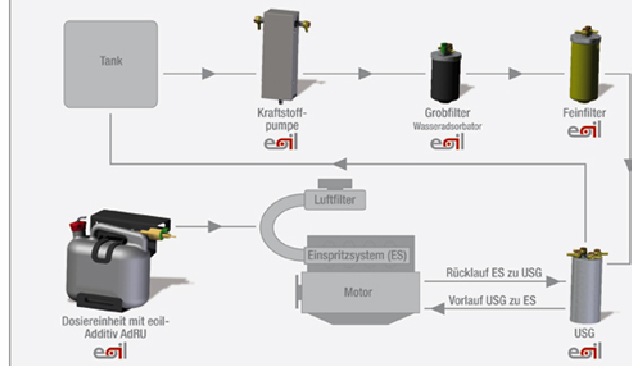
Parameter	Unit	Limit	
		min.	max
Visual inspection	---	free from visible contaminations and sediments and free water	
Density at 15°C	kg/m <sup>3</sup>	910,0	925,0
Kinematic Viscosity at 40°C	mm <sup>2</sup> /s	---	36,0
Net Calorific Value	MJ/kg	36,0	---
Iodine Number	g I/100 g	---	125
Acid Value	mg/KOH/g	---	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?

Das eoil-System<sup>plus</sup>





## Adaptation Systems and Suppliers

### One tank systems ( $\Sigma$ 18):

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



### Two tanks systems ( $\Sigma$ 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.**







## 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