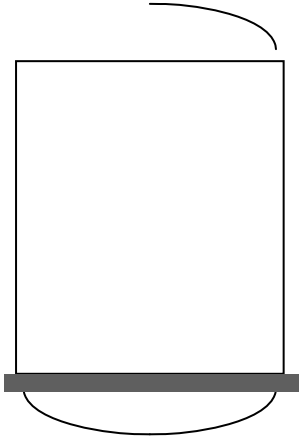
Biodiesel production with Lewatit® GF202

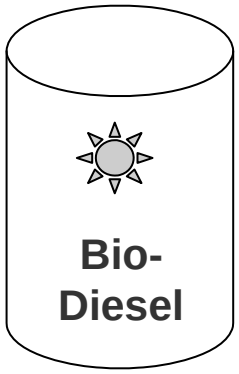


Biodiesel production with Lewatit® GF202

Removal of glycerine & soaps with Lewatit GF202

No water wash necessary

Reduces investment and operating costs



Advantages of using Lewatit GF202

Lewatit GF202 has specifically been developed for biodiesel purification and is used to remove glycerine, monoglycerides, soaps and salts.

Biodiesel purified with GF202 fulfills the stringent specification requirements of the European and American fuel industries.

GF202 is a macroporous cation exchange resin with monodisperse bead sizing, to optimize break-through and pressure drop performance in packed beds.

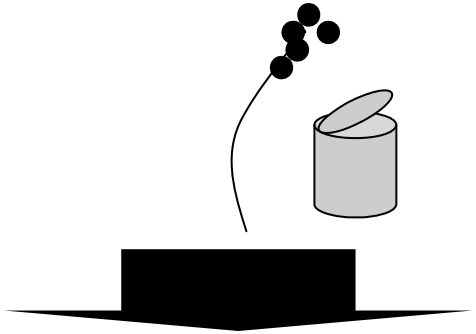
One litre of GF202 will purify 11-14 tons biodiesel / year
It can be reused many times, thus minimizing resin disposal costs.
Resin lifetimes up to 7 years have been obtained.
Therefore only relatively small beds are necessary for cycle times of 7–10 days
It can be retrofitted into existing plants.
All biodiesel qualities irrespective of the triglyceride source can be treated.
It is currently used in plants ranging widely in size, from 10,000 ↛ 350,000 to/a.
And it is the most cost-effective ion exchange resin based purification system in the market.

Lewatit GF202 has been used for biodiesel production in Europe since 1997.

Biodiesel quality standards

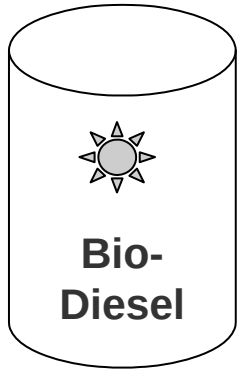
Property	ASTM Method	Limits	Units
Flash Point	93	100 min.	°C
Water & Sediment	2709	0.05 max	vol. %
Carbon Residue	4530	0.050 max	wt. %
Sulfated Ash	874	0.020 max	wt. %
Kin. Viscosity 40°C	445	1.9-6.0	$mm^2/sec.$
Sulfur	5453	0.05 max	wt. %
Cetane	613	40 min	
Cloud Point	2500	by customer	°C
Copper Corrosion	130	No 3 max	
Acid Number	664	0.08 max	mg KOH/g
Free Glycerine	6584	0.02 max	wt. %
Total Glycerine	6584	0.240 max	wt. %

Raw oil sources of biodiesel treatable with GF202



Palm oil
Rape seed oil,
Soyabean oil,
Sunflower oil,
Canola oil,
Coconut oil,
Jatropha nut oil,

Conversion



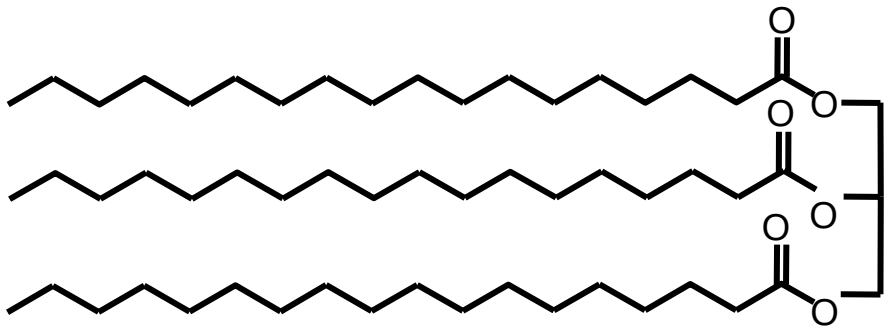
- High viscosity
- Poor combustion properties

- Low viscosity
- Excellent combustion properties

Raw oils chemical composition

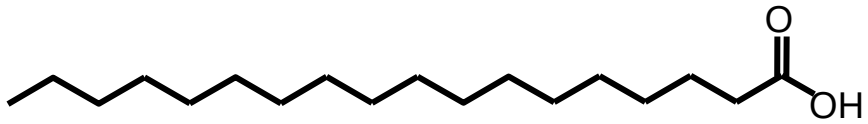
Triglycerides

> 95%



Fatty-Acids:

0.1- 5%



Others:

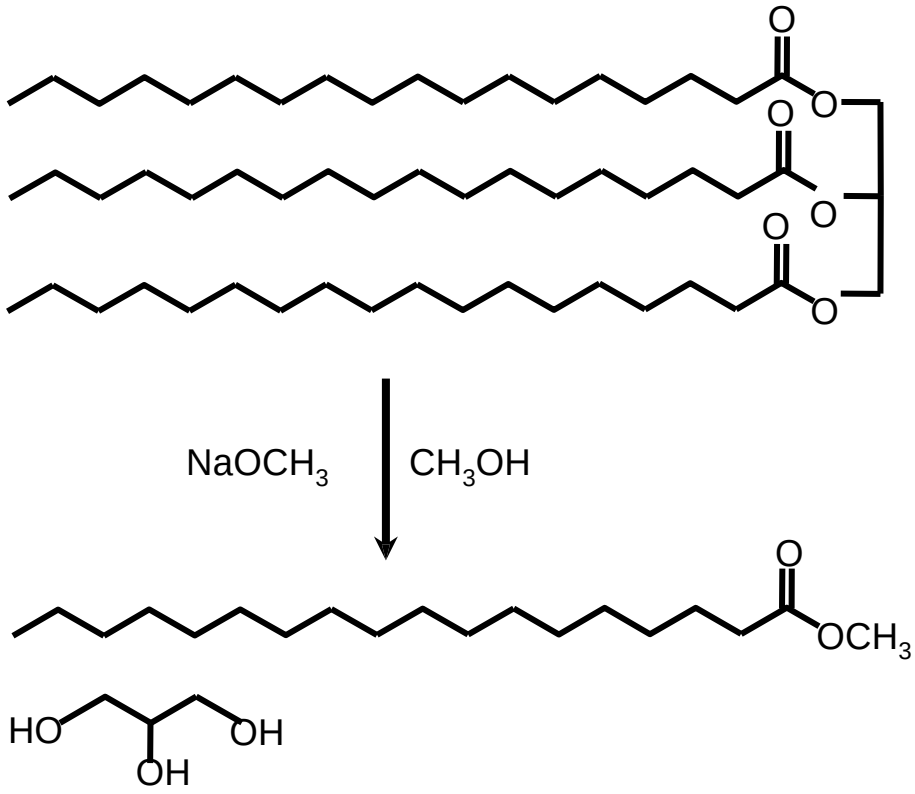
< 1%

Micelles, phospholipids, proteins, mineral salts

Triglyceride transesterification

Purified Triglycerides

> 95%



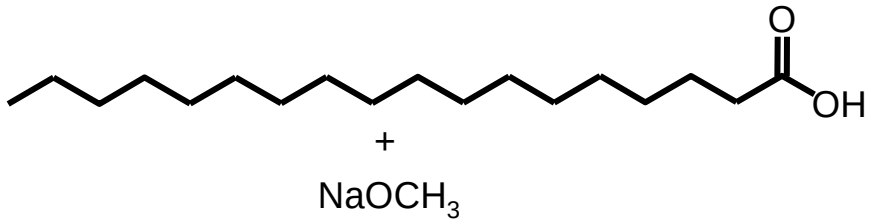
Biodiesel

Glycerine

Soap formation

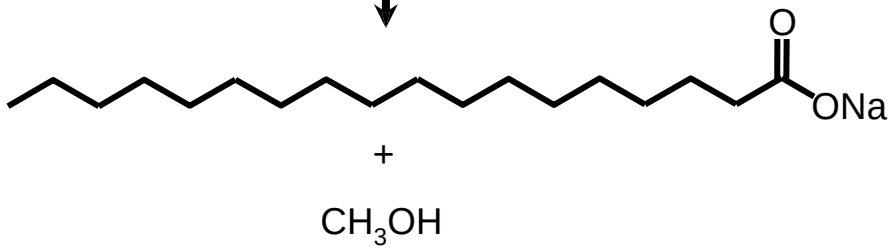
Free fatty acid (FFA)

< 5%



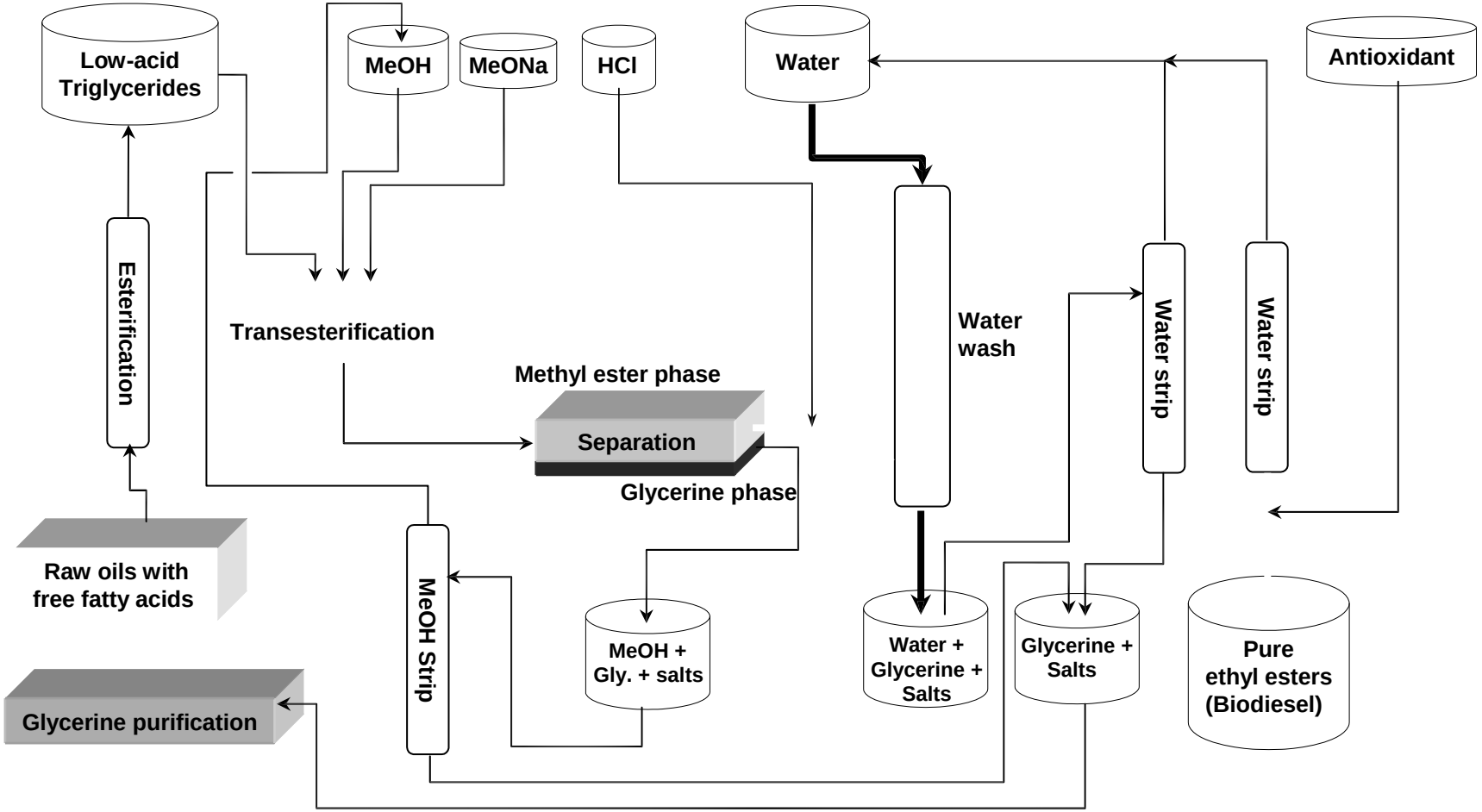
Soap

Methanol

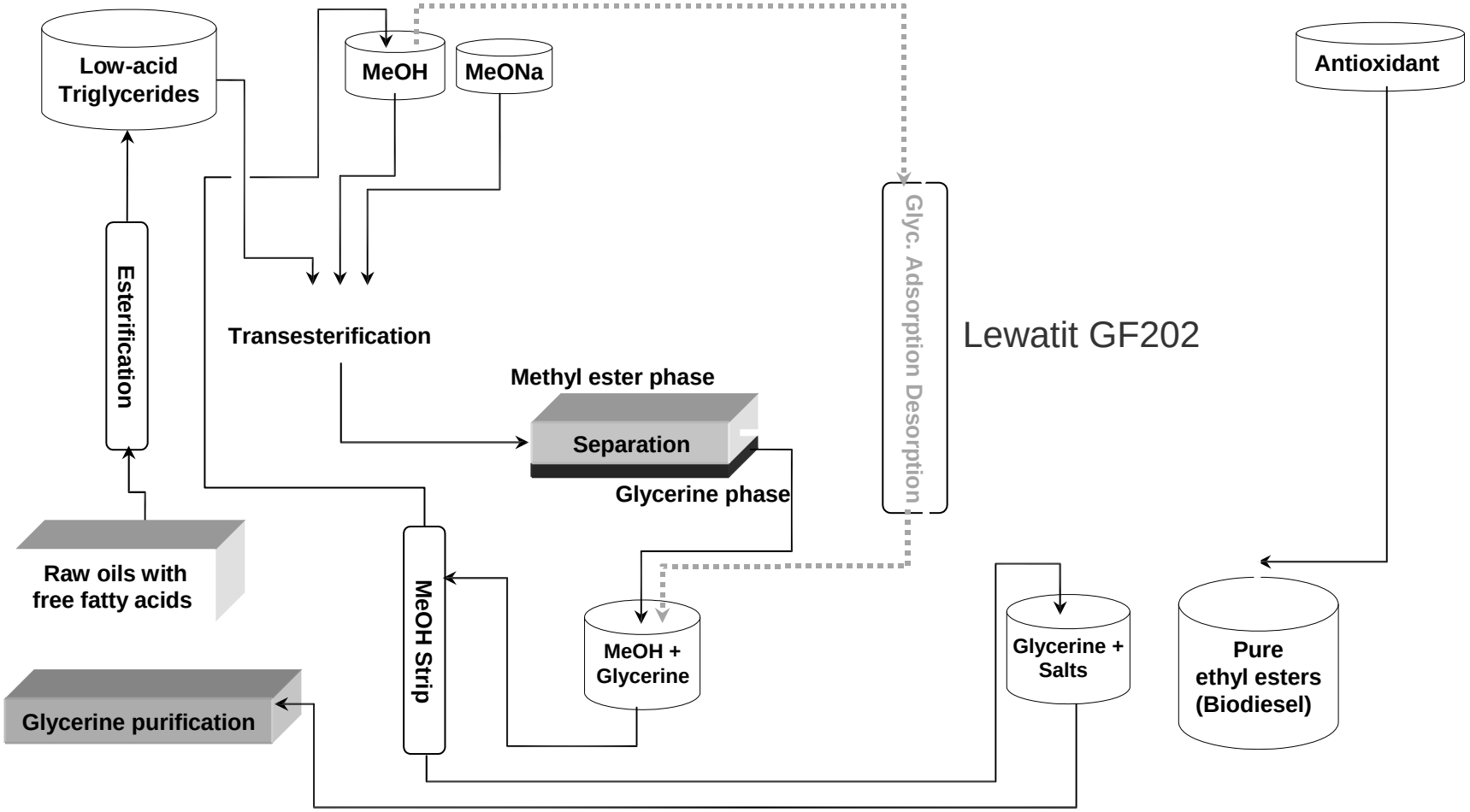


The FFA content of the triglycerides should be maintained below 0.5% to minimize soap formation and maximize BD selectivity

Conventional Biodiesel Production Process

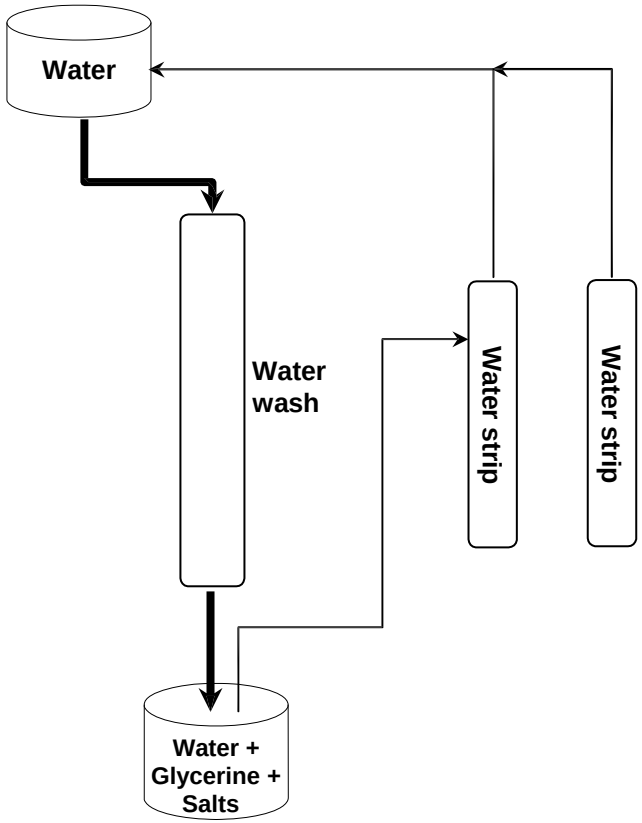


Biodiesel production with Lewatit GF202

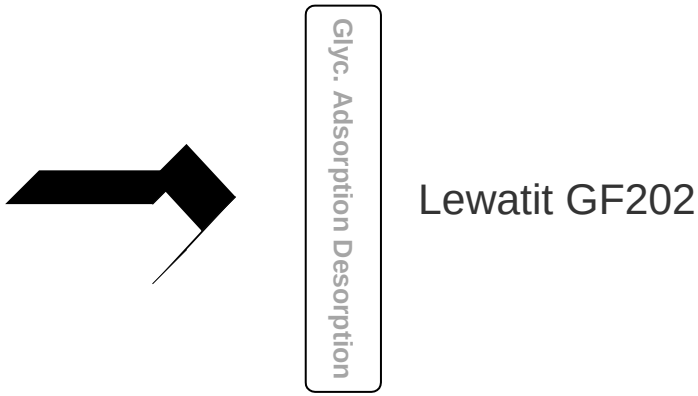


Lewatit GF202 vs water wash

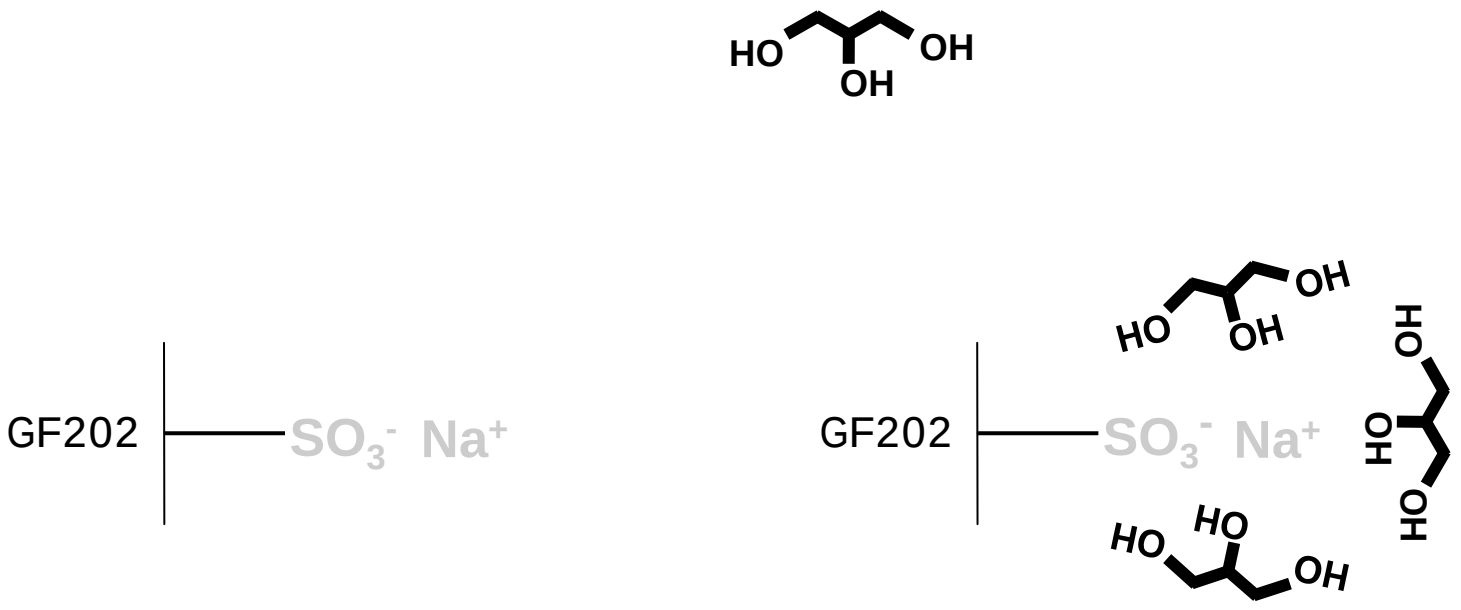
Production with water wash



Production with Lewatit

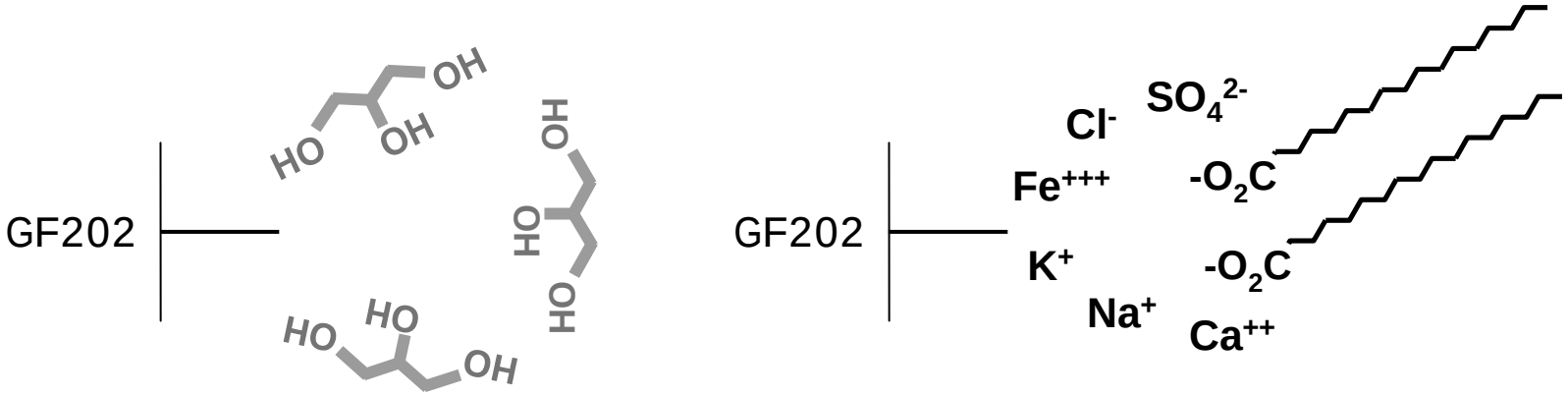


Solvation of GF202 with glycerine



Adsorption of ionic impurities and soaps

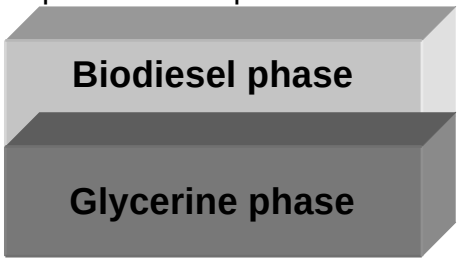
ionic impurities + soaps



Impurities capture by glycerine

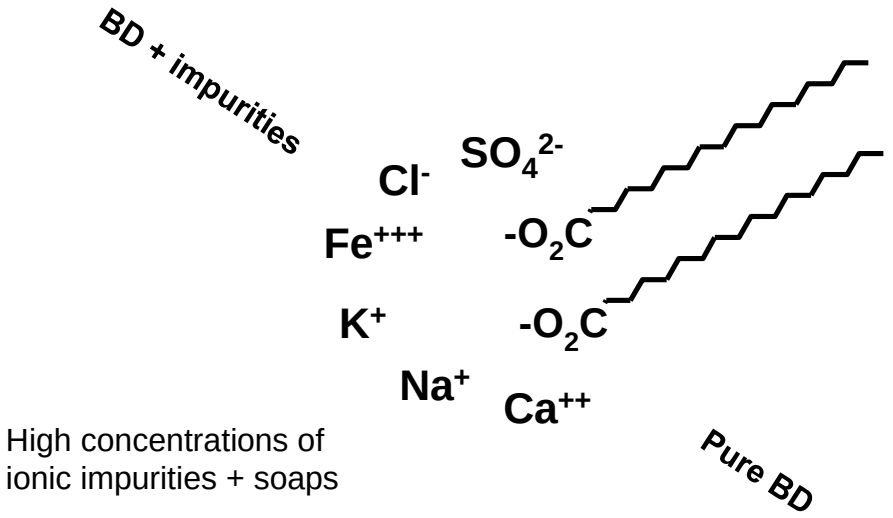
Transesterification phase separation

Small concentrations of ionic impurities + soaps



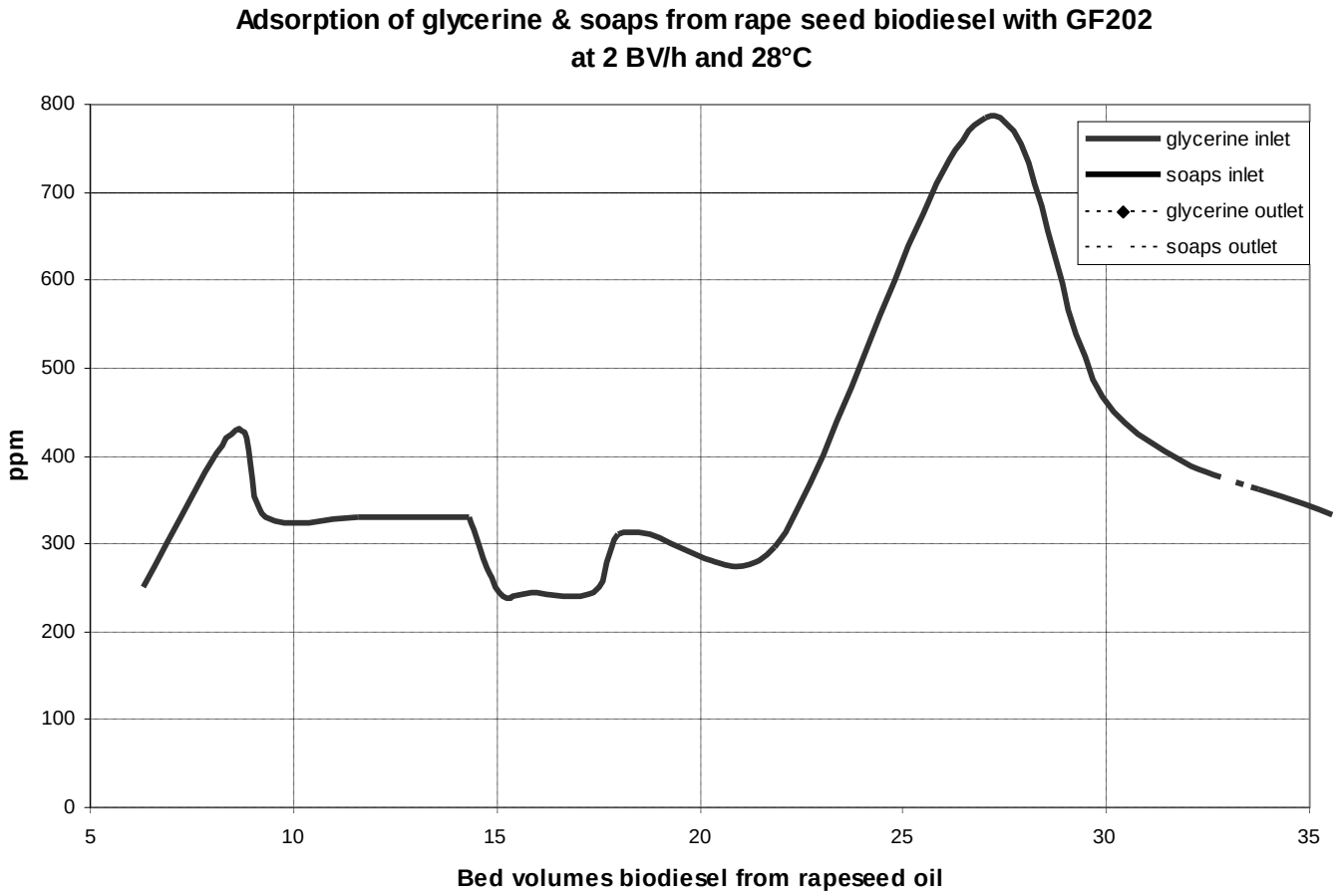
High concentrations of ionic impurities + soaps

Purification with GF202



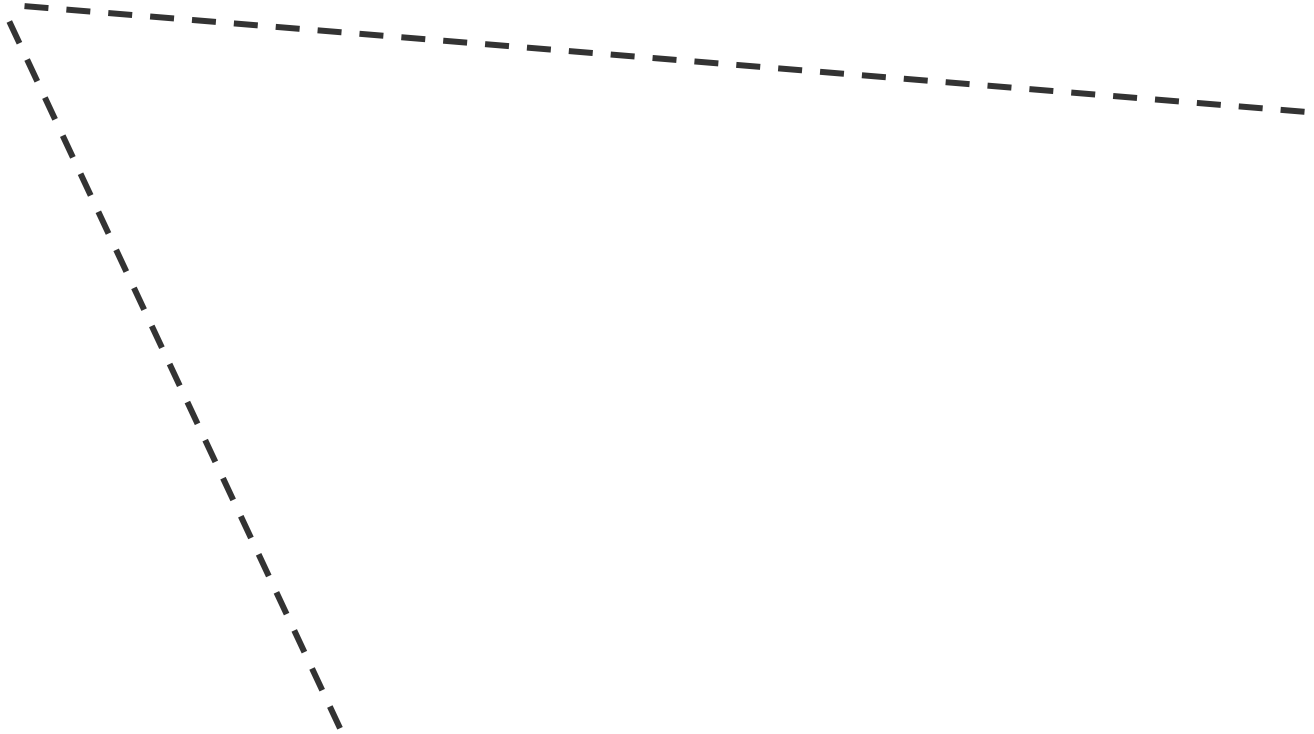
High concentrations of ionic impurities + soaps

In both transesterification and treatment with GF202, glycerine phases adsorb hydrophilic soaps and salts


Adsorption of glycerine & soaps from rape seed biodiesel with GF202
at 2 BV/h and 28°C
ppm
800
700
600
500
400
300
200
100
0
5
10
15
20
25
30
35
Bed volumes biodiesel from rapeseed oil
glycerine inlet
soaps inlet
glycerine outlet
soaps outlet

Resin packing & structure of Lewatit GF202

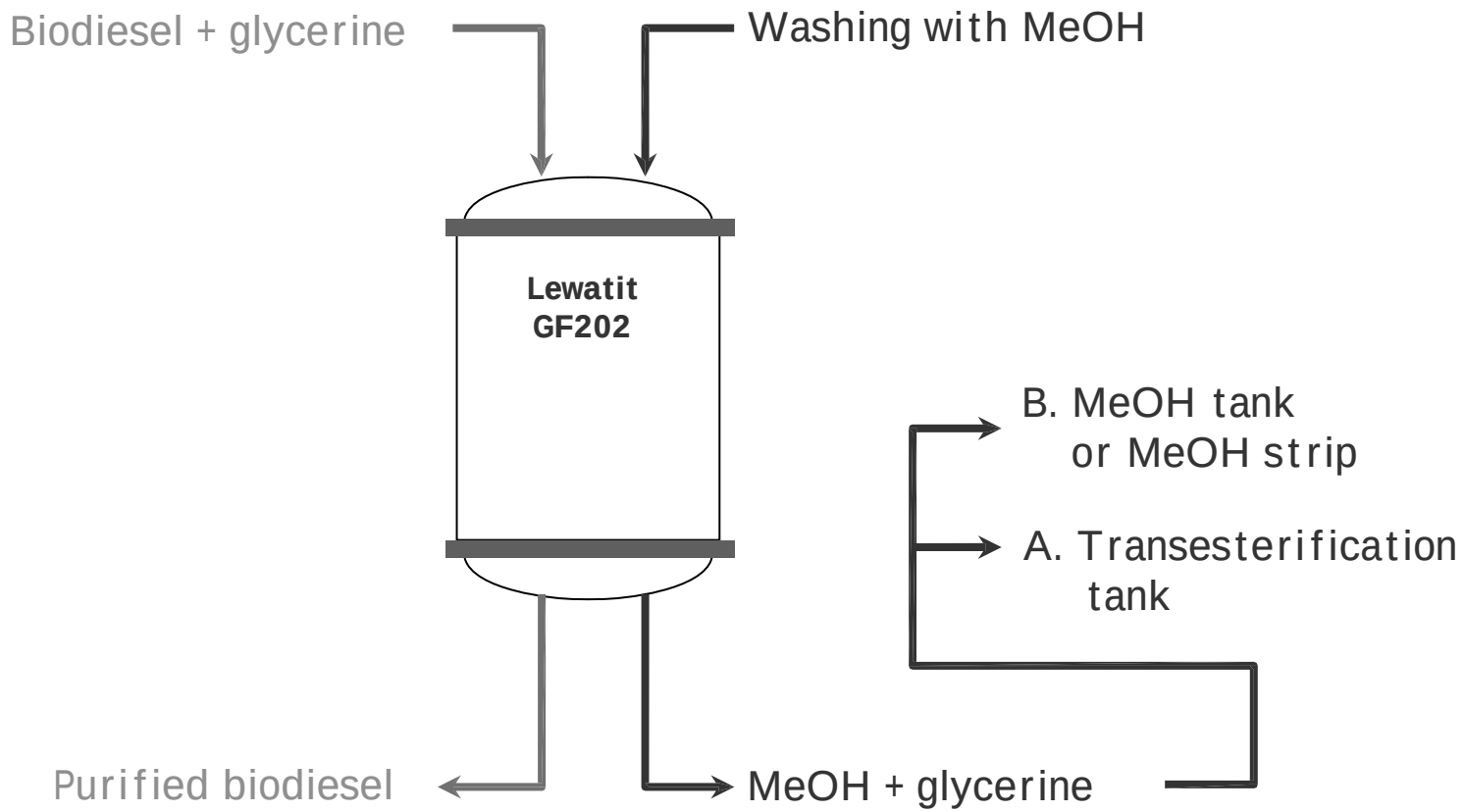
Monodisperse bead sizing, hexagonal closest packing



GF202 “sponge-structure“

Application mode of Lewatit GF202

Alternate loading and washing



Loading / washing GF202

Biodiesel + Impurities

+

GF202 — SO_3^- Na^+

+

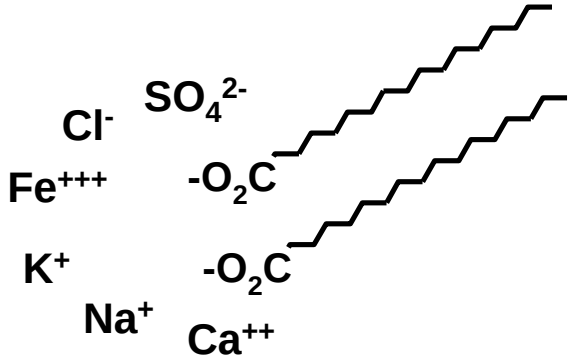
Methanol + impurities

Loading

Washing

Pure Biodiesel

+



+

Methanol

Removal of glycerine and soap with Lewatit GF202

Biodiesel from
phase separation
glycerine: 600…2000 ppm
soap: 10 – 200 ppm

refined biodiesel
glycerine: <10 ppm
soap: < 5 ppm

Operating information

• Fresh GF202 is first preconditioned by drying with 3-4 bed volumes MeOH at 2BV/h. The MeOH is then drained and the biodiesel passed into the reactor. Before the MeOH wash, the biodiesel is also drained.

• After preconditioning, GF202 is only subjected to alternate MeOH / biodiesel treatments and **never** washed with water.

• 100% bed volume water-wet, 95% in MeOH, 90% in biodiesel + glycerine

Operating Conditions:

Temperature:	30°C – 40°C
LHSV:	1.5 – 2 BV*biodiesel/hr
Bed height:	1 – 2 m
Op. Capacity:	250 g glycerine/litre
Regeneration:	MeOH @ 20-35°C
Reg. volume:	2-4 BV to transesterification 5-10 BV to MeOH storage
Resin life:	4-5 years (average)

*BV = bed volumes

Advantages of water wash elimination

Reduced investment

Lower operating costs

Ease of operation

Basic design and resin cost

Capacity	100,000	to/a
Annual operation	8,000	h
Throughput	12.5	to/h
	15,600	l/h
	69	gal./min.
LHSV	2	bed vols/h
Bed volume	7,800	litre GF202
Bed height	2	meter
Pressure drop	0.4	bar
Glycerine capacity	250	g/litre resin
Glycerine conc	800	ppm
Cycle time	156	h
Resin lifetime	5	years
Resin cost / l biodiesel	0.000044	€ / l
	0.000682	$ / gal

This basic design can be scaled linearly for plant sizing ranging from 1,000 ⇗ 300,000 to/a. Bed depth should be kept in the range 1.5 m (1,000 to/a) to 3 m (300,000 to/a)

Cost comparison Lewatit GF202 vs Competitor resin

	Resin cost / l biodiesel	
Competitor resin dry (one way application)	0.0075	€ / l
Lewatit GF202 (reusable over 5 years)	0.000043	€ / l
Competitor : Lewatit	170	cost factor