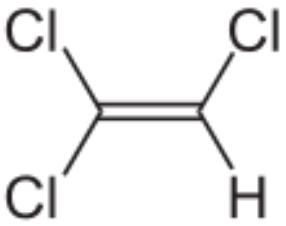
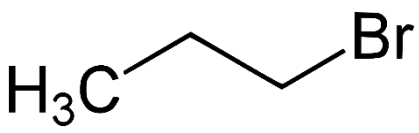

infraTest®
TESTING SYSTEMS
ALWAYS
2 STEPS
AHEAD ...

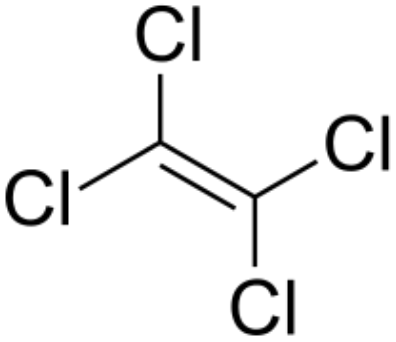
Development testing equipment

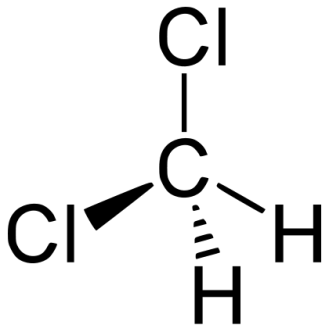
Matthias Martus

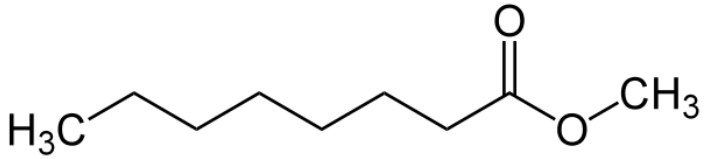
infraTest Prüftechnik GmbH











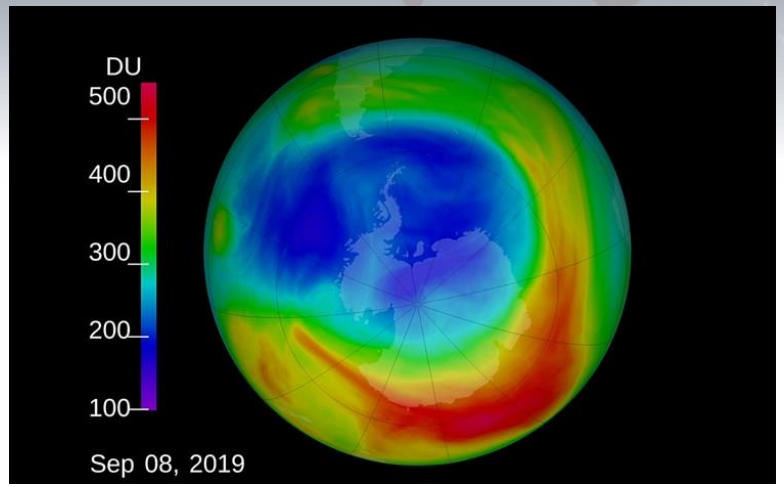
Solvents in Asphalt Extraction

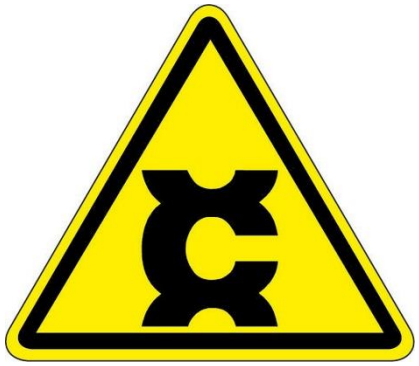
REACH

Registration,
Evaluation,
Authorisation and
Restriction of **Ch**emicals

ECHA
EUROPEAN CHEMICALS AGENCY

Yes solvents are not nice:
Thats why they are solvents

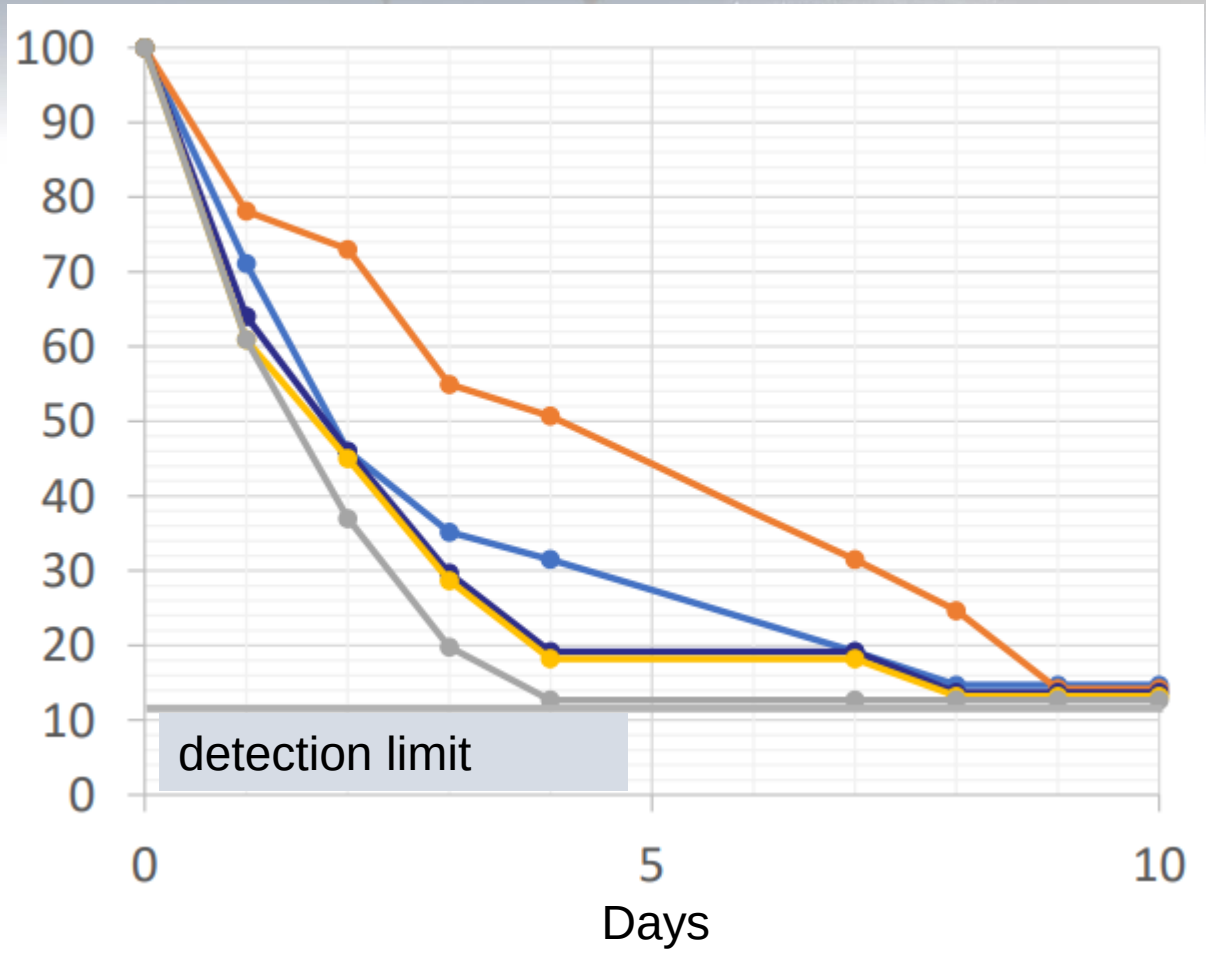




Some key facts

Solvents in asphalt extraction are in direct contact with aggregates, binder, polymers, waxes, recycled materials and unknown materials

Example: Boiling test Aggregate/Solvent:



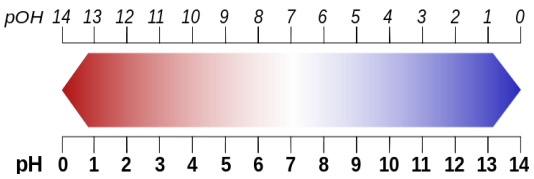
Aggregates:

- Diabase
- Greywacke

With different grading curve and therefore different dimension of surface

Some key facts

Solvents have to be handeld as a test fluid and must be monitored and tested regulary



pH value and alkalinity in ppm have to be determined

Batteriesäure	<0	sour
Magensäure (nüchterner Magen)	1,0–1,5	
Zitronensaft	2,4	
Cola	2,0–3,0	
Essig	2,5	
Fruchtsaft der Schattenmorelle	2,7	
Wein	4,0	
Saure Milch	4,5	
Bier	4,5–5,0	
Saurer Regen	< 5,0	
Kaffee	5,0	
Hautoberfläche des Menschen	5,5	
Regen (natürlicher Niederschlag)	5,6	
Mineralwasser	6,0	
Milch	6,5	
Wasser (je nach Härte)	6,0–8,5	sour to alkaline
Menschlicher Speichel	6,5–7,4	
Blut	7,4	alkaline
Meerwasser	7,5–8,4	
Pankreassaft (Darmsaft)	8,3	
Seife	9,0–10,0	
Haushalts-Ammoniak	11,5	
Bleichmittel	12,5	
Beton	12,6	
Natronlauge	13,5–14	

Some key facts

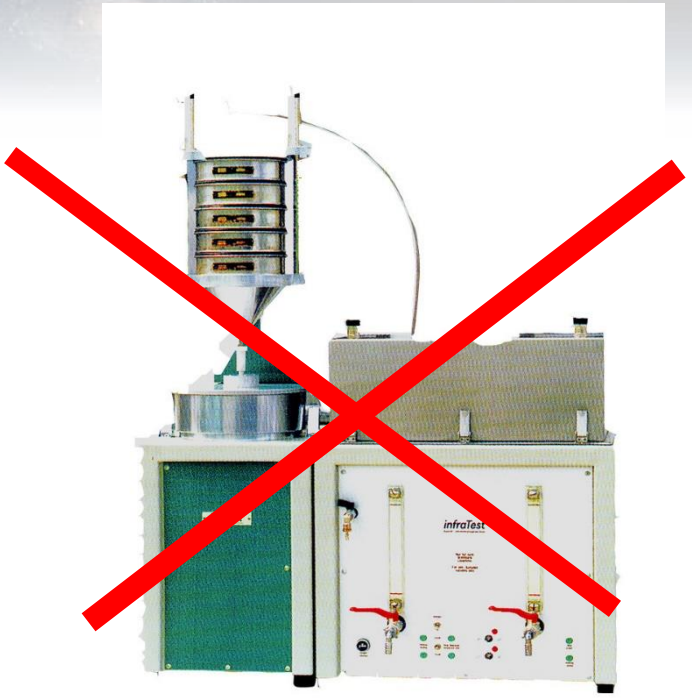
- Solvents in use should have a purity of higher 99,5 %
- Solvent mixtures have different influence on binder
- Solvent mixtures have most likely different boiling points
- All recycled solvents will destroy the machine due to unknown substances

Important Solvent questions

1. What is the possible impact on human health ?
2. What is the possible environmental impact ?
3. What is the influence on binder property ?
4. How is the dissolving power (extraction time)
5. How do we get it out of the binder ?
6. How stable is it ?
7. Is it flammable ?
8. Is it explosive ?
9. Is it avaiable ?
10. Is it affordable ?
11. How can we recycle it ?

Answer to 1 and 2: Closed systems

Asphaltanalysator



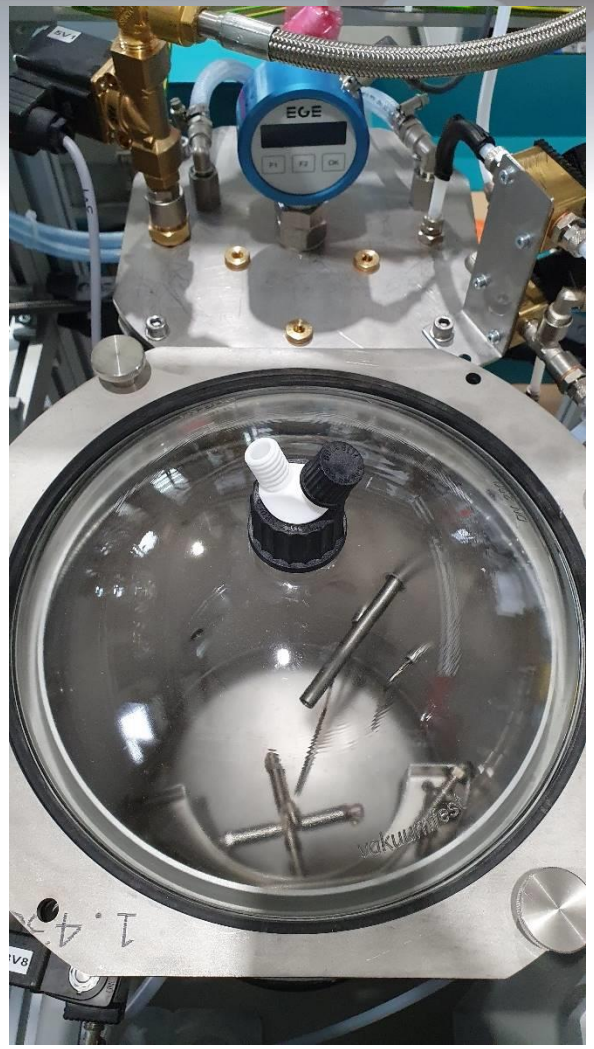
Automatic Extractor

Answer to 1 and 2: Closed systems

Answer to 1 and 2: Closed systems

Answer to 1 and 2: Closed systems

Closed system indirect recovery



Answer to 1 and 2: Closed systems

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TESTING SYSTEMS

Answer to 1 and 2

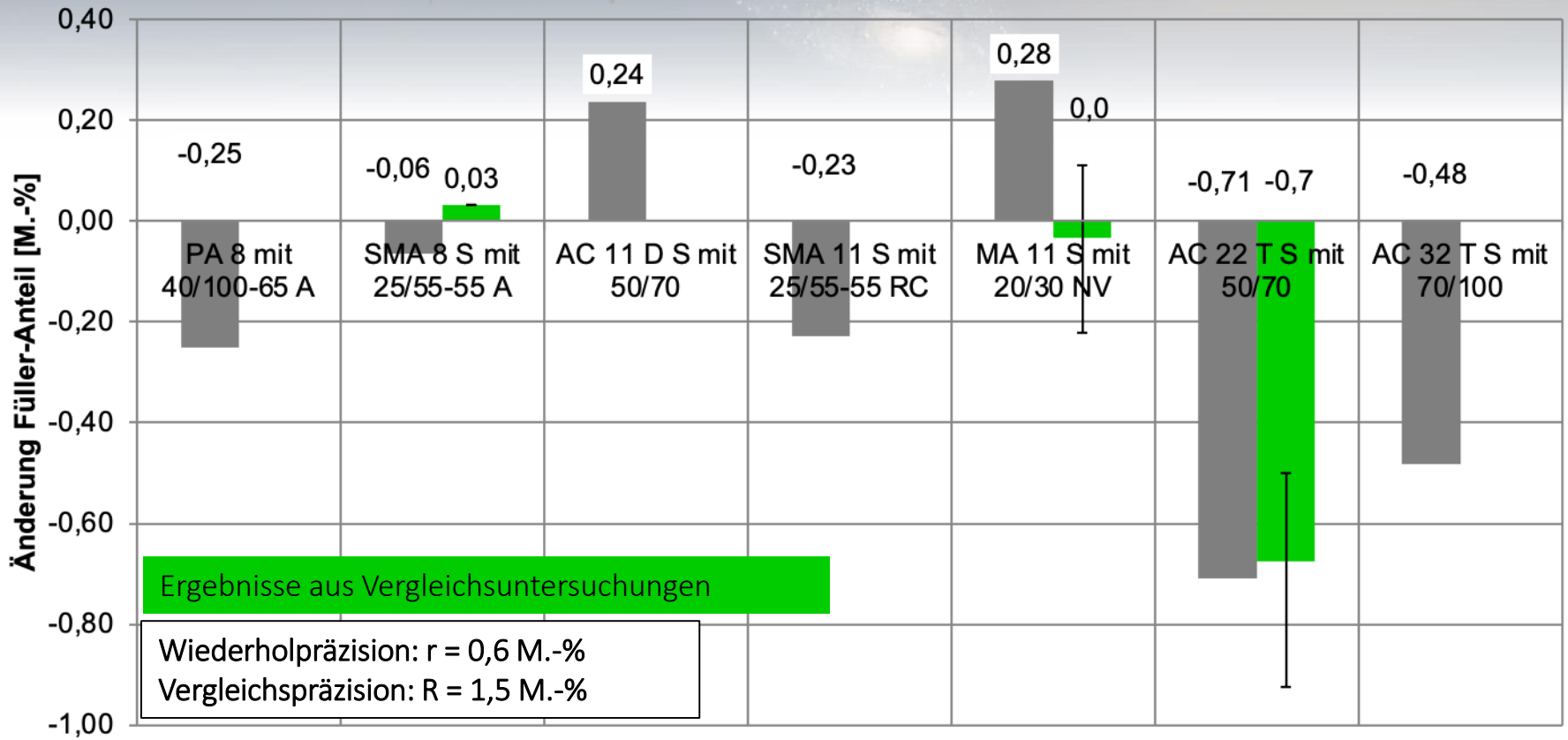
1.1 What is the possible impact on human health ?

1.2 What is the possible environmental impact ?

Answer to 1 and 2: Closed systems

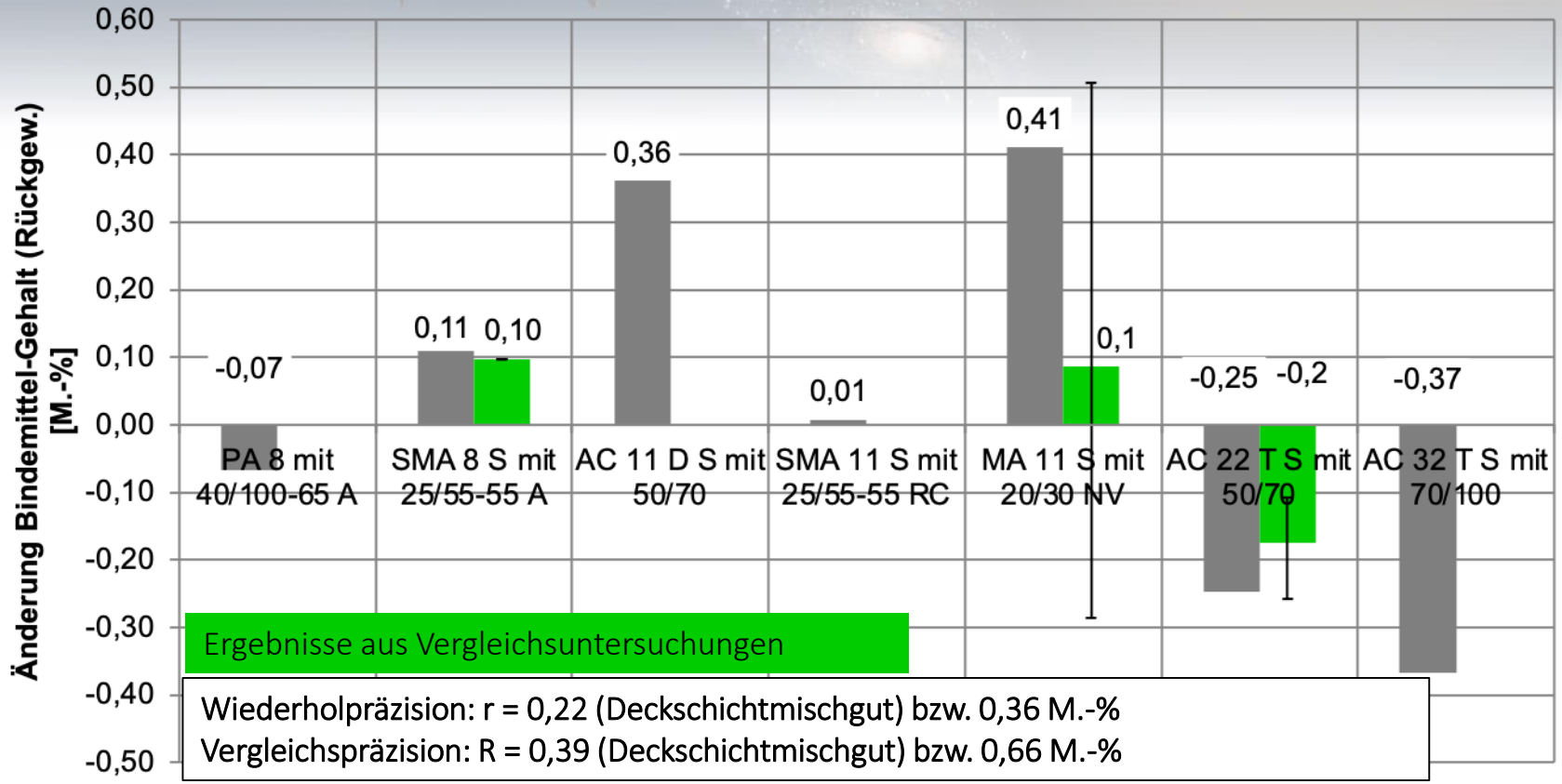
- **Safety belt and Airbag = internal, machine based**
- **Traffic rules and signs = external, system based**
- **E and hydrogen cars**
- **Conclusion: Make a known machine and system as safe as you can**

3. Filler content OME versus TRI



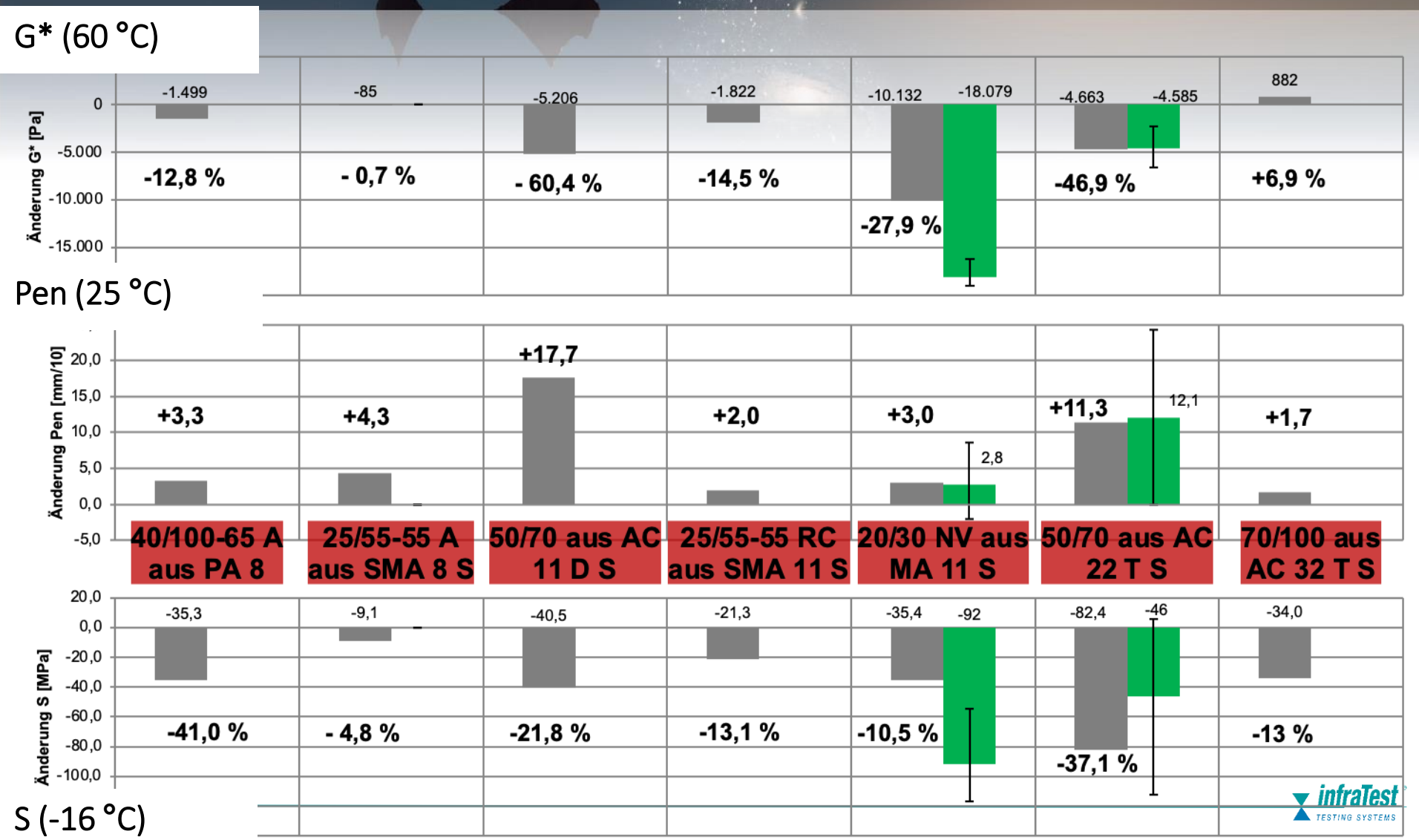
→ Die Bestimmung des Füllergehalts mit OME ist gleichermaßen präzise wie mit Tri

3. Binder Content OME versus TRI

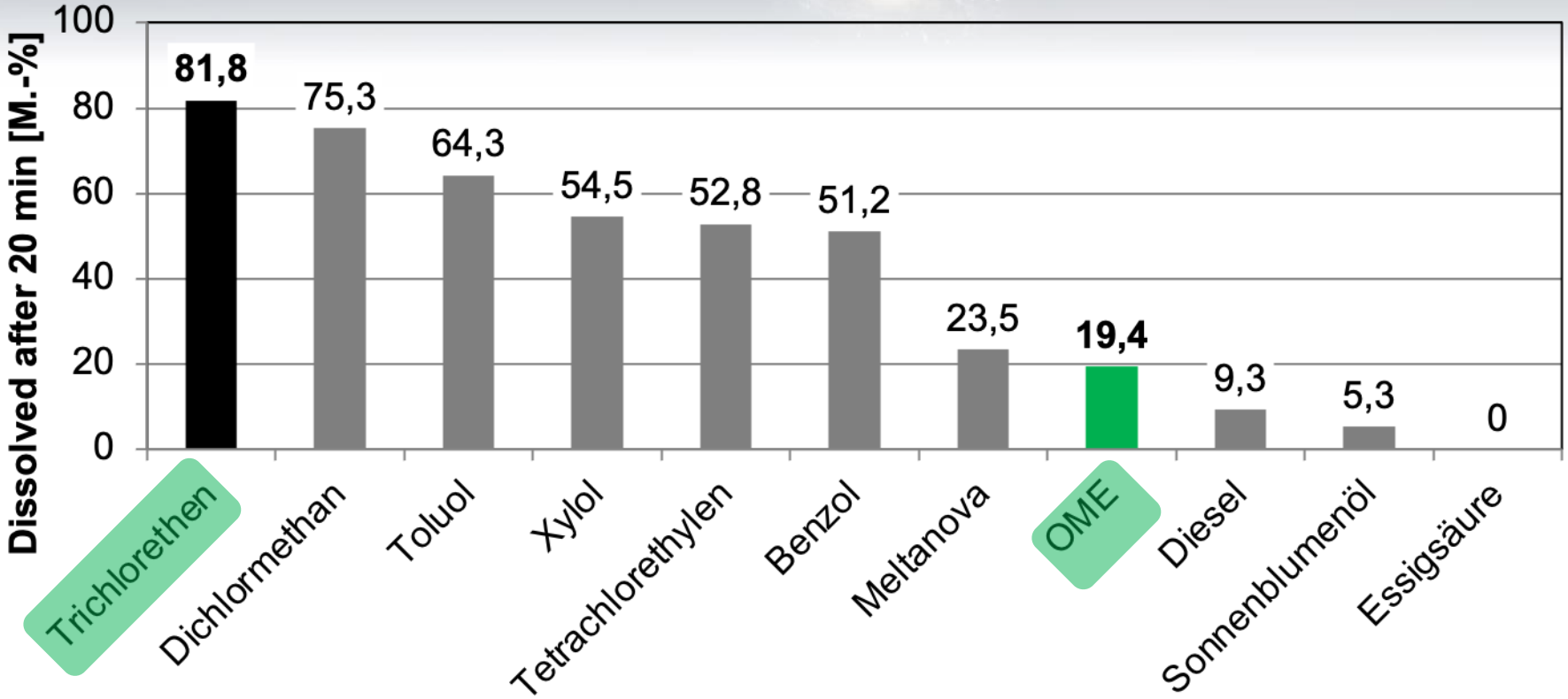


→ Die Bestimmung des Bindemittelgehalts mit OME ist gleichermaßen präzise wie mit Tri

3. Binder properties OME versus TRI



4. Dissolving power of different solvents at 26°C



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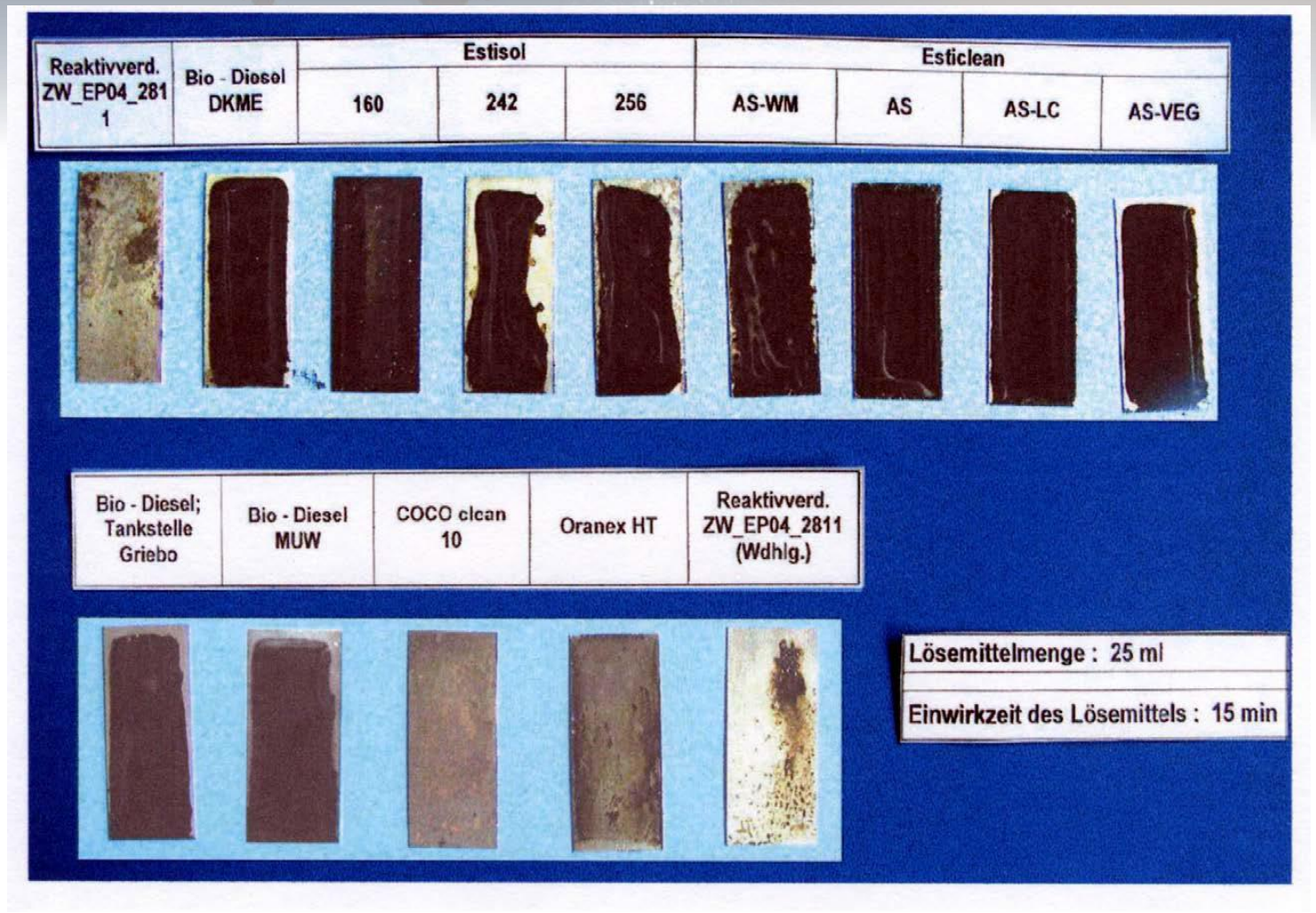
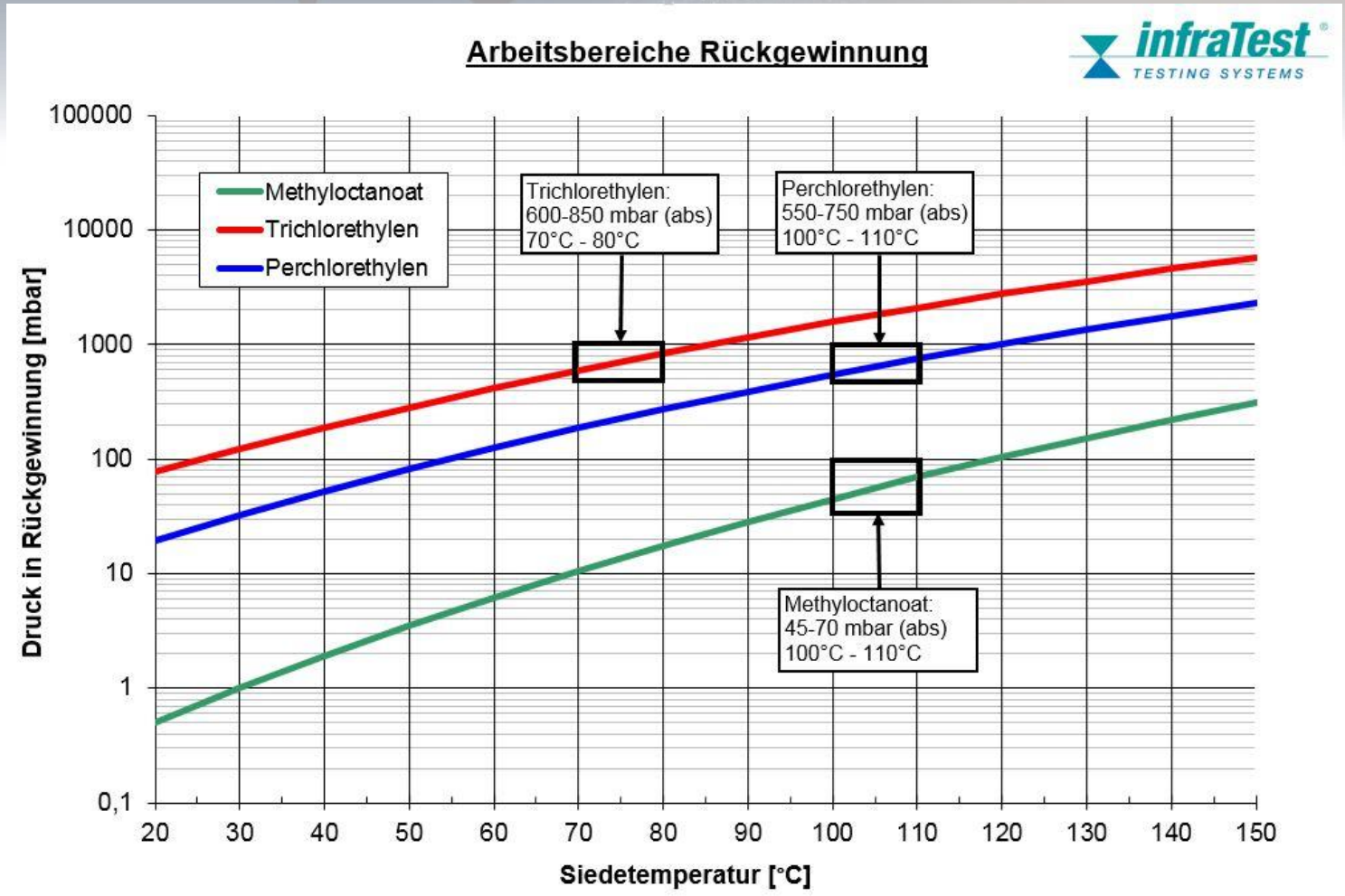
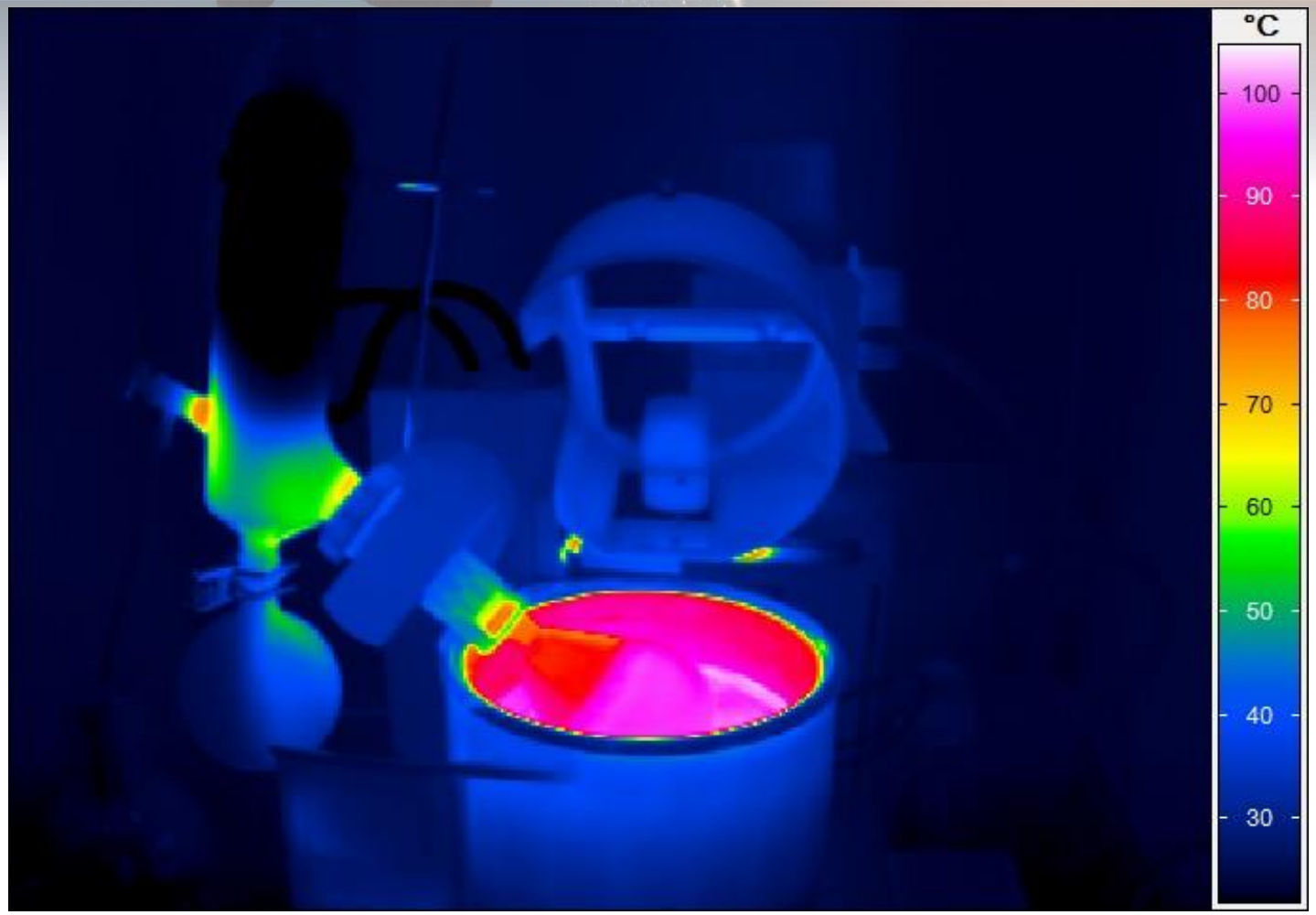


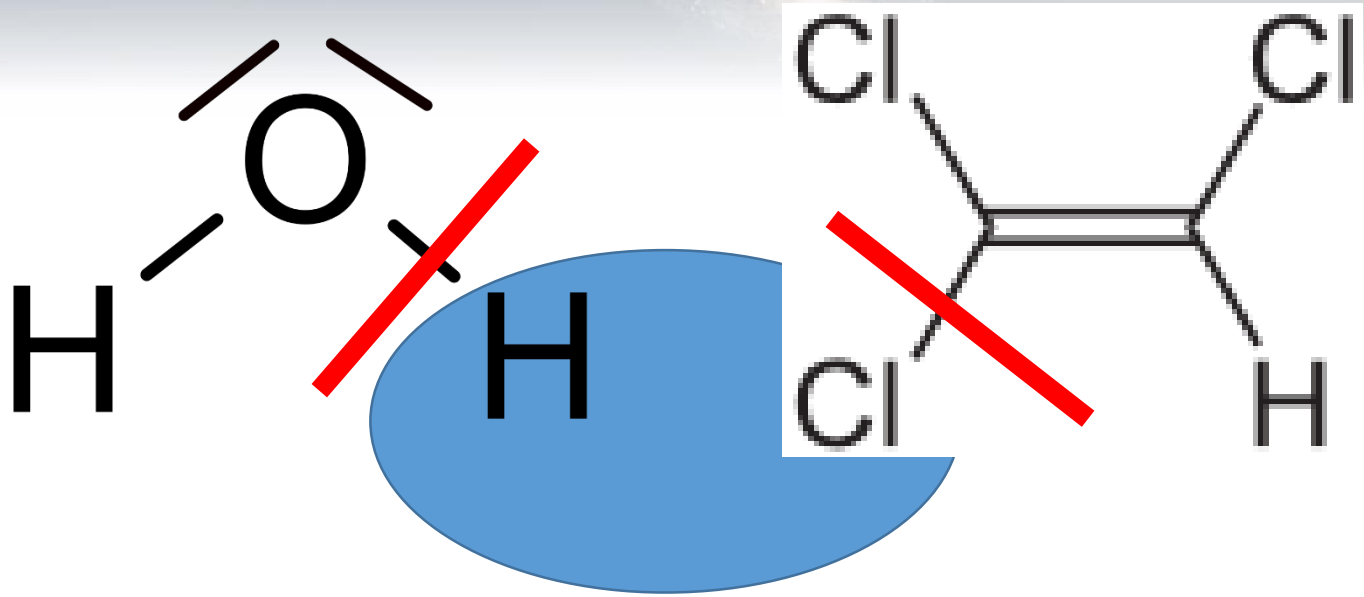
5. Distillation: Boiling Temperature and Pressure



5. Temperature level at Vaccum Evaporator



6. How stable is the solvent during use ?



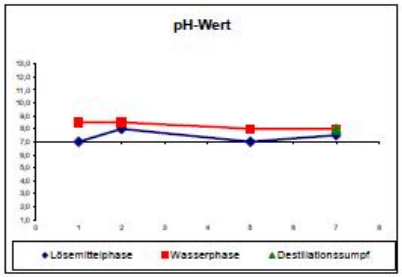
= HCL (hydrochloric acid)

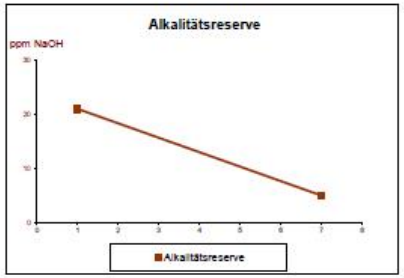
6. How stable is the solvent during use ?

1. **Influence of aggregats binders and polymers etc.**
2. **Solvent is ageing**
3. **Unstable against UV and heat**
4. **Certain metals (for ex. from milling machine)**
5. **Rust in buckets**
6. **Malfunction Analyser**

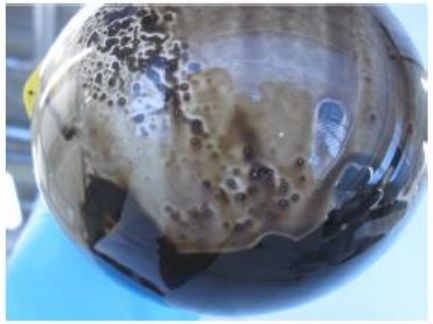
6. How stable is the solvent during use ?

Analysedetails





	Tag	1	2	3	4	5	6	7	8
Lösemittelphase									
pH-Wert		7,0	8,0			7,0		7,5	
Alkalitätsreserve		21,0						5,0	
Chlorid-Test		neg.	neg.			neg.		neg.	
Kommentar		Klar und farblos							
Wasserphase									
pH-Wert		8,5	8,5			8,0		8,0	
Chlorid-Test		neg.	neg.			neg.		neg.	
Kommentar									
Destillationssumpf									
pH-Wert								8,0	
Kommentar		trübe dunkelbraune Flüssigkeit, mit schwarzen Ablagerungen und "Steinpartikeln", graue Verkrustungen am Thermometer.							



Metalle

Aluminium	ok
Eisen	ok
Messing	leichte Verfärbung
Kupfer	Verfärbung

7 and 8: flammables and explosives

Currently no machine is designed for that kind of solvents

Pricing is 150 % higher then now

9 and 10: avaiable, affordable ?

Solvents are usually produced in distillation columns like this.

If you need 100 t per year for the asphalt extraction nobody will care

9 and 10: avaiable, affordable ?

The project coconutester (metyl octanoate) also died because nobody wanted to produce or deliver it(and we dont have enough coconuts in germany and sweden I guess)

11: recycle ?

Solvent handling
always must
include
a procedure
for recyling

11: recycle ?

Chemical leasing concepts are a possible solution

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Which solvents are in use

1.1 Trichlorethylen

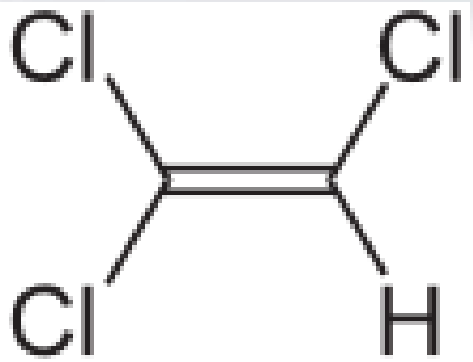
1.2 Tetrachlorethylen

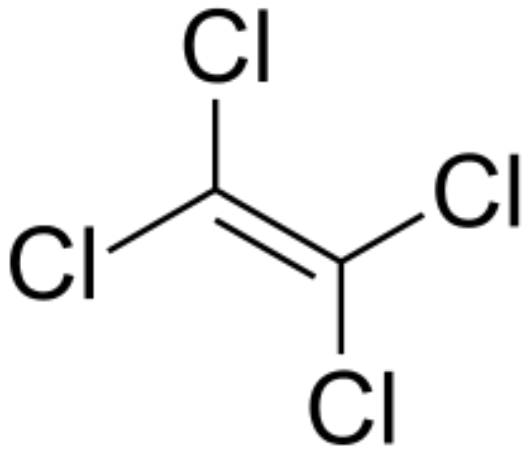
1.3 Methylenchlorid

1.4 Toluene

1.5 Methyl Octanoate

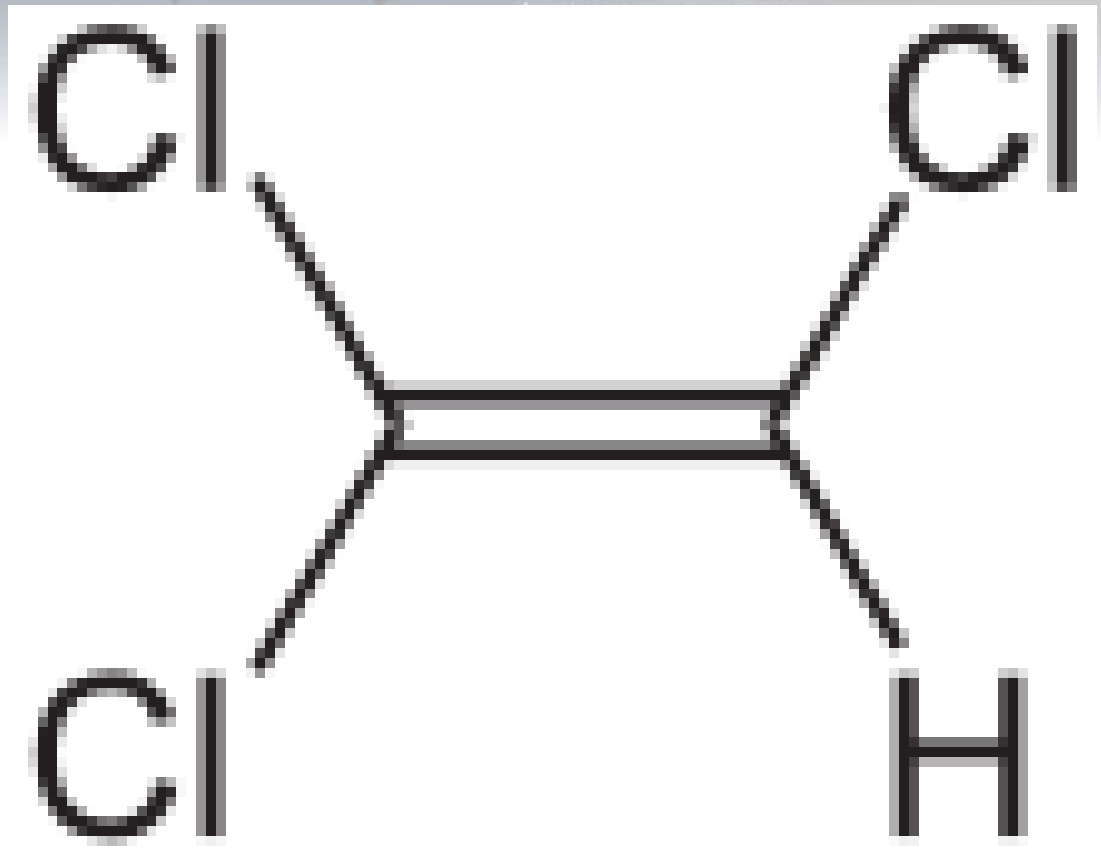
1.6 n-propyl bromide





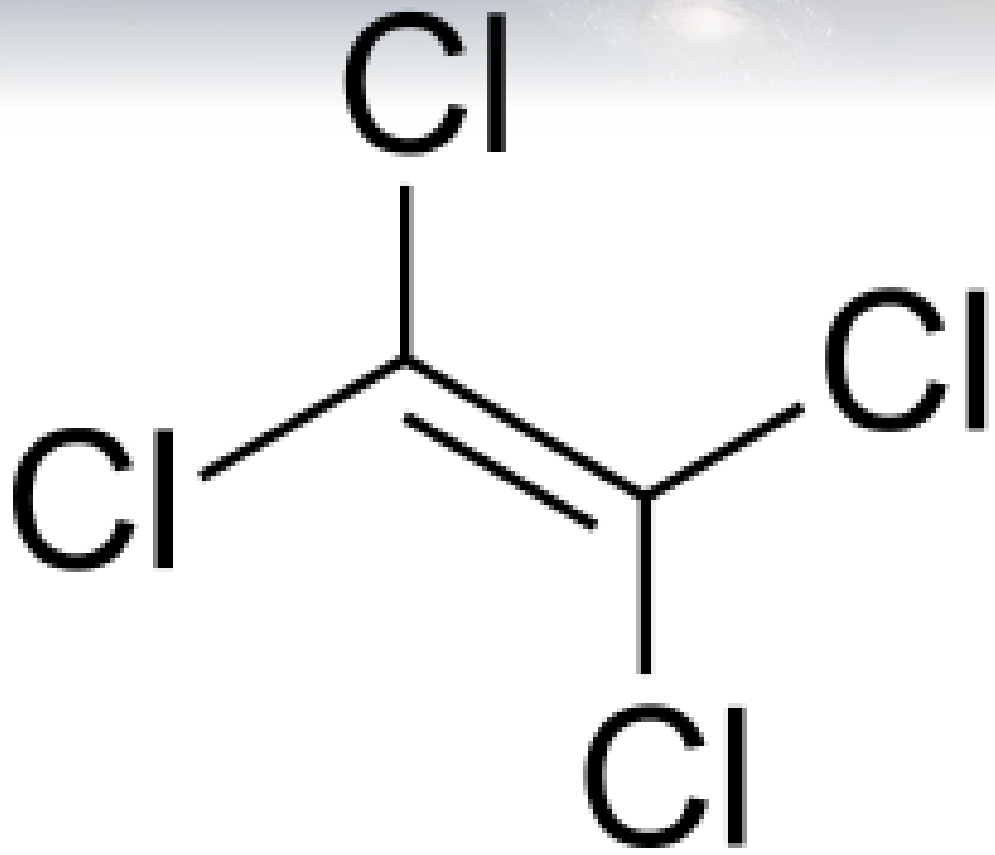
1.1 What is TRI ?

- Chlorinated hydrocarbon
- Density: 1,46 g /cm³
- Boiling point: 87 ° C
- SVHC (permission for use will expire 04/23)


Cl
Cl
Cl
H

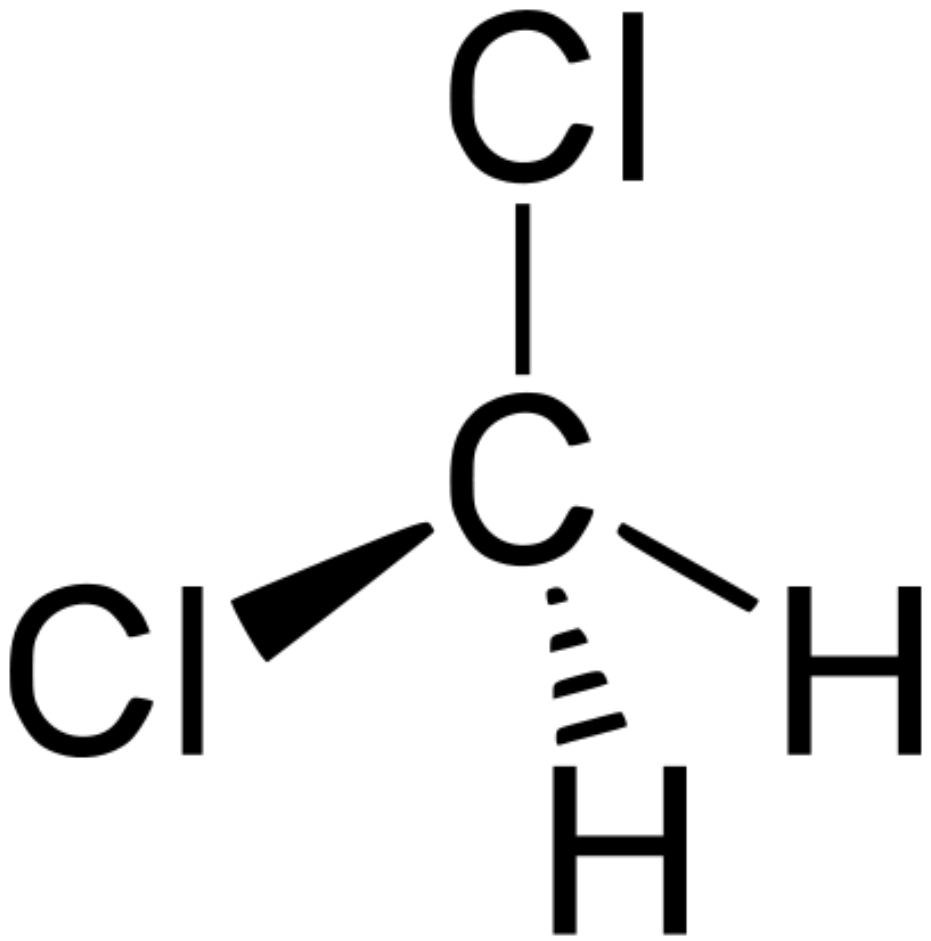
1.2 What is Tetra ?

- Chlorinated hydrocarbon
- Density: 1,62 g /cm³
- Boiling point: 121,1 ° C
- not listed as a SVHC


Cl
Cl
Cl
Cl

1.2 What is Methylenchloride?

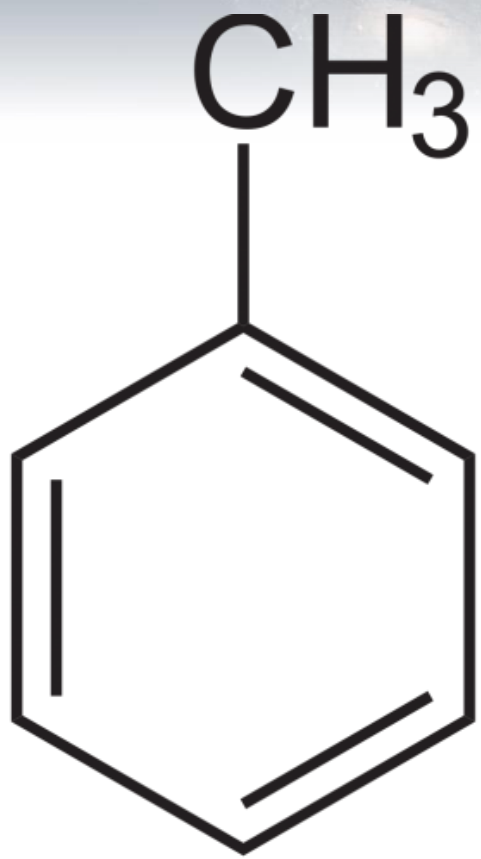
- Chlorinated hydrocarbon
- Density: 1,33 g /cm³
- Boiling point: 40 ° C
- Not listed as a SVHC


Cl
C
Cl
H
H

1.2 What is Toluene?

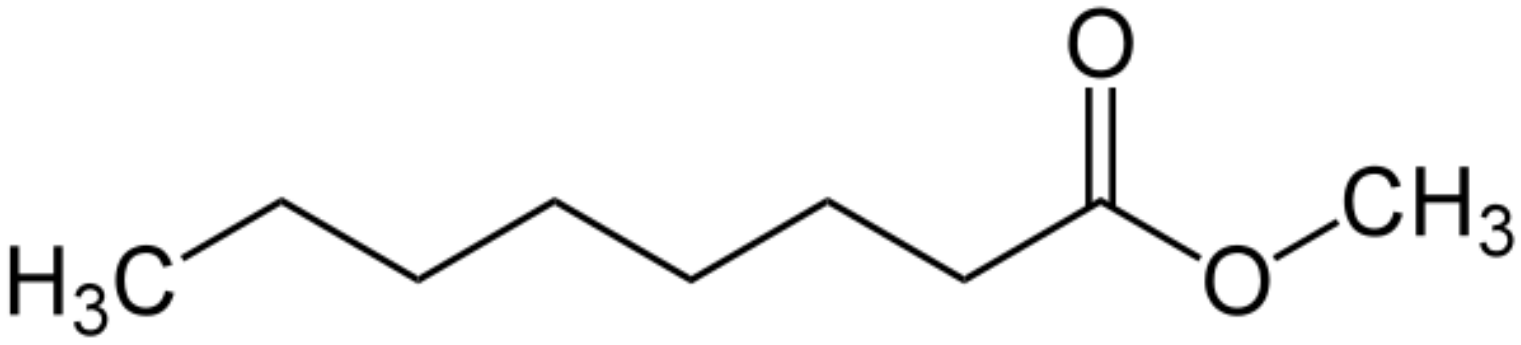
- Aromatic hydrocarbon
- Density: 0,87 g /cm³
- Boiling point: 108 ° C
- Lower and upper exlosion limit:

  1,1 vol% to 7,1 vol%
- Flash point: 4,4 ° C


CH3

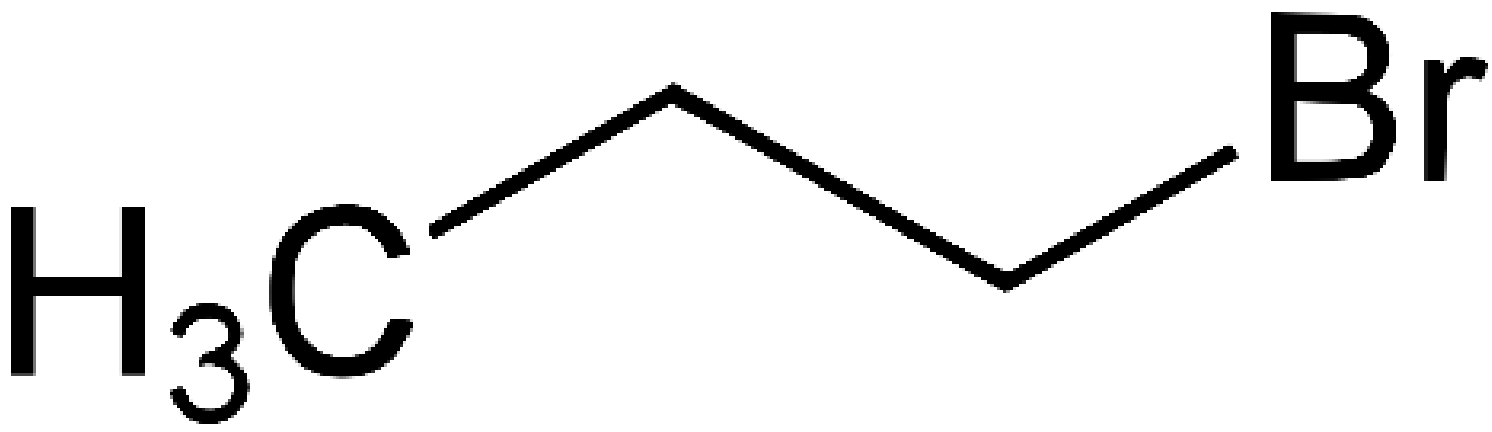
1.2 What is methly octanoate?

- Carboxylic acid ester
- Density: 0,88 g /cm³
- Boiling point: 193 ° C


O
H_3C
O
CH_3

n-propyl bromide

- Bromocarbon
- Density: 1,35 g /cm³
- Boiling point: 71 ° C
- ASTM
- Listed as SVHC (since 4/2020 forbidden in EU)


H3C
Br

Conclusion:

Asphalt extraction and finding binder properties are a task of high complexity

With the use of closed systems, extractions can be performed save and precise

Over the years of analysers development the consumption of solvent dropped down enormously

Conclusion:

The evaluation process for finding a new solvent is complex

It is not just mixing solvent 1 and 2 together

Extraction is not washing it is testing

Conclusion:

Knowing the devil and take care of him in the best way with state of the art principles and technologies is smarter then looking for a new one

Conclusion:

One last question: what are you doing with the dioxins and furans during burning in an ignition oven ?

Friends for more then 30 years

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Asphalt

The use of bituminous materials is mainly addressed to road constructions. The asphalt, named also bitumen, is mainly composed by aggregates and binder, with an infinite variation of mixtures. It is therefore necessary to get suitable equipment to perform different test methods and to determine: binder content, internal friction, cohesion, consistency, softening point, viscosity, quality of aggregates, voids percentage, Marshall test and many other parameters.

infraTest TESTING SYSTEMS

Lets go.. I wish you all a fantastic 2022