

TAR GUIDELINE

A STANDARD METHOD FOR SAMPLING AND ANALYSIS OF TARS AND PARTICLES IN BIOMASS PRODUCER GASES

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Contents

- Aim of this presentation
- Introduction
- Outline of the Guideline
- Definition of tar
- Use in practice and standardisation
- Conclusions and acknowledgement
- Discussion

Aim of this presentation

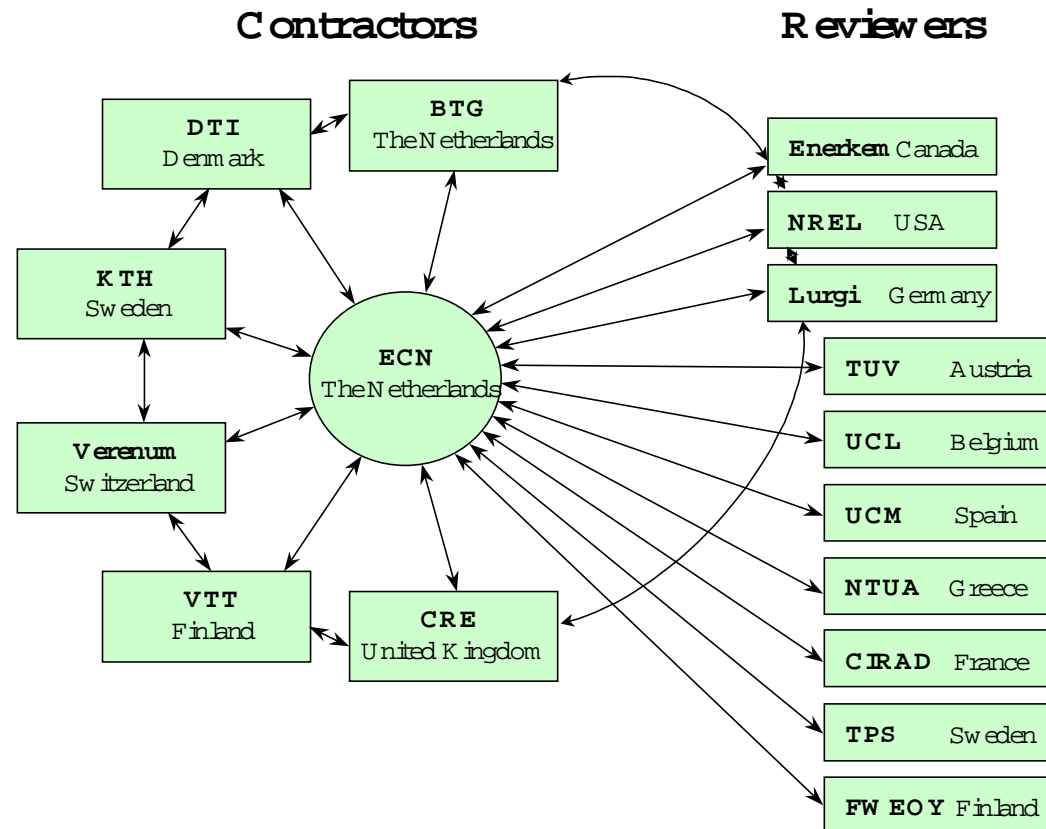
1. Present project "Tar Protocol"
 2. Start discussion on questions
 - 'do we have to define the word "tar" ?'
 - 'do we need a Protocol, Guideline or Standard ?'
- Discussions will continue tonight in
Expert Meeting (19.00 - 22.00, same room)

Results will be presented in Session O2J
(Friday morning, 10.00 - 11.00)



Introduction - Project "Tar Protocol"

Project was executed by 17 partners from Europe and North-America:



Introduction - Project "Tar Protocol"

Aim of the project is to:

(1) Develop a Guideline:

- Describing necessary equipment and procedures for sampling-, post-sampling- and analysis of tars
- Suitable for measurement of tars at all relevant conditions (0 - 900°C; 0.9 - 60 bars) and concentrations (1 mg/m³_n - 100 g/m³_n)
- Simultaneous measurement of particles and soot

(2) Disseminate the Guideline to become a world-wide accepted standard measurement method



Introduction - Project "Tar Protocol"

We renamed the Protocol into "Guideline"
as:

Protocol = Outcome of two Working
Groups (1998)

Guideline = Method to be recommended
and basis for comparison,
nothing more and nothing
less

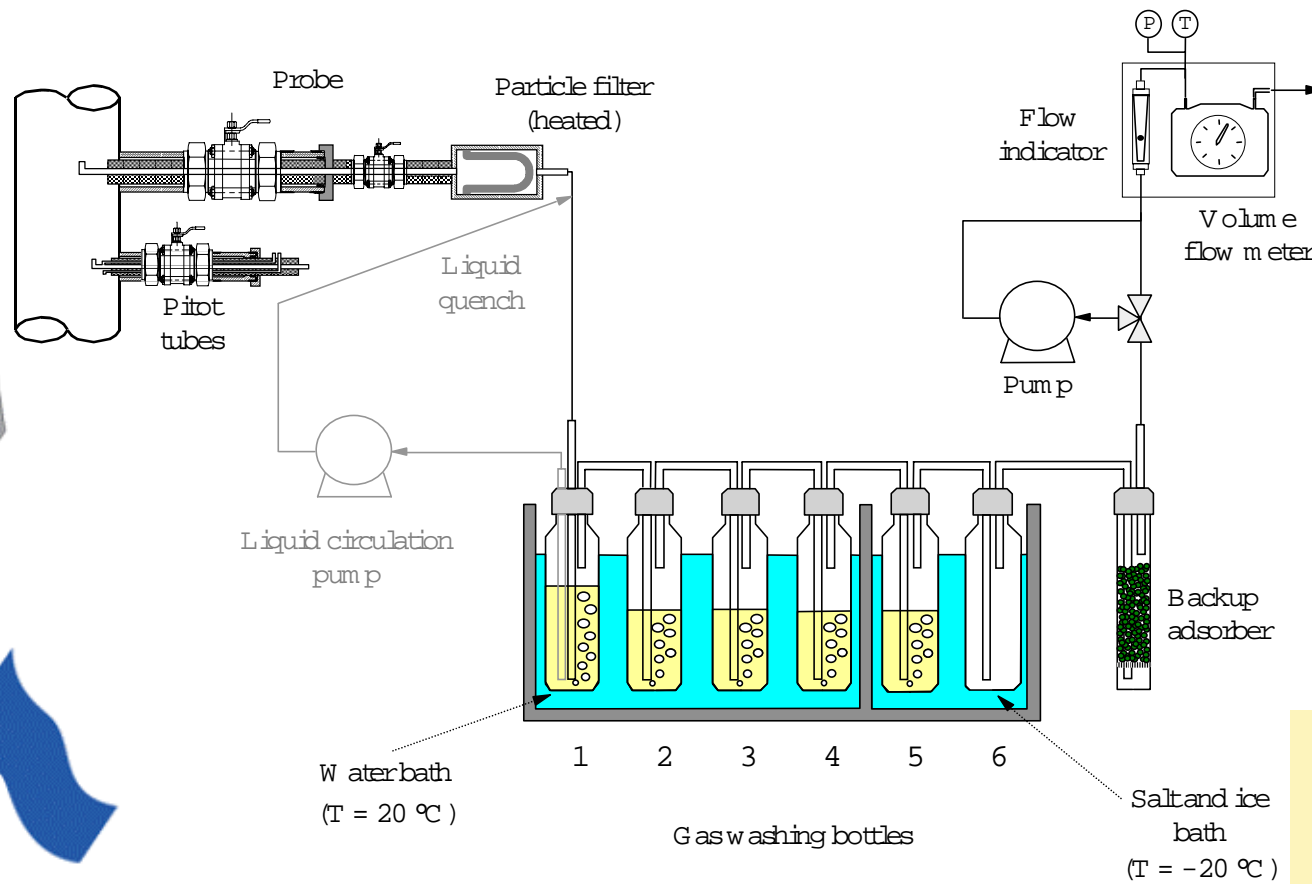
(see later)

Standard = Method to be approved by
certification institute (e.g.
CEN).



Outline of the Guideline

The Guideline is a modular method:



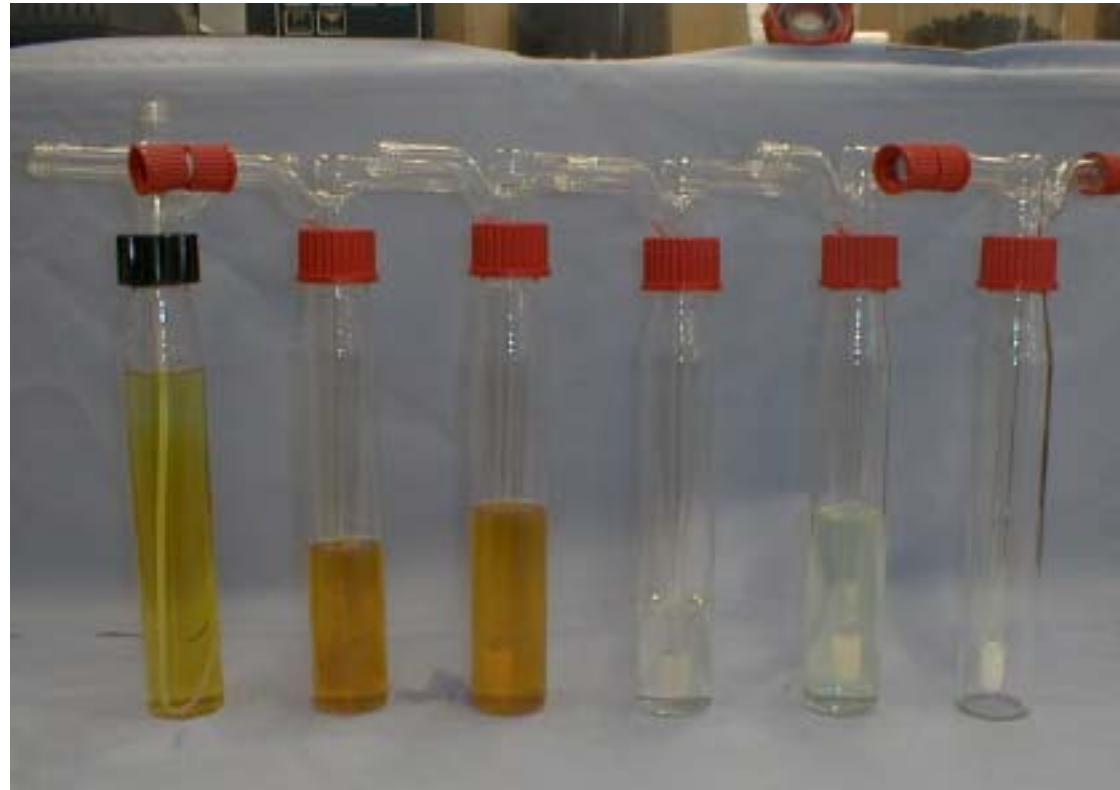
Outline of the Guideline

Figure of sampling train



Outline of the Guideline

Sampled tars on impinger bottles



Outline of Guideline - R&D Results

Main R&D results are:

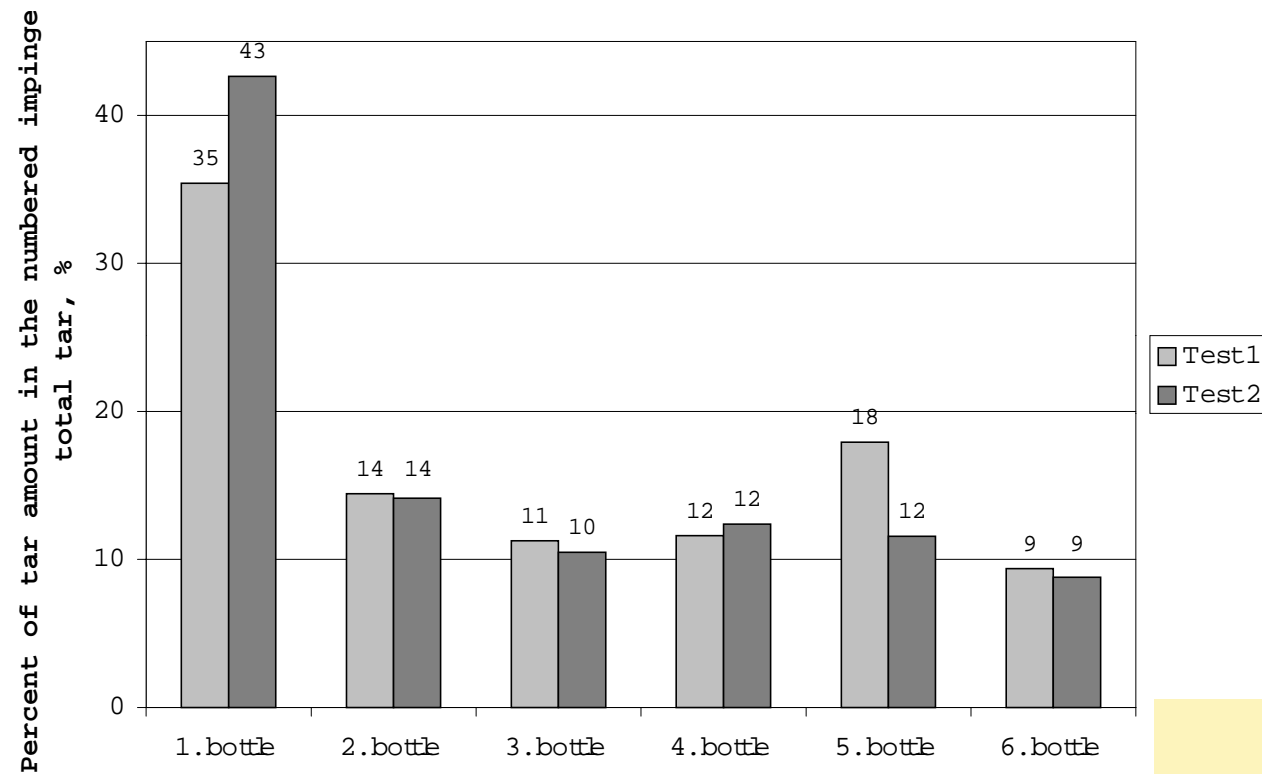
- Aerosol formation is a major problem in tar sampling
Result is incomplete tar collection
=> a liquid solvent is needed
- Selection of liquids gave 4 candidates
DCM, ethanol and 1-methoxypropanol have disadvantages
=> isopropanol is an appropriate and the selected solvent
- Even with a solvent, quantitative collection is not obvious
=> sampling train must be carefully designed
Imp. Train temp.: 4x +20°C 2x -20°C + a quartz filter or frits

CONCLUSION: A Guideline ensures good
sampling and analysis procedures over a wide
range of conditions

Outline of Guideline

- R&D Results

Tars are found in sixth impinger bottle as well as after the impinger train



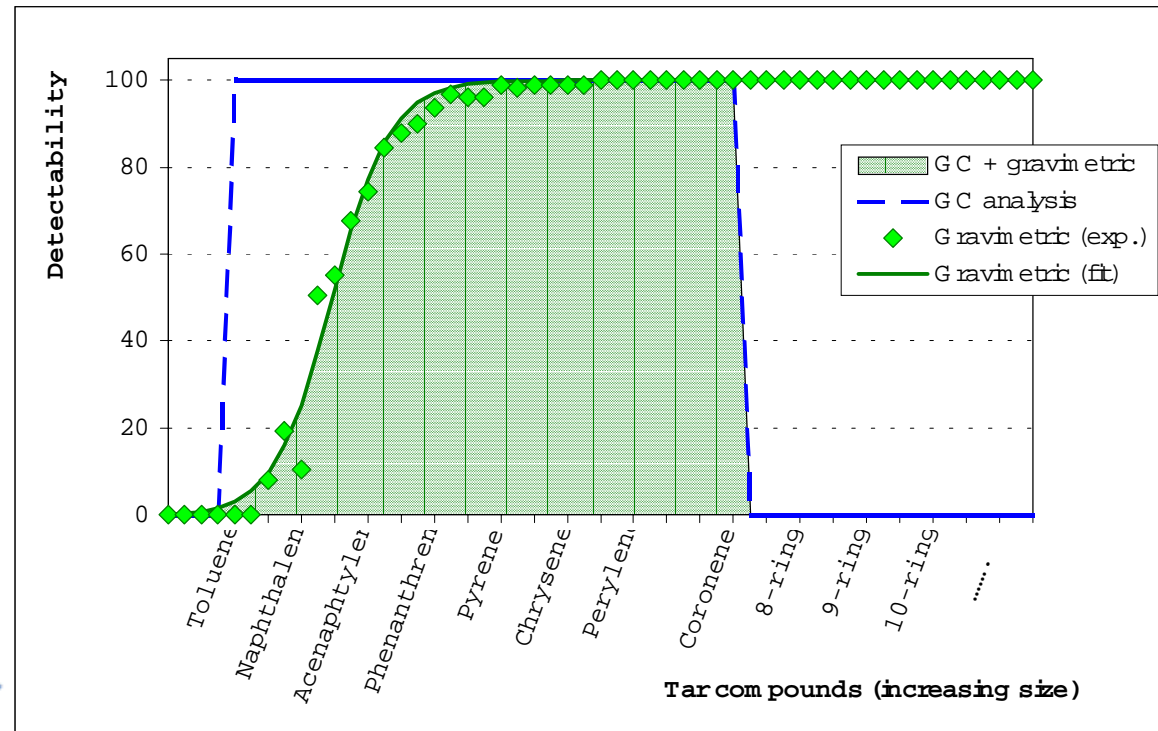
Y-axis: Sum of tar compounds measured by GC up to pyrene.

Tars collected in 1-Methoxy-2-propanol at 0°C (1-4) and -70° (5-6)

(Definition of tar) - Intermezzo -

Analysis of tars => two possible numbers:

- Gravimetric (evaporation / condensation)
- Compounds analysis



Definition of tar

Definition is controversial: "what are tars"?

We believe and propose that the word "tar"

- irrespective of the definition given, will always cause discussion and confusion as it is used in several fields and applications never having exactly the same meaning
- For example: even defined as "compounds that condense" is ambiguous as condensation or contamination varies with T, p, [tar], [H₂O]

If a definition causes confusion and is ambiguous, then:

DO NOT DEFINE !



Definition of tar

How to measure "tars" when we accept that "tar" it is an ambiguous term without well-defined meaning?

We can measure "tars" once we define what we measure!

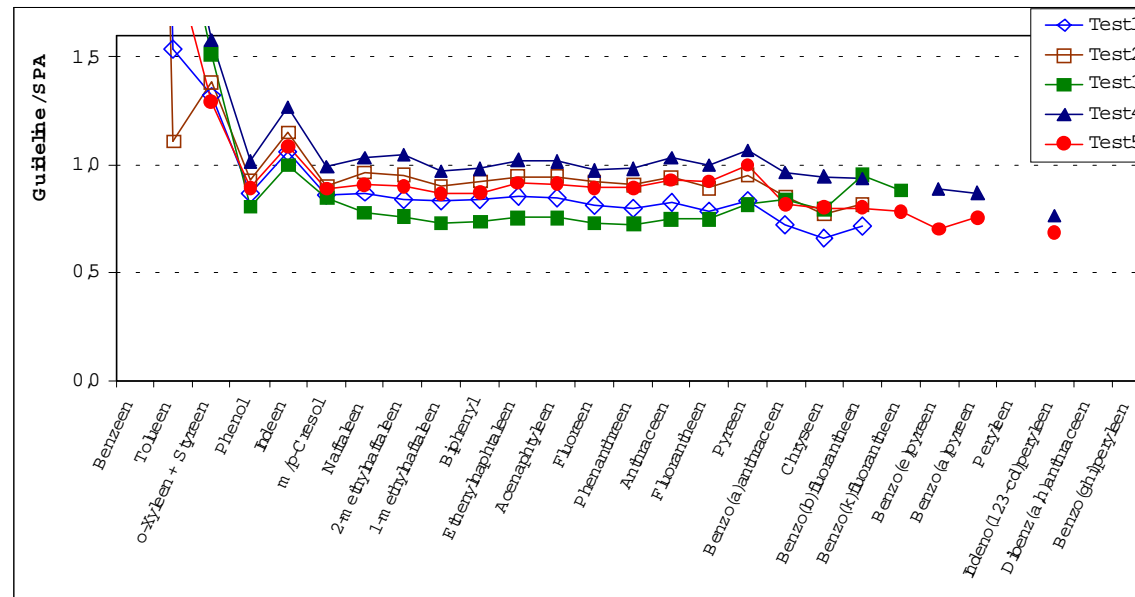
How to compare "tars"?

- Measure with the same method
(=> same definition);
- Measure with different methods using the same definition
(=> other methods. First: compare if two methods give same result at conditions considered)

Definition of tar

Example:

Comparison of Guideline with SPA method:



Conclusion: methods give same results in range phenol - pyrene. SPA can be used in that range.

Definition of tar

In the Guideline we measure two concentrations:

- **Concentration of gravimetric tar** = evaporation residue at standard conditions (T, p, and t)
- **Concentration of individual tar compounds** = those to be expected in biomass producer gases are listed (updraft, downdraft and fluidised bed gasification)

Individual tar compounds: SPA can also be used (range phenol - pyrene, downdraft and fluidised bed gasifier tar compounds)

Definition of tar

In conclusion:

- Do NOT define the ambiguous word "tar"
- Measure with own definition
Report what you have measured
- For comparison of tar concentrations, use one basis for comparison (the Guideline):
 - (a) measure numbers according to Guideline definitions
(gravimetric tar and/or single compounds); or
 - (b) use the Guideline



Use in practice, Standardisation

Implications for use

- The above does NOT implicate:
 - Use of the Guideline is mandatory or necessary
 - We all should compare
- The above DOES implicate:
 - If you want to compare your results with others, use a method that has been compared to other methods
- Practical implications that we foresee:
 - small gasifier systems: method that has been compared with Guideline. Result is gravimetric tar
 - larger gasifier systems: idem or Guideline. Compounds and/or gravimetric tar
 - commissioning of plants: idem, use one method! Guideline is preferred.



Use in practice, **Standardisation**

Standardisation needs:

- data on accuracy and reproducibility
- approval of national standardisation institutes

Standardisation = guarantee for quality

= > We believe standardisation is useful

A 2nd EU project has been applied for

Aim of project is to standardise the
Guideline into a CEN standard

(CEN = Commission Européenne de Normalisation)



Conclusion and Acknowledgement

Conclusions are:

- Guideline has been prepared
- Sampling conditions are essential due to aerosol formation
- Definition of tar is controversial. We propose:
 - Do not define the general word "Tar"
 - Define what you measure and make sure everyone measures the same = (1) Guideline gravimetric tar and (2) GC based compound analysis
- Use the Guideline when appropriate
Else use method that was compared to Guideline

Conclusion and Acknowledgement

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