To the participants of the PT on Gasoline iis14B01ASTM

Report on the Questionnaire of Distillation ASTM D86 – July 3, 2014

iis aims to improve and expand the scope of our proficiency test schemes continuously. In the last Gasoline PT iis14B01ASTM bimodal distributions were observed for the distillation test results of IBP, 10% evaporated, 50% evaporated and 70% evaporated. The purpose of the questionnaire was to find a possible cause for these bimodal distributions.

The response on the questionnaire was high. Until now, 56 questionnaires were returned (approx. 42%). The results have been summarized below. Among these laboratories were 9 that performed a manual method, 44 performed an automated method and 3 participants did not complete the questionnaire with all requested results.

In the method ASTM D86 (Distillation of Petroleum Products at atmospheric pressure) the temperature of a certain percentage recovered is measured. To obtain the temperature at the corresponding percentage evaporated, an arithmetical calculation is done using the loss reported in the same test. iis calculated per responding participant the temperature at 50% evaporated using the reported temperature at 40% recovered, the reported temperature at 50% recovered and the reported loss (see ASTM D86:12 §11.6.1 or appendix X1.2.2).

Manual Method:

Around 30 laboratories in the PT used a manual method. Nine laboratories returned the questionnaire. iis performed the D86 arithmetical calculation on the data and found that 5 participants (=60%!) did not calculate the temperature at 50% evaporation correctly. The differences between the iis calculation and the reported test results ranged from (absolute) 0.4-1.6°C. It also means that more than half of the laboratories, which returned the questionnaire, may not be calculating the temperature at 50% evaporated according to ASTM D86.

Automated method:

In the PT around 90 laboratories performed the automated method. The questionnaire was returned by 44 laboratories. The equipment used by these laboratories were PAC/Herzog Optidist (50%), ISL AD86 (25%), Herzog 626-627-628 (20%) and other equipment like Orbis PAM distillation, Normalab NDI 440 and Tanaka AD-6 (combined 5%). It should be noted that PAC, ISL and Herzog are all commercial product lines of the same company (PAC).

iis calculated the temperature at 50% evaporated according to ASTM D86 from the reported data. We found differences between the reported test results and the iis calculated results for 15 laboratories (=34%!). There were different causes: in 6 cases it was a calculation difference and in 6 cases the temperature at 50% recovered was reported instead of 50% evaporated. In 2 cases the temperature at 50% evaporated was higher than that of 50% recovered, although a loss was found and in 1 case results of duplicate runs were reported and later in part corrected with results of a single run.

It is remarkable that there appears to be so much confusion about which result to report, when automated equipment is used (which print or display results automatically). Different software versions and instrument manuals of the different equipment might not be as clear to what results are displayed. On the other hand, laboratory personnel should be sufficiently trained to check any results that are given by automated procedures and these automated calculations should be checked before use and regularly.

When the results mentioned above are discarded and a new statistical evaluation is done on the results of the other 29 responding participants (with a correct calculation according to ASTM D86), it can be seen that the reproducibility is much better (and in full agreement with the method ASTM D86:12). For the statistical evaluation, see Appendix 1.

Regretfully the cause for the bimodal distribution of the PT results was obviously not found, because this bimodal distribution is still present in the statistical evaluation as in Appendix 1. This may mean that there is still yet another unknown source of uncertainty present in the test results.

Recommendations:

All participants are advised to check if the temperature at % evaporated is reported for gasolines and if so whether the calculation is correct.

For the upcoming PT's on gasoline, in which a distillation according to ASTM D86 is performed, the report form will be adjusted to ensure that the temperature at % evaporated is reported. It would be helpful to us if the laboratories using automated equipment would send us a copy of the print-out of the automated results.

We thank all who did take the trouble to complete the questionnaire and return it to us. The results and remarks of this questionnaire will be a great help to improve our PT's on Petroleum Products.

If you have any additional questions or remarks, please do not hesitate to contact us.

Best regards,

Ing. Cynthia Nijssen-Wester
Institute for Interlaboratory Studies
Scientific Co-ordinator

Appendix 1:

Determination of Distillation ASTM D86 (automated) on sample #14009; temperature at 50% evaporated in °C (laboratories from questionnaire with correct D86 calculation, result from iis14B01ASTM)

lab	method	value	mark	z(targ)	remarks
120	D86-A	94.8		0.22	
132	D86-A	95.5		1.26	
194	D86-A	94.17		-0.72	
273	D86-A	93.8		-1.27	
311	D86-A	94.4		-0.38	
323	D86-A	94.3		-0.52	
333	D86-A	94.9		0.37	
338	D86-A	95.2		0.82	
340	D86-A	95.3		0.96	
353	D86-A	95.0		0.52	
447	D86-A	95.1		0.67	
485	D86-A	94.95		0.44	
495	D86-A	93.5		-1.72	
657	D86-A	95.3		0.96	
862	D86-A	94.3		-0.52	
1081	D86-A	94.5		-0.23	
1109	D86-A	94.6		-0.08	
1299	D86-A	94.0		-0.97	
1340	D86-A	95.4		1.11	
1395	D86-A	94.4		-0.38	
1397	D86-A	95.2		0.82	
1531	D86-A	94.4		-0.38	
1556	D86-A	95.1		0.67	
1677	D86-A	93.9		-1.12	
1776	D86-A	93.5		-1.72	
1807	D86-A	95.5		1.26	
1810	D86-A	94.4		-0.38	
1938	D86-A	94.1		-0.82	
2129	D86-A	95.4		1.11	

		From report iis14B01ASTM:
normality	OK	OK
n	29	91
outliers	0	0
mean (n)	94.65	94.79
st.dev. (n)	0.601	0.818
R(calc.)	1.68	2.29
R method	1.88	1.88