



EXECUTIVE SUMMARY:



Freeze Point and DrySac Presentation to EI STB7 Freeze Point Task Group, July 31st, 2007

Presenter: Dr. Gordon Chiu, Director of Research, Phase Technology

Background:

DrySac is a molecular sieve-type desiccant recommended by Phase Technology to dry sample jet fuels prior to freeze point testing according to ASTM D5972/IP 435.

This presentation made to the Energy Institute (EI) on July 31, 2007 answered three questions posed by recent studies on the use of DrySac and its impact on freeze point of jet fuels.

Presentation:

1. Question: Does the use of DrySac produce a statistically significant effect on freeze point?

Answer: No, DrySac does not change hydrocarbon freeze point. Evidence was presented including: (a) Shell's internal round-robin on seven jet fuels using both D2386 and D5972; (b) Phase Technology's study with nine ASTM Crosscheck samples using D5972; and (c) the 2007 EI study on eleven samples using D2386.

In all three cases, the freeze point results of samples with DrySac were indistinguishable from those without DrySac.

DrySac is used worldwide by multinational oil companies and commercial inspection laboratories. There has not been a single complaint about the use of DrySac since it was introduced approximately 10 years ago. This further supports the assertion that DrySac does what it is stated to do—improve repeatability without changing the hydrocarbon freeze point.

Presentations from other parties:

Prior to the July 31st meeting, ASTM statistician Richard Stanley re-analyzed the 2003 ASTM/IP freeze point round robin data for D5972 on thirteen fuels. In this round robin study, 3 laboratories used DrySac and 9 laboratories did not. He found no difference in the results between the two groups.

During the July 31st meeting, Jim Crighton of BP, Greg Hemighaus of Chevron and Richard Heins of Shell presented their company studies on the topic, again showing no difference in freeze points between tests with and without DrySac.

All of the above offer additional proof that DrySac does not change hydrocarbon freeze point.

2. Question: Why is the use of DrySac recommended?

Answer: The use of DrySac improves freeze point repeatability of some, but not all jet fuels. Although fuel chemistry is a determinant in disposition to DrySac treatment, it is impossible to reliably predict *a priori* which chemical component(s) are responsible due to the large variation in fuel-water interaction. Conducting trials remains the only reliable method to establish effectiveness of DrySac towards a particular fuel.

Examples were given for two fuels studied by Phase Technology, both wetted with water. It was shown that the use of DrySac improved repeatability in one case; but offered no improvement in the other. The mean freeze points remained the same in both fuels whether DrySac was used or not.

3. Question: Does the 2007 EI study demonstrate that DrySac changes freeze point?

Answer: Three supporting points using data from the 2007 EI study were presented to answer this question:

- (a) The 2007 EI study showed no significant difference in the freeze point under D2386, as stated earlier.
- (b) 8 of 11 fuels showed no significant difference under D5972. The 3 remaining fuels shared similar characteristics as observed in “contaminated” fuels studied in previous round robins (e.g. 2003 ASTM/IP freeze point round robin). The onset of these characteristics renders freeze point determination less repeatable than with “neat” fuels and produces an effect greater than that attributable to DrySac alone.
- (c) 8 fuels (not the same 8 as in [b] above) under D7153 showed significantly warmer freeze points than D2386, by up to 23°C. The reason for such deviations are unknown but cannot be explained by use or non-use of DrySac.

The presence of contaminants such as incompatible high-boiling components typically produces a “tail” in the freeze point behavior of fuels. This tail renders freeze point determination less precise; this fact has been demonstrated in previous round robins of all test methods. The 3 fuels mentioned in (b) above and purported to show a DrySac effect all display the characteristics of a tail.

Four fuels used in the 2007 EI study received further detailed testing at Phase Technology. Again, no differences were observed in the freeze point between those dried or not dried with DrySac, as shown by detailed examination of their phase behavior plots. In one case (fuel #129012), the fuel was studied to a greater extent as follows:

- (i) fuel was tested without DrySac
- (ii) a portion of the same fuel was separately treated with DrySac and tested
- (iii) DrySac was removed from the fuel used in (ii) and left exposed to ambient air at room temperature before tested again
- (iv) Finally, the same fuel in (iii) was re-treated with DrySac and tested

It was shown that the freeze points in (i) and (iii) above were the same, as were those in (ii) and (iv). The experiment’s result supports the assertion that DrySac removes the moisture in the fuel as stated but does not adsorb other hydrocarbon components.

Conclusion:

Phase Technology maintains its recommendation that the decision to use DrySac be made at the discretion of the testing laboratory. EI seeks formal standardization of a directive regarding use of DrySac.