LSC in Practice

Safer Cocktail for an Ethanol/Water/ Ammonia Solvent Mixture

Problem

A laboratory had been under pressure to move towards the newer generation of safer liquid scintillation cocktails. Unfortunately, the sample composition of one of their targets kept giving the researchers problems. Before the lead researcher contacted PerkinElmer, they had tried PerkinElmer's Opti-Fluor®, ULTIMA Gold™ LLT, and ULTIMA Gold XR. All of the safer cocktails could incorporate each of the constituents as indicated by their sample capacity graphs.

The problematic sample was an extraction solvent consisting of 900 mL ethanol, 50 mL ammonium hydroxide, 500 mL water and an enzyme containing ^{14}C. The mixture had a pH in the range of 10 to 11.

Discussion

The problem encountered was due to the ethanol/water mixture. As reported previously, getting alcohol/water samples into a cocktail can be very troublesome. Such alcohol/water mixtures are commonly encountered in flow counting; therefore, we looked at the ULTIMA-Flo™ cocktails to resolve this problem.

In addition, we also checked ULTIMA Gold LLT, even though the researcher had reported that it did not work. Given the ratio of ethanol to water in the sample, we suspected that some minor compromise would be needed to get the sample into a cocktail. In other words, it may have required 10 mL of cocktail to get 4 mL of this mixture into solution with the cocktail.

For this evaluation we prepared the sample as follows:

90 mL ethanol + 50 mL water + 5 mL ammonium hydroxide (S.G. 0.88)

Using this mixture, the sample uptake capacity of ULTIMA-Flo AP, ULTIMA-Flo M and ULTIMA Gold LLT (PerkinElmer 6013599, 6013579 and 6013377, respectively) at 20 °C was determined and the results were:

ULTIMA-Flo AP 4.00 mL in 10 mL cocktail

ULTIMA-Flo M 4.25 mL in 10 mL cocktail

ULTIMA Gold LLT 4.25 mL in 10 mL cocktail

From these results, we observed that it was possible to get 4.0 mL of the sample into all of these cocktails.

In addition, we determined that it was not possible to get 4 mL sample into 7 mL of any of these cocktails.

To complete this work, we also checked for luminescence using 4 mL of sample in 10 mL of each cocktail. In all cases, the backgrounds were down to approximately 40 to 45 cpm (0 to 156 keV window) within ten minutes. This slightly high background was expected and originates from the naturally occurring ^{14}C present in ethanol. Ethanol derived from petroleum distillates contains significantly less ^{14}C than ethanol derived from current carbon sources (e.g., grain alcohol). With ULTIMA-Flo AP, a small amount of precipitate developed over time due to a reaction between the ammonium hydroxide and one of the surfactants present in the ULTIMA-Flo AP.

Recommendation

From the observed data, we recommended the use of either ULTIMA Gold LLT or ULTIMA-Flo M, providing the researcher increases the quantity of cocktail to 10 mL to satisfactorily incorporate the 4 mL sample.

PerkinElmer, Inc.
940 Winter Street
Waltham, MA 02451 USA
Phone: (800) 762-4000 or
(+1) 203-925-4602
www.perkinelmer.com

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