

LSC in Practice

Yellowing of Cocktail Mixture Containing Soil Extract

Problem

A researcher reported that his sample/cocktail mixture had turned yellow. After digesting soil samples, 4 mL 1 M nitric acid were added to the digest. This sample was added to 16 mL ULTIMA Gold™ AB (PerkinElmer part number 6013309) for counting. Over a period of 3 to 4 days, yellowing would occur accompanied by a drop in the tSIE value. The researcher wanted to know what was causing the yellowing.

Discussion

It is known that strong nitric acid solutions can cause yellowing in cocktail, primarily due to dissociation of the nitric acid and release of NO₂ (nitrogen dioxide – a brown gas). However, this normally only occurs with nitric acid solutions at a concentration greater than 5 M and has never been reported with 1 M nitric acid. Yellowing can also occur with mixed nitric acid/hydrochloric acid solutions, but again the yellowing is usually only seen when the acids are in a fairly high concentrated form.

To confirm that this problem was not cocktail related, 4 mL 1 M nitric acid was added to 16 mL of ULTIMA

Gold AB and these were stored at 15 °C, 20 °C and 25 °C for 7 days. For this test, four different lots of ULTIMA Gold AB were used. The tSIE was measured at the beginning and at the conclusion of the test.

After seven days, all the test mixtures remained clear and colorless. In addition, there was no change in the tSIE values. This confirms that the problem is not cocktail related.

Recommendation

The researcher could not change his sample preparation and therefore has modified his procedures to complete counting within 24 hours of sample preparation.

Follow-Up Comment

The researcher also repeated this test and confirmed that the cocktail with nitric acid did not form any color. In a parallel test, the researcher stored the soil extract with added nitric acid, and found that this turned yellow within three days. Consequently, the source of the problem was identified as the sample and not the cocktail.

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