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FLASH POINT OF CSSX SOLVENT

R. J. Ray and D. D. Walker

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Savannah River National Laboratory
Washington Savannah River Company
Savannah River Site
Aiken, SC 29808

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REVIEWS AND APPROVALS

Authors:

3/2/06

R. J. Ray, SRNL Analytical Development — Date

3/1/06

D. D. Walker, SRNL Process Chemistry and Science — Date

Technical Review:

3/2/06

J. E. Young, SRNL Analytical Development — Date

SRNL Management:

3/6/2006

S. D. Fink, Manager, SRNL Process Chemistry and Science — Date

3/6/06

J. C. Griffin, Manager, SRNL Chemical Science and Technology — Date

Customer:

3/7/06

W. L. Isom, Jr., Manager, Salt Engineering — Date

1.0 EXECUTIVE SUMMARY

Savannah River National Laboratory (SRNL) researchers measured the closed-cup flash point of a sample of Caustic-Side Solvent Extraction (CSSX) solvent. As expected, the flashpoint of 148 °F for the full solvent slightly exceeded the flashpoint of the major combustible component (Isopar® L, flash point 144 °F).

2.0 INTRODUCTION

The Department of Energy (DOE) identified the CSSX process as the preferred technology to remove cesium from radioactive waste solutions at the Savannah River Site (SRS).[1,2] As a result, Washington Savannah River Company (WSRC) began designing and building a Modular CSSX Unit (MCU) in the SRS tank farm to process liquid waste for an interim period until the Salt Waste Processing Facility (SWPF) begins operations. Both the MCU and SWPF use the CSSX technology although the facilities differ in size and processing rate.

The CSSX solvent contains four components (Table I). One component, Isopar® L, is volatile and combustible with a flash point of 144 °F.[3] Isopar® L is a mixture of primarily10-carbon to 12-carbon branched chain hydrocarbons. Addition of the less volatile components, such as the extractant and modifier, will increase the flash point for the mixture. Researchers determined the increase by measuring the closed-cup flash point of the full solvent and of Isopar® L.

TABLE I. Composition of CSSX Solvent.

Component*	Concentration (molar)
Extractant (BOBCalixC6)	0.0070
Modifier (Cs-7SB)	0.75
Tri-n-octyl amine	0.0030
Diluent (Isopar® L)	(balance)

* BOBCalixC6 = Calix[4]arene-bis(*tert*-octylbenzo-crown-6); Cs-7SB = 1-(2,2,3,3-tetrafluoropropoxy)-3-(4-*sec*-butylphenoxy)-2-propanol.

3.0 EXPERIMENTAL

3.1 SAMPLE DESCRIPTION

Researchers measured closed-cup flash points of a sample of Isopar® L and of a sample of CSSX solvent. Both samples were used as received.

Exxon Mobil Chemical Company provided the Isopar® L (Lot #3608110420515).

Wright Industries, Inc., Nashville, TN, provided the CSSX solvent sample. This sample derived from solvent used during air flow testing in January 2006. Personnel at the Savannah River National Laboratory prepared the solvent and shipped it to Wright Industries.[4] Wright Industries returned

used samples to SRNL for analysis. The solvent sample used in the flash point measurement had contacted salt solution and, thus, contained water and small amounts of inorganic salts (e.g., $CsNO_3$). Wright Industries identified the solvent sample as "V10 Solvent Sample, 1/31/06, Lot G0122050, Serial AL 280574."

3.2 FLASH POINT MEASUREMENT

Researchers measured closed-cup flash points using a Petrolab Mini-Flash CCA-FLAH Flashpoint Tester using Analytical Development Procedure L16.1, ADS-2250. This method corresponds to ASTM Standard D 93-84. The instrument has been calibrated to yield equivalent results to the Pensky-Martens closed cup method.

Quality control (QC) standards were analyzed before and after the project samples to demonstrate the acceptable performance of the instrument during the run. n-Dodecane, Fisher part # 02666-500, lot # 982668, flashed at 172 °F for the initial QC, and at 172 °F for the closing QC. Both of these values are within established QC limits (172 to 174 °F) and support the sample analysis results. The sample was analyzed in duplicate on separate aliquots.

4.0 RESULTS AND DISCUSSION

SRNL researchers obtained the following flash point results.

Isopar® L	144 ± 3 °F
CSSX solvent	148 ± 1 °F

The value for the Isopar® L matches exactly the value provided by the manufacture. The value for CSSX solvent exceeded Isopar® L by 4 °F. The increase in the flash point results from the addition of the non-volatile components of the CSSX solvent (i.e., BOBCalixC6 and Cs-7SB).

5.0 REFERENCE

[1] C. L. Huntoon to G. P. Rudy, memorandum titled "Preferred Alternative for the Savannah River Salt Processing Project", June 25, 2001.
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[3] ExxonMobile Chemical Company, Material Safety Data Sheet (MSDS) No. 92842637, Feb. 27, 2003.
[4] K. Adu-Wusu, D. D. Walker, T. L. White, and S. L. Crump, "Preparation of Caustic-Side Solvent Extraction (CSSX) Solvent with BOBCalixC6 for Wright Industries - Component Amounts, Analytical, and Quality Assurance Results," SRNL-WPT-2005-00134, December 2, 2005.