

HPLC-PETRO

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## Determination of Static Dissipater Additives (SDA) In Aviation Turbine Fuels (ATF) and Middle Distillate Fuel by HPLC

**Abstract**

Static dissipative additives (SDA) are commonly used in the aviation industry to suppress the charge formation in the aviation turbine fuel when the fuel is transferred to the aircraft. If there was no SDA there is a possibility of a static discharge, where just one spark can ignite the fuel and impact surrounding infrastructure. SDA can be defined as a material added to a fuel in very small amounts to increase its electrical conductivity and thereby reduce relaxation time.<sup>1</sup> These materials may also be known as antistatic additives or conductivity improver additives. The SDA content varies from 1 mg/L to 12 mg/L. In the current communication the HPLC method (IP 568/11) (ASTM D7524-10) was successfully performed on Flexar HPLC. The isocratic HPLC method shows excellent sensitivity with linearity more than 0.995%.

**Standard & sample preparation**

The standards of 55 wt. % Dinonylnaphthalenedisulfonic acid (DINNSA) solution in Iso-butenol & 70 wt. % Dodecyl benzenesulphonic acid (DDBSA) solution in Isopropanol was procured from Sigma-Aldrich and used for Calibration and quantitative analysis of aviation jet fuel. The detection standard calibration solution (DINNSA - 0.8 mg/L to 16 mg/L and DDBSA- 0.7 mg/L to 8.5 mg/L) and system suitability solutions were prepared as per the procedure given in IP 568/11 (ASTM D7524-10)

**Sample preparation**

50 mL of sample is used for the analysis. The sample preparation was performed as per the IP 568/11 (ASTM D7524-10) method using PerkinElmer Supra-Clean SPE columns NH<sub>2</sub>-S (500 mg; p/n: N9306414).



## Instrumental conditions

Flexar FX-15 UHPLC Optimized Experimental Conditions	
Instrument	Flexar FX-15 UHPLC
Software	Chromera CDS
Column	C-6 Alkyl bonded reverse phase column or equivalent (250 mm X 4.6 mm X 5 µm)
Column Temp.	40°C
Flow Rate	0.5 mL/min
Type	Isocratic
Mobile Phase	400 mL MeOH / 400mL THF / 50 mL buffered phosphoric acid (pH 2.5)
Injection volume	20 µL
DINNSA Detection	234 nm (UV-Visible Detector)
DBBSA Detection	225 nm (UV-Visible Detector)

## Analytical results & conclusions

### System suitability:

1. **Signal to Noise Ratio:** Inject 20 µL of DDBSA Calibration Standard F to check system sensitivity.

**Requirement:** The Signal to Noise (S/N) ratio should be greater than 10.

**Result:** The S/N was found to be 19.45 for DDBSA Calibration Standard F and 15.84 for DINNSA Calibration standard F.

2. **System Repeatability:** Inject 20 µL of DINNSA calibration standard C & DDBSA calibration standard C five times to check system repeatability

**Requirement:** The area RSD should be less than 1%

**Result:** The area RSD for DINNSA calibration standard C solution is 0.49 & DDBSA calibration standard C solution is 0.76

3. **Linearity:** Inject the 20 µL of DINNSA calibration standards A, B, C, D, E or DDBSA calibration standards A, B, C, D, E.

**Requirement:** Correlation coefficient should be greater than 0.995

**Result:** Correlation coefficient for DINNSA is 0.9987 & for DDBSA is 0.9991

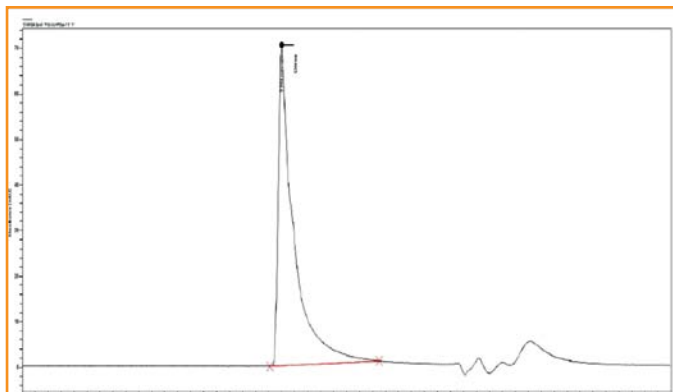


Fig.2: Chromatogram of DINNSA Solution A Calibration Standard

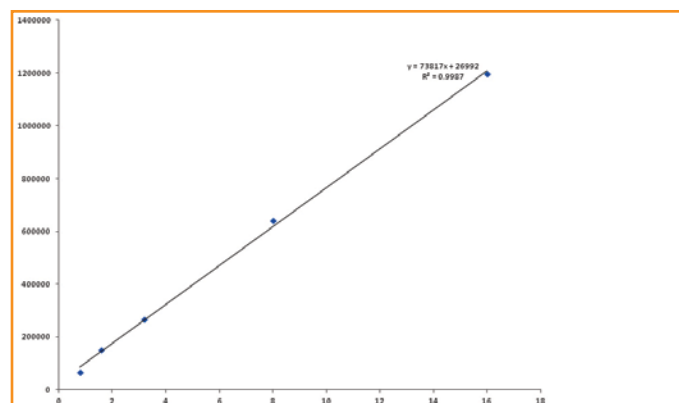


Fig.3: Five point calibration curve for DINNSA concentration range (0.8 mg/L to 16mg/L)

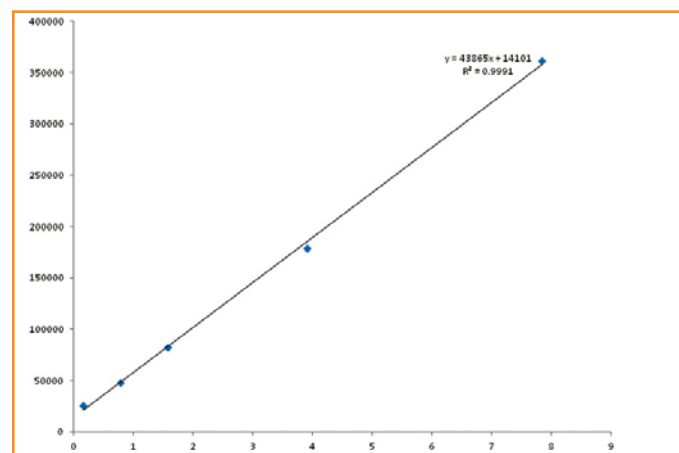


Fig.4: Five point calibration curve for DDBSA concentration range (0.16mg/L to 7.84 mg/L)

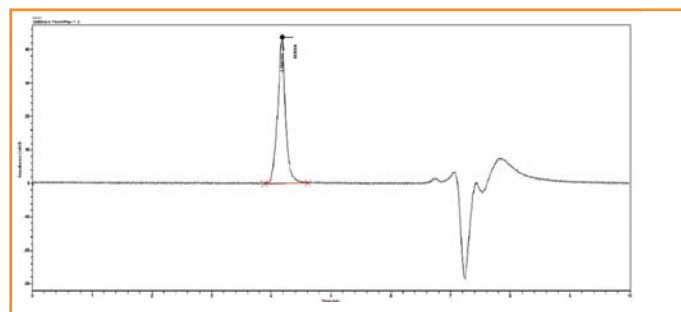


Fig.1: Chromatogram of DDBSA Solution A Calibration Standard

## Conclusions

The system suitability result shows the capability of PerkinElmer Flexar-15 HPLC system for determination of static dissipater additives (SDA) in aviation turbine fuels and middle distillate fuel.

Reference:

Determination of the static dissipater additives (SDA) in aviation turbine fuel and middle distillate fuels – HPLC method”, ASTM D7524-10 (IP-568/11) (568/11)