VINCI TECHNOLOGIES
Laboratory and field instruments for Petroleum Industry

FT-1 Atmospheric Flocculation Titrimeter

Determination of Intrinsic Stability of Asphaltene-Containing Oils
In Full Compliance with ASTM D7157

1. Introduction

Asphaltene instability remains one of the major operational risks in crude oil production, transportation, refining, and blending. Flocculation and precipitation can lead to fouling, plugging, storage instability, and incompatibility during blending operations. The FT-1 Atmospheric Flocculation Titrimeter has been developed to determine the intrinsic stability (S-value) of asphaltene-containing crude oils, residues, and heavy fuel oils in strict accordance with ASTM D7157.
The instrument provides automated, accurate, and reproducible measurement of:

- S – Intrinsic Stability of the oil
- Sa – Peptizability of asphaltenes
- So – Peptizing power of the oil matrix

VINCI TECHNOLOGIES Parc de l'Ile, 27B rue du Port, 92022 NANTERRE
Phone: +33 1 41 37 92 20 - vincinet@vinci-technologies.com - http://www.vinci-technologies.com

2. ASTM D7157 Principle

The method dissolves the oil sample in toluene and performs automatic titration with n-heptane. An optical probe operating at 880 nm detects the onset of asphaltene flocculation. The inversion point corresponding to precipitation is identified, and stability parameters are calculated through linear regression.

The S-value is defined as:

$$S = 1 + Xmin$$

Where Xmin is the minimum volume of n-heptane (mL/g oil) required to induce flocculation. Higher S-values indicate higher intrinsic stability.

3. FT-1 System Description

The FT-1 consists of:

- Three independent titration stations
- PC-based control system
- Precision motor-driven metering pumps
- Magnetic stirring system (200–400 rpm)
- Optical probe at 880 nm
- Borosilicate titration cells (95 mL nominal volume)

The optical system automatically selects the optimal signal range, ensuring reliable detection even with very dark crude oils.

4. Test Procedure Using FT-1

Three dilutions are prepared using measured oil mass and specified toluene volumes. The system performs automatic n-heptane titration in 0.05 mL increments at 0.05 mL/s. Flocculation is identified when the optical signal transitions from increasing (due to dilution) to decreasing (due to particle formation). The system automatically records Vpara and calculates FR and 1/X. The test stops when inversion is detected or when total liquid volume reaches 50 mL.

5. Calculation of Stability Parameters

Primary calculations performed automatically:

$$FR = Varom / (Varom + Vpara)$$
$$1/X = Moil / (Varom + Vpara)$$

From regression:

$$S = 1 + Xmin$$
$$Sa = 1 - FRmax$$
$$So = FRmax \times S$$

The FT-1 validates results using the ASTM requirement $R^2 \geq 0.98$.

6. Output Report

The generated report includes:

- Reference to ASTM D7157
- Sample identification
- Date of test
- S, Sa, So values (to nearest 0.01)
- R^2 goodness of fit
- Any deviation from specified procedures

7. Applications

The FT-1 is suitable for:

- Crude oil blending compatibility evaluation
- Residual fuel oil stability control
- Refinery process optimization
- Storage stability monitoring
- Heavy fuel oil certification

8. Advantages of FT-1

- Fully automated ASTM D7157 execution
- Simultaneous 3-cell measurement
- High repeatability and reproducibility
- Advanced optical detection
- Automatic regression validation
- User-friendly Vinci software interface

9. Conclusion

The FT-1 Atmospheric Flocculation Titrimeter provides a robust, automated, and fully standards-compliant solution for determining the intrinsic stability of asphaltene-containing oils. By strictly implementing ASTM D7157 methodology and reporting requirements, the FT-1 ensures reliable determination of S, Sa, and So parameters while reducing operational risk and improving refinery performance.