Asphaltene Stability Using TURBISCAN LAB following ASTM D7061

CONTEXT

The stability of **asphaltene**-containing crude oils is critical for refining, transportation, and storage. Instability can lead to flocculation and phase separation, resulting in operational issues such as fouling, sludge formation, and blending incompatibilities.

ASTM **D7061** is a widely used method to evaluate the stability reserve of heavy fuels and crude oils. It relies on asphaltene destabilization induced by the addition of *n*-heptane. The resulting flocculation and sedimentation are monitored through the evolution of optical transmittance profiles using **TURBISCAN**-based instruments (CLASSIC, HEAVY FUEL, or OIL SERIES). Results are expressed as the **Separability Number** (SN), which quantifies the tendency of a sample to phase separate over time.

Separability number	Oil Stability Reserve
High	Poor
Low	High

Based on the same measurement principle as ASTM D7061, **TURBISCAN LAB**, as a new-generation instrument, provides results correlated with Separability Number (SN) values while offering enhanced sensitivity to early destabilization phenomena within the standard **15-minute test** duration.

EXPERIMENTAL RESULTS

Five crude oils were analyzed. Sample preparation was performed following **ASTM D7061** protocol:

- ✓ Dilution of crude oil in toluene following ASTM D7061 recommendation
- ✓ Addition of n-heptane
- ✓ Rapid transfer of the mixture into the measurement cells: 7mL in TURBISCAN CLASSIC OIL SERIES and 25mL in the TURBISCAN LAB vials.
- ✓ Recording transmission and backscattering values all over the sample height every minute for 15 minutes in both instruments.

The figure below represents the transmission (top graph) and backscattering (bottom graph) variation as a function of the sample height for Crude oil 4. The first scan is shown in blue and the final scan in red, enabling visualization of the destabilization phenomena occurring over time.

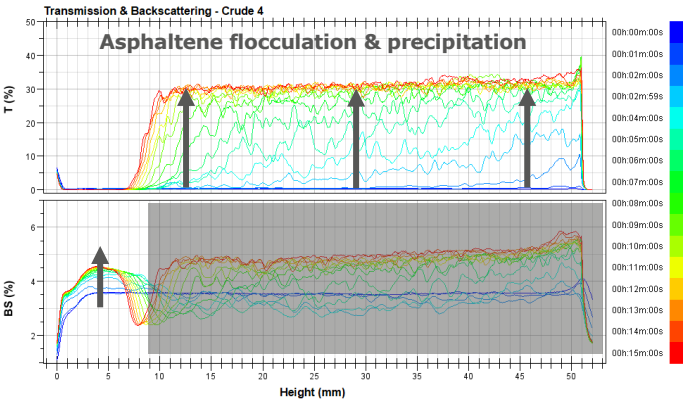

Figure 1: *Transmission (top) and backscattering (bottom) in function of sample height for crude 4*

From **Figure 1**, we observe an increase in transmission in the middle of the sample and an increase in backscattering at the bottom of the vials. These variations are the consequences of the asphaltene flocculation and precipitation.

Not only can the phenomena be detected, but the asphaltene destabilization can also be quantified. The evolution of the transmission signal in the middle of the sample and as a function of time can easily be computed from the software (**Figure 2**). The higher the transmission evolves, the more flocculation and precipitation of the asphaltenes.

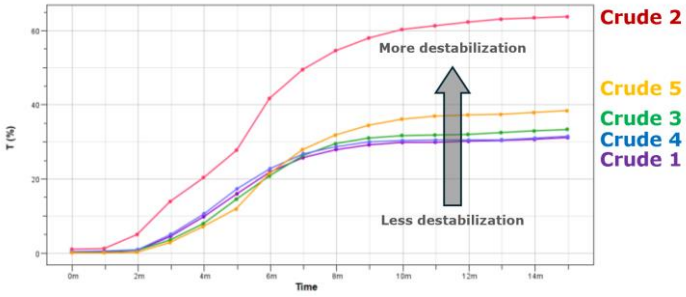

Figure 2*: Evolution of the transmission signal as a function of time in the 15-45mm*

From **Figure 2**, we can easily range the crude oil based on its asphaltene stability and follow the ASTM D7061 concepts. Crude 2 being the least stable, and crude 1 and 4 having the highest stability.

Comparison with the Separability Number (SN)

The asphaltene stability ranking obtained with the TURBISCAN LAB and following the ASTM D7061 procedure is comparable with the Separability number (SN) obtained with the TURBISCAN CLASSIC OIL SERIES.

Sample	%Transmission var after 15min	SN
Crude 1	31.1	14.0
Crude 4	31.3	14.3
Crude 3	33.3	14.7
Crude 5	38.3	14.9
Crude 2	63.6	17.7

Figure 3: *% of transmission variation after 15 minutes for the different crude oils obtained with TURBISCAN LAB compared with SN obtained with TURBISCAN CLASSIC OIL SERIES.*

The ranking of the samples based on **TURBISCAN LAB** measurements **is consistent** with the ASTM Separability Number classification.

TURBISCAN Range

CONCLUSION

TURBISCAN LAB successfully differentiates the stability of crude oil samples by monitoring **asphaltene flocculation and phase separation kinetics** following the ASTM D7061 protocol. A **good correlation** is observed between:

- the **Separability Number (SN)** obtained from ASTM D7061
- the **signal variation measured with TURBISCAN LAB**

Samples with low stability reserve (high SN) exhibit strong transmission changes, while stable samples (low SN) show minimal evolution.