Turbiscan **S**tability **S**cale
- The stability criteria and correlation to visual observation -

THE NEXT STEP FOR STABILITY COMPARISON:

The Turbiscan® Stability Index has been introduced for a fast, robust and objective quantifying of sample evolution over time in one single click. Ever since, the TSI is becoming more and more THE criteria used to compare sample stability evolution, extensively used in research and development, quality control and academic researches.

Questions that remain when using the TSI are: *How significant is the TSI value? Which value allows to consider the sample stable? How much different are the samples in terms of global physical stability?* …

From our deep experience with stability and particle size characterization (25+ years), and the knowledge of the static multiple light scattering (S-MLS) technology we can correlate the **TSI value** with a **visual observation** for better analysis of the TSI values and stepping towards the stability prediction.

WHAT IS THE TSI?

The Turbiscan® Stability Index is a dimensionless number that is a result of summing all occurring destabilization phenomena in the sample that can be measured by noticeable change of the backscattering or transmission signal intensity along the sample height (for more information about the calculation see the note TS_STAB_60). These signal variations are directly linked to any destabilization in the sample, thus the higher the TSI value, the lower the stability.

ORIGINS OF THE TSI SCALE?

While TSI provides fast, quick and robust number for sample comparison, questions remain about the intensity of the destabilization and correlation with visual observation.
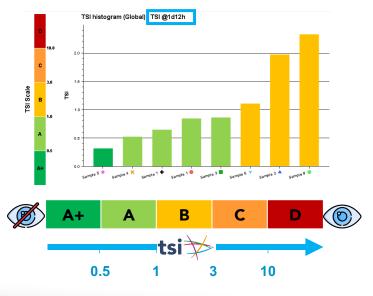
During our 25 years of experience in characterizing liquid dispersions and colloidal systems, at Formulaction we have gathered a significant amount of test results of stability measurements done with Turbiscan® that could be correlated with visual observation methods.

Our database contains thousands of sample examples of various types that our customers work with: from low to high concentrations, from nm to µm particle sizes, emulsions to particle suspensions… and covers most of the application fields: cosmetics, paint and coatings, food and beverages, including dairy products, pharmaceutical injectable formulations, oil and lubricant emulsions…

From this large database, a TSI scale has been set to correlate TSI number with destabilization intensity and correlated to visual observation

UNDERSTANDING THE TSI SCALE:

While the TSI is a dimensionless number, it is a function of time. However, the time of calculation is not to be disregarded when ranking samples. TSI values should be compared at the same aging time.

Once the TSI value, corresponding to a given state of destabilization, is calculated, the series of samples can be ranked and compared. The values are associated with a color that allows for a direct analysis and sample validation.

A+ *Visually Excellent*

No significant destabilization is observed with the Turbiscan® and the sample remains visually stable. A+ ranking is the best stability mark.

A *Visually Good*

Destabilization is detected but are at the very early stage (migration or size variation). In the A ranking, no visual destabilizations are observed at this stage.

B *Visual Pass*

The variations detected by the Turbiscan® are higher than "early" stage and correspond to the beginning of the destabilization, however, the destabilizations remain non visual in most cases (>90%).

C *Visual Warning*

Important stability destabilization corresponding to large sedimentation/ creaming, wide particle size variation, small phase separation... The destabilization may or may not be visible at this stage and the sample in the C ranking sample must be carefully monitored.

D: *Visual Fail*

Extreme and important variation and the destabilization most likely visible corresponding to large sedimentation or creaming, phase separation, wide change in the particle size or color…

ADJUSTING THE TSI SCALE:

Models: Turbiscan^{LAB}, Turbiscan^{TOWER} and Turbiscan^{AGS} are equipped with the latest software version which includes TSI scale that can be represented as a bar chart. The TSI scale color code is also displayed on the LCD screen of the Turbiscan^{TOWER}.

In addition, as the sample validation may vary from one sample type to another, it is possible to adjust border values of the scale in order to optimize the visual validation. For example, in oil field an emulsion may fail the stability requirements at TSI >10, while for a vaccine maximum acceptable TSI may not exceed 2,5. Thus, in these cases it is possible to adjust the values for more specific analysis. The TSI scale is based on the TSI Global

Disclaimer: It shall be noticed that the scale is not applicable for dispersion with particle absorbing light at the Turbiscan wavelength (black sample). Furthermore, this scale has been established based on thousands of analyses performed on wide range of samples. It provides general trend on sample behavior and shall not be used as absolute scale. Formulaction shall not be taken responsible for non-correlation of the scale to the sample behavior.

CONCLUSION

The Turbiscan® scale combines the Turbiscan® benefits (detection of early stage destabilization, non-disruptive measurement, **real** stability measurement) and Formulaction's 25-year experience in measuring stability. It correlates the TSI value with visual observation to allow even easier comparison with previous methods and helps defining stability criteria for stability comparison and stability prediction.

Turbiscan® is a unique tool providing full characterization of your formulation with an extremely wide range of applications:

ELECTRONICS   POLYMERS   RAW MATERIALS   PHARMACEUTICAL   HOME & PERSONAL CARE   FOOD & BEVERAGES   AGROCHEMICALS   PAINT & INKS