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Application Note | TURBIDI.T™

How to measure the solubility point of compounds in liquids with TURBIDI.T™?

SUMMARY

— Determining the solubility point of a compound is an essential step in many areas of science and many industries, for optimizing the performance, quality and purity of products.

— The solubility point of sodium bicarbonate in distilled water was successfully obtained using the TURBIDI.T™ instrument.

INTRODUCTION

The solubility point represents the maximum amount of a substance that can be dissolved in a given solvent under specific conditions, such as temperature and pressure. This information is crucial for predicting how a substance will behave in its final application, for designing chemical reactions, and for determining the optimal conditions for manufacturing drugs or other products at the desired quality and purity.

An example of how the solubility point is important in manufacturing is when compounds are produced through the crystallization process. Crystallization is a process of forming a solid material from a liquid or a gas phase by the formation of ordered arrangements of atoms, ions, or molecules in a crystal lattice structure. When this process is carried near to the solubility point, the resulting crystals are more uniform in size and morphology and have less defects or impurities. This process is used to produce a wide range of materials in various fields, including chemistry, materials science, pharmaceuticals, and the food industry. After the manufacturing process, measuring the solubility point of compounds in specific media is important to predict their performance in the final application, such as the dissolution of drugs in the body which affects their bioavailability.

Turbidity measurements are used to determine the solubility point of a compound by measuring the amount of light scattered by the solution at various concentrations. It has been suggested in literature that the solubility point is below the threshold value of 10 FTU (when formazin is used as reference standard) [1]. After this range, the light scattered comes mainly from the non solubilized particles of the sample. In order to demonstrate the use of the TURBIDI.T™ for the determination of solubility point, sodium bicarbonate was added in distilled water at different concentrations and their turbidity were measured in the instrument.

MATERIALS AND METHODS

The TURBIDI.T™ equipment measures the turbidity of solutions at various scales with the possibility of changing (1) the emitter cartridges to use different wavelengths, (2) sample holders to better fit with the experimental plan, (3) collect, customize, analyze and export

TIME MEASUREMENTS

TESTING CONFIGURATION

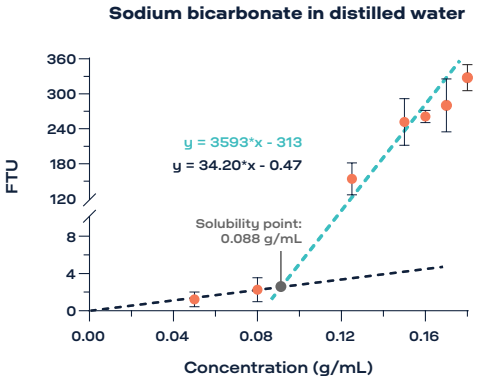

Figure 1. Turbidity (in FTU) of different concentrations of sodium bicarbonate in distilled water obtained with the TURBIDI.T™.

the generated data in the same operating software through a wireless tablet, and (4) upscaling this measurement platform by connecting multiple instruments.

The TURBIDI.T™ was previously calibrated with formazin standards (FTU). The cartridges used in this study for optical emission and reception were the Emitt.635 (wavelength of 635 nm) and Receiv.ViS (wavelength range of 400 nm to 1000 nm), respectively.

Sodium bicarbonate (SB) was dissolved in distilled water at 7 different concentrations. The solutions were stabilized at 25°C and 3 samples of each concentration were transferred in 10 mL vials for testing (n=3). Each vial was well mixed before introducing into the equipment for the measurement. Average results are expressed as mean ± standard deviation. Measurement points were divided in two groups according to the FTU value (lower and higher than 10 FTU). A simple linear regression was calculated within each group and the solubility point was considered to be their intersection.

RESULTS AND DISCUSSION

Figure 1 displays the turbidity (in FTU) of samples containing 7 different concentrations (from 0.5 to 0.18 g/mL) of sodium bicarbonate dissolved in distilled water (orange dots). The simple linear regression of each group of measurement points (lower and higher than 10 FTU) is also shown in the image. The solubility point of this compound obtained from the intersection of the two linear regression lines was found to be 0.088 g/mL, which is well correlated with the literature (approximately 0.090 g/mL, [2]).

CONCLUSIONS

The TURBIDI.T™ instrument was used to accurately determine the solubility point of sodium bicarbonate in distilled water with only 7 measurement points.

PERSPECTIVES

— The solubility point of compounds can be easily measured with the user-friendly TURBIDI.T™ instrument.

— The user can choose different wavelengths of light emission in the TURBIDI.T™ to better fit the type of compound.

— Turbidity data can be collected and stored into a tablet via the Soft Matter Analytics™ App and exported as needed to create the curve of turbidity versus compound concentration.

— TURBIDI.T™ allows the use of different vials that are of common use in laboratories for performing the measurements which can better fit into the experiments and avoid sample manipulation.

— Multiple TURBIDI.T™ units can be connected to the same operating tablet to create a scalable testing platform, allowing the measurement of more than a sample per time to accommodate the needs of R&D and QC.

REFERENCES

[1] COLE, T., Fortaner, S., Langezaal, I., & Coecke, S. (2023). Solubility Determination of Chemicals by Nephelometry.

[2] Greenstein, G. R. (2007). The Merck index: An encyclopedia of chemicals, drugs, and biologicals. Reference Reviews, 21(6), 40-40.