

Refractometry & Polarimetry

Glycerol Concentration – How to Speed up Quality Control?

Ms Norina Nolte, Anton Paar OptoTec

Glycerol is used as a raw material, in intermediates and in many final products, for example in the pharmaceutical, cosmetics, food and chemical industries. Precise measurement of the glycerol content is essential to ensure the quality of the end products.

Refractometric measurements prove quicker and more efficient than measurements using gas chromatography. A refractometer is an easy-to-use benchtop instrument which determines the refractive index, a parameter which is characteristic for every substance. According to the European Pharmacopoeia, the refractive index of anhydrous glycerol solutions has to be within the range from 1.470 to 1.475 nD at 20°C and 589 nm. To check the quality of glycerol solutions used as raw materials, for instance, a refractometer requires just a few drops of sample placed on the measuring prism. The built-in temperature control ensures measurement at the required temperature. Measuring results are available after 20 to 30 seconds.

The refractive index is a reliable quality parameter for pure glycerol and mixtures. To check the content of aqueous glycerol solutions, modern refractometers may use a glycerol method, as described below.

The 'Glycerol Method' used by Abbemat Refractometers to Determine Glycerol Content

To determine the content of aqueous glycerol solutions quickly and reliably, Abbemat refractometers from Anton Paar convert the refractive index into the corresponding glycerol content in %mas using a predefined method. This provides quick and reliable quality control of glycerol content in water. This predefined method is based on the correlation between the refractive index and the concentration of glycerol in g/100 g aqueous glycerol solution at 20°C (Figure 1).

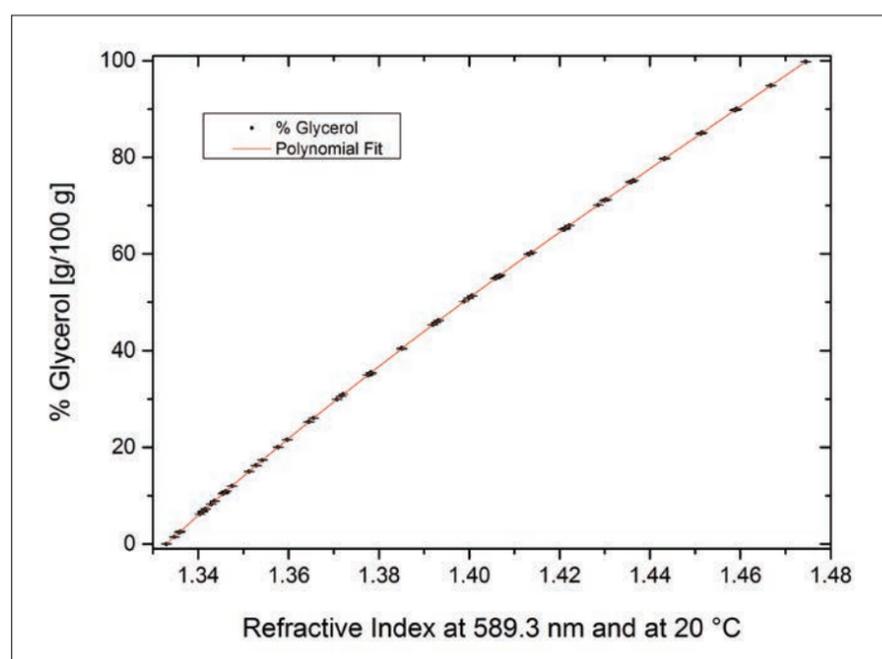


Figure 1. Correlation of refractive index (nD) and mass fraction (%mas, g/100 g) of aqueous glycerol solution in the range of 0.0 g/100 g to 99.8 g/100 g aqueous glycerol solution. The refractive index correlates with the concentration of glycerol with an accuracy of up to ± 0.017 g/100 g aqueous glycerol solution at 20°C when measured with the Abbemat refractometers from Anton Paar.

The method covers a measuring range from 0.0 g/100 g to 99.8 g/100 g aqueous glycerol solution and provides an accuracy of up to ± 0.017 g/100 g. The reproducibility and repeatability (up to 0.07 g/100 g) of this method has been thoroughly tested in Anton Paar's laboratories.

Table 1. Specifications of the glycerol scale for Abbemat refractometers supplied by Anton Paar.

Range	Accuracy	Reproducibility and repeatability
0.0 g/100 g to 99.8 g/100 g	up to ± 0.017 g/100 g	up to ± 0.07 g/100 g

Features and Compliance

Temperature is the most important external factor influencing refractive index measurements. To pave the way to reliable results, Anton Paar's Abbemat refractometers are equipped with a built-in temperature control which ensures a stable and precise temperature. In addition, Anton Paar has developed the Abbemat T-Check which precisely calibrates and adjusts the surface temperature of the prism of the Abbemat refractometer.

If many samples need to be measured regularly, the Abbemat refractometers of the Performance Plus line can automate sample filling and measurement of up to 96 samples with an Xsample 122 sample changer.

Abbemat refractometers comply with national and international standards. The instrument's software supports the requirements of the pharmaceutical industry, including 21 CFR Part 11, GMP, GAMP 5, USP<1058> and international pharmacopoeias (e.g. Ph. Eur., USP, JP). For users in the pharmaceutical industry, Anton Paar's Pharma Qualification Package ensures quick integration into the workflow within a short period of time.

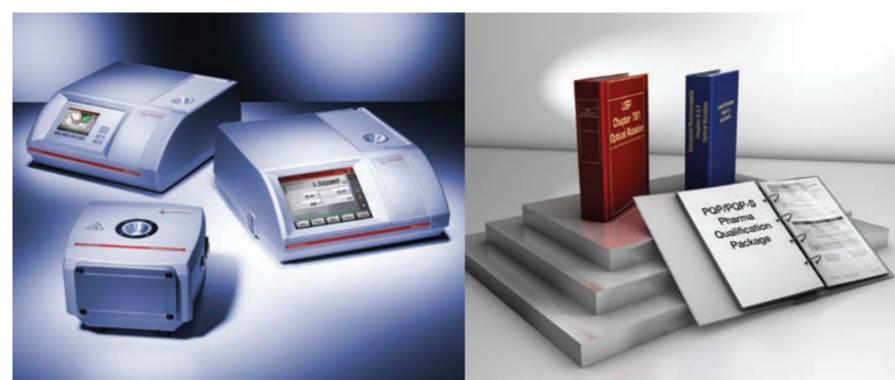


Figure 2. Anton Paar offers the Pharma Qualification Package for the refractometers of the Abbemat series to minimise the time it takes to integrate the new Abbemat into the workflow.

Main applications and refractometric approach for quality control of glycerol

- Pharmaceutical / medical industry: glycerol serves as a moisturiser, lubricant and to improve the smoothness of the products. It is, for instance, an ingredient in cough syrups, expectorants and mouthwashes.
- Cosmetics industry: in cosmetic products glycerol is applied as a humectant and to improve the smoothness of products. It is added to skin and body care products as well as toothpaste.
- Food industry: in food, glycerol is mostly used as a humectant, solvent, sweetener and to improve the smoothness of the products. In addition to that, it functions as a filler in low-fat products and as a thickening agent in liqueur.
- Chemical industry: glycerol is applied as an intermediate to produce nitroglycerin which is an ingredient in explosives (e.g. dynamite) or used in medicines for heart insufficiency.

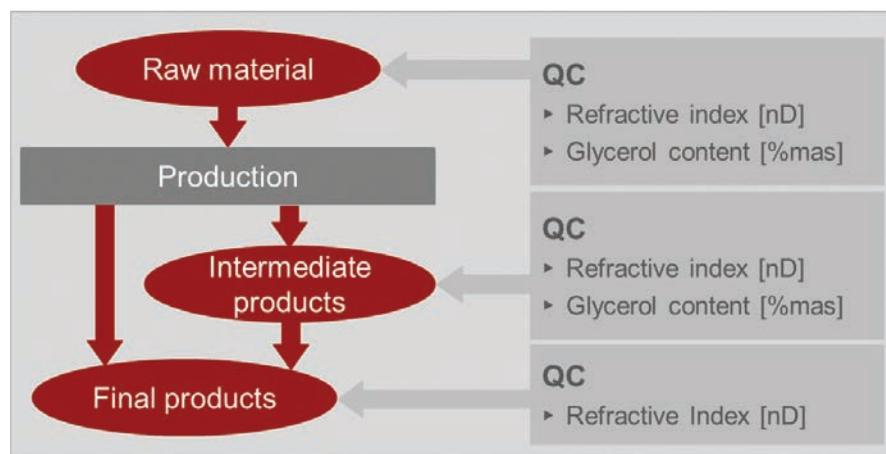


Figure 3. Anton Paar refractometers are used throughout the whole workflow from raw materials to final products.

Measuring Principle

The measuring principle of refractometers is based on a light reflection measurement at the boundary between prism and sample. The advantages derived from this measuring principle are that it is non-destructive and requires only a few drops of sample. The influence of air bubbles in the sample, which may disturb the measurement, is minimised. Another method for glycerol determinations is gas chromatography. However, this method requires well-trained personnel, is more expensive and the measuring process takes more time compared to refractometric determinations.



Figure 4. Anton Paar's Abbemat refractometers offer an easy, fast and precise determination of glycerol content.

Conclusion

The automatic Abbemat refractometers from Anton Paar are used throughout the glycerol workflow, from the quality control of raw materials and intermediates to checks on final products. They measure the refractive index as a quality parameter and have a predefined glycerol method which determines the glycerol content in g/100 g (%mas) with a high accuracy up to $\pm 0.017\%$ mas. The use of these refractometers brings clear economic benefits in terms of time-saving and ensures a high quality of product.



Read, Share and Comment on this Article, visit: www.labmate-online.com/articles