



Everything all right?

Optical or Acoustic Process measurement of liquids

- Oil on Water **ppm** **g/l** **FTU**
- UV- / VIS- / NIR- Photometry
- Ultrasonic Turbidimetry **AU** **%ots** **mg/l**
- Optical Turbidimetry **EBC** **m⁻¹** **...**

Principle of Absorption Measuring

What does Turbidity mean?

Turbidity is an optical impression, which describes the characteristic of a transparent product, to scatter and absorb light. A focused light beam will be attenuated and scattered in hazy products, so that this product can become practically opaque in bigger layers.

What Causes Turbidity?

Turbidity is caused by particles in transparent products. A particle is defined as something with a different refractive index as the carrier product. Some examples of particles are minerals, yeast cells, metals, oil drops in water, milk in water, gas bubbles and aerosols.

Measurement of Turbidity

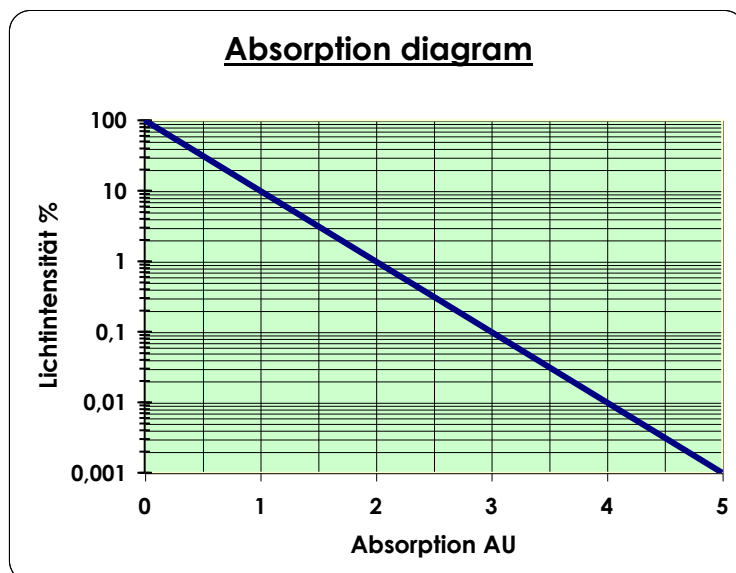
Turbidity is not a clearly defined magnitude like e.g. temperature or pressure. Turbidity is a subjective impression. For this reason turbidity measurement systems will be typically calibrated by using a comparison's standard such as Formazin or Diatomaceous Earth.

Principle of Absorbance Measurement

A light source and a detector are located parallel over against. The changing of light intensity, caused by the product between lamp and detector, will be detected and displayed as measuring result. The application is the measurement of concentrations (color or solids) in a liquid. The basic measurement unit of an absorption photometer is called AU (Absorption - Unit).

Definition of AU:

- 1 AU = 90 % loss of light intensity
- 2 AU = 99 % loss of light intensity
- 3 AU = 99,9 % loss of light intensity
- 4 AU = 99,99 % loss of light intensity
- 5 AU = 99,999 % loss of light intensity



Typical Turbidity Units

ppm: Parts per million	FNU ¹ : Formazin nephelometric unit
FTU: Formazin Turbidity Unit	mg/l: Milligram per liter
TEF: Trübungseinheiten Formazin (German for FTU)	gr/l: Gram per liter
EBC: European brewery convention	% TS: Percent total solids
NTU ¹ : Nephelometric turbidity unit	AU Absorption unit

The Dependencies of Different Measurement Units

$$1\text{FTU} = 1\text{TEF} = 1\text{NTU}^1 = 1\text{FNU}^1 = 0,25\text{EBC}$$

¹Nephelometry describes the method of side scatter turbidity measurement these units are used at 90° side scattered turbidimeter only.

Based on comparisons measurements, by using a 12° forward turbidity measurement system we have found the following dependencies.

$$1\text{FTU} = 1\text{TEF} = 0,25\text{EBC} = 2,05\text{ppm} = 2,05\text{mg/l} = 0,00205\text{g/l} = 0,0000205\% \text{TS}$$

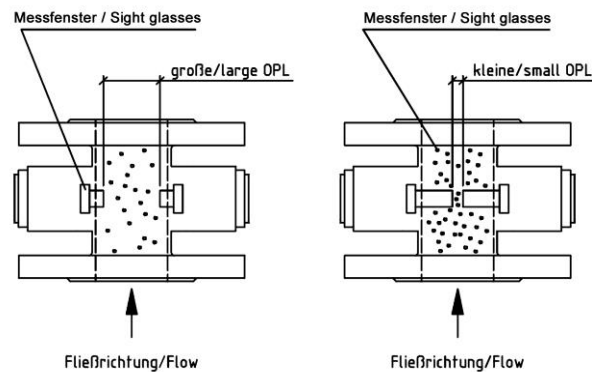
* At a specific particle weight of 1kg/dm, 1mg/l particles in 1kg of water will correspond to 1ppm.

Concentration Measurement

Mainly two parameters will affect the sensitivity of the measurement.

1. The initial intensity of the light source, which is a constant value of the respective sensor.
2. The optical path length (OPL) which is a variable magnitude of the sensor.

The sensor requires a large optical path length (OPL) to generate enough light attenuation at low colour concentration. The sensor requires a small optical path length (OPL), to ensure enough light intensity penetrates the product at high colour concentration.



Large OPL = Low concentrations / high sensitivity

Small OPL = High concentrations / low sensitivity

¹OPL [= optical path length] specifies the product slot between light source and detector

Typical Ranges (depending by product)

OPL	lowest range	highest range
3 mm	approx. 0 - 2g/l	approx. 0 - 100g/l (10%TS)
50 mm	approx. 0 - 200mg/l	approx. 0 - 6g/l

The OPL has to be specified according to the requirements of customer's application. The Sensor allows to specify optical path lengths between 1/10" (2mm) and 20" (500mm).

The absolute range of Chemtronic absorption sensors:

- 0 to 0.1 AU (lowest range)
- 0 to 4,5 AU (highest range).