



Fundamentals

In UV disinfection, germs in the water are inactivated by hard UVC rays. This process requires the UV radiation to arrive on the micro-organism with sufficient intensity. For this reason, it is essential to pay attention to the water's light permeability for the configuration of a UV system. The water's light permeability is determined as UV absorption at the wavelength 254 nm and is expressed as SAC, SATC or transmission.

The relationship between transmission and the spectral absorption coefficient (SAC) is shown in the table below, calculated from the formula:

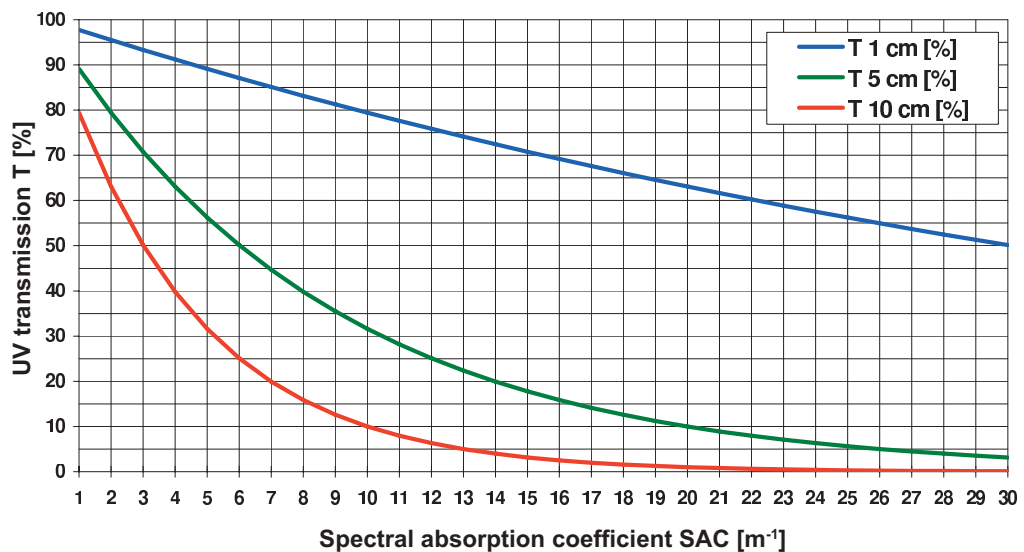
Formula

$$\text{SAC} = \frac{-\log\left(\frac{T [\%]}{100}\right)}{0.01} \quad \text{at 1 cm}$$

Conversion table

Spectral absorption coefficient	UV transmission		
	T 1 cm * [%]	T 5 cm * [%]	T 10 cm * [%]
SAC 254 nm [m ⁻¹]			
0.44	99.0	95.10	90.4
0.88	98.0	90.40	81.7
1.32	97.0	85.90	73.7
1.77	96.0	81.50	66.5
2.23	95.0	77.40	59.9
2.69	94.0	73.40	53.9
3.15	93.0	69.60	48.4
3.62	92.0	65.90	43.4
4.10	91.0	62.40	38.9
4.58	90.0	59.00	34.9
5.06	89.0	55.80	31.2
5.55	88.0	52.80	27.9
6.05	87.0	49.80	24.8
6.55	86.0	47.00	22.1
7.06	85.0	44.40	19.7
7.57	84.0	41.80	17.5
8.09	83.0	39.40	15.5
8.62	82.0	37.10	13.7
9.15	81.0	34.90	12.2
9.69	80.0	32.80	10.7
10.79	78.0	28.90	8.34
11.92	76.0	25.40	6.43
13.08	74.0	22.20	4.92
14.27	72.0	19.30	3.74
15.49	70.0	16.80	2.83
16.75	68.0	14.50	2.11
18.05	66.0	12.50	1.57
19.38	64.0	10.70	1.15
20.76	62.0	9.16	0.84
22.18	60.0	7.78	0.61
23.66	58.0	6.56	0.43
25.18	56.0	5.51	0.30
26.76	54.0	4.59	0.21
28.40	52.0	3.80	0.15
30.10	50.0	3.13	0.10

* Layer thickness or measuring cuvette

**Relationship between SAC and transmission**

Pure water has only very weak light absorption. However, the wavelength-dependent light absorption is greatly influenced by compounds dissolved in water. The amount of UV absorption therefore indirectly correlates with the water quality.

The light absorption and attenuation of the radiation is determined by an optical measurement and is expressed as a spectral attenuation coefficient SA_TC or spectral absorption coefficient SAC.

In the context of water treatment, the following measured values are relevant to the spectral absorption:

- SA_TC 254 nm: The SA_TC 254 nm is determined without prior filtration at the wavelength 254 nm. In the case of the SA_TC, impurities causing turbidity and particles are also recorded, resulting in a higher measured value.
- SAC 254 nm: The SAC 254 nm is determined in a filtered sample, and this value is relevant to UV disinfection. In water free of turbidities and treated, filtered water, the SAC is almost the same as the SA_TC.
- SAC 436 nm: This value is known as colouration. For drinking water, the colour should be < 0.5 m^{-1} .

UV transmission The UV transmission is expressed as a percentage as a measure of the spectral transmission factor for a particular layer thickness (table on previous page). The layer thickness or the size of the measuring cuvette (10 mm, 50mm or 100 mm) must be stated with the transmission factor, and the value is determined with a suitable photometer.

Summary Water free of turbidities and a low microbial load are the requirements for effective UV disinfection. UV treatment is only effective during the radiation time and does not have an enduring effect in the water system. Only tested and certified systems with a minimum dose of 400 J/m^2 may be used for disinfection in the context of drinking water treatment. If several systems are operated in parallel, the flow must be measured and regulated so that it is possible to guarantee that there is no shortening of the time required for the inactivation of germs inside the irradiation chamber.