

## Measurement of photocatalytic activity

Product no. 328, Airfresh wallpaint, of AURO Pflanzenchemie AG

Degradation of methylene blue according to DIN 52980

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This document shows the measurement of the photocatalytic activity of surfaces of AURO Pflanzenchemie AG by means of the degradation of methylene blue (MB) in an aqueous solution under artificial light, characterising photocatalytically active surfaces with regard to their ability to degrade dissolved organic molecules under irradiation by UV light.

### Abstract

Methylene blue is brought into contact with the photocatalytic active surface of a test sample that is irradiated through the supernatant solution ( $320 \text{ nm} < \lambda < 400 \text{ nm}$ ). The solution is decolourated in the process. Throughout the measurement, the colour concentration of the solution is measured by UV-vis spectroscopy. For the determination of the photocatalytic activity, the adsorption is measured. The same surface, without UV irradiation, serves as reference. The degradation rate of the test sample surface is determined by these measurements.

### Preparation of the measurement

The conditioning solutions of the affixed test cylinders are substituted by the test solution at a time  $t_0$ . The layer of supernatant MB test solution over the photocatalytically active surface has to be in the range of 20 to 50 mm. The volume of the test solution has to be at least 10 times as much as the volume of the measuring solution needed for the measurement in the photometer. The volume of the test solution has to be exactly determined.

REMARK: Typically the test solution in affixed test cylinders has a volume of 10 ml on a surface  $A=30 \text{ cm}^2$ .

### Realisation of the measurement

The test cylinders are covered with a glass pane. The irradiation of the test sample starts when the absorbency-time-curve of the test solution is approaching a linear progression. The lamp has to provide an irradiance of  $E=10 \pm 0,5 \text{ W/m}^2$ .

During the test phase, the MB test solution has to be homogenised every 20 minutes by stirring. This can be performed by means of a glass stick, a magnetic stirrer or by compressed air. The testing temperature of the test solution must be at  $23 \pm 2^\circ\text{C}$  and has to be entered in the minutes.

The measurement is carried out at a wavelength of  $\lambda = 664 \pm 5 \text{ nm}$  (see illustration 1 B). During the irradiation, the absorbency is determined by measurement of the test solution taken.

The measurement of the absorbency has to be carried out in short intervals of  $< 20 \text{ min}$ . The measurements are carried out over a period of 3 hours but at most until the discolouration of the solution.

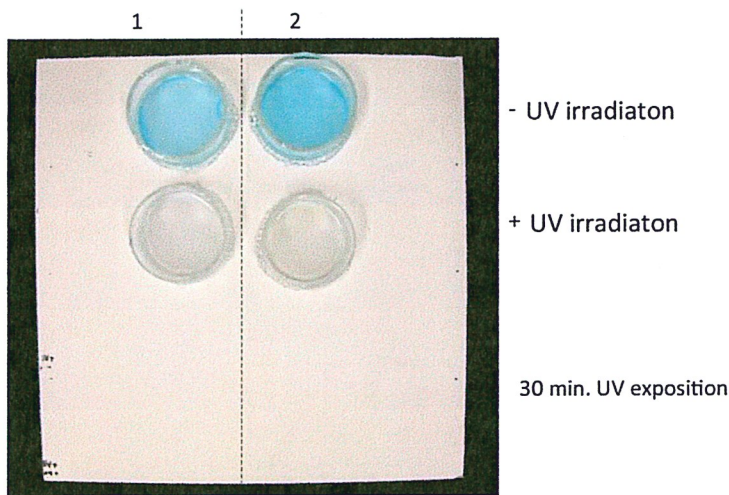
Analogous to this procedure, a curve without irradiation has to be prepared under otherwise same conditions.

### Evaluation

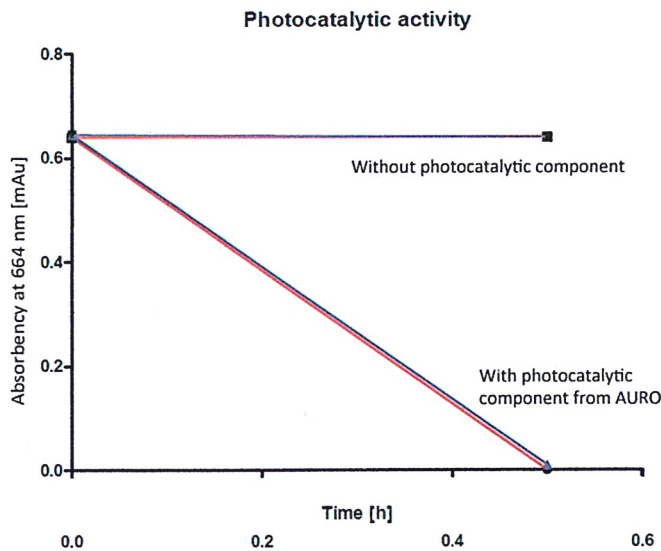
The evaluation refers to the test volume  $V=0,01 \text{ l}$ , an area  $A=28,75 \text{ cm}^2$ , an irradiation wavelength  $\lambda = 365 \text{ nm}$  and a measuring length  $d=10 \text{ mm}$  at  $23^\circ\text{C}$ . The result is presented as a

representative image of the photocatalytic surfaces with the respective test cylinders containing methylene blue (MB). For a quantitative presentation, the absorbency is shown over time. Already after 30 minutes of UV exposure, the MB was completely discoloured by photocatalysis (see illustration 1 A). This result is valid for the concentration of the photocatalytic raw material used by AURO. The quantitative evidence also shows a surface with a strong photocatalytic activity (see illustration 1 B).

**Illustration 1 A:**



**Illustration 1 B:**



**Photocatalytic activity of a coating system of AURO AG.**

The photocatalytic activity was determined by degradation of methylene blue (MB).

**A.** Qualitative evidence of the photocatalytic activity of the surface coated with a photocatalytic product of AURO AG:

**B.** Quantitative evidence of the photocatalytic activity by means of absorption measurement at  $\lambda=664\text{nm}$  (+ =30 min UV treatment / - = no UV treatment).

**The product of AURO Pflanzenchemie AG shows an excellent photocatalytic activity according to DIN 52980 and is able to completely break down pollutants within a short period of time.**

Annex

Measuring equipment



Evaluation of the measurement according to DIN 52980 by the University of Osnabrück.

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Osnabrück, March 7, 2017