

# Hydroquinone in Cosmetics

## Introduction

Hydroquinone is an organic compound of the phenol family used as a skin-bleaching agent to lighten the area of darkened skin. Therefore, it is widely used in cosmetics [1]. In 1982, FDA proposed the presence of 1.5 – 2.0% of hydroquinone in drugs as a GRASE (Generally Recognize as a Safe and Effective) [2]. Later in 2006, this rule has been withdrawn because evidences indicate hydroquinone as carcinogen and possible cause of ochronosis (skin darkening and disfiguration) [1].

In this application, the content of hydroquinone in cosmetic products is determined by UV/VIS spectroscopy at 289 nm using a METTLER TOLEDO UV/VIS Excellence Spectrophotometer.

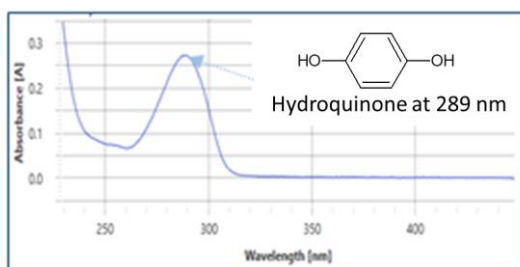


Fig. 1: Spectrum showing the absorption peak of hydroquinone in the UV region at 289 nm.

## Material & Method

### Instruments and Accessories

- UV7/UV5/UV5Bio/UV5Nano Spectrophotometer (UV7 - 30254726)
- XP 205 Analytical balance (11106027)
- CuvetteChanger (30236313)
- 25, 50, 100 and 1000 mL volumetric flasks
- Rainin pipette and tips L-1000 (27060058), L-5000 (27060059) and L-10ML (27060051)
- Water bath
- Heating mantle, 1000 mL

### Samples and reagents

- Body lotion
- Shower gel

- Petroleum jelly
- Lip guard
- Hydroquinone, 99.5 %
- Sulfuric acid, 98 %

### Reagent preparation

#### 0.05 M sulfuric acid

Pipette out 2.72 mL of 98 % sulfuric acid in a 1000 mL volumetric flask already filled with 500 mL deionized water. Mix well and dilute up to the mark with deionized water.

#### Hydroquinone standard stock solution (100 mg/L)

Weigh 10 mg of hydroquinone in a 100 mL volumetric flask. Dissolve it by adding 0.05 M sulfuric acid. Make up the volume to 100 mL with 0.05 M sulfuric acid.

#### Standards for calibration curve

Prepare the hydroquinone standard solutions for the calibration curve according to the following table using a 50 mL volumetric flask for each standard. Fill up to the mark with 0.05 M sulfuric acid.

Final conc. of hydroquinone (mg/L)	Pipette hydroquinone standard stock solution (mL)
2	1
4	2
6	3
8	4
10	5
12	6

## Measurement

### Preparation of samples

- Weigh a sample containing about 10 mg of hydroquinone in a beaker. Dissolve it with 20 mL 0.05 M sulfuric acid.
- Transfer the solution in 25 mL volumetric flask. Fill up to the mark of 25 mL with 0.05 M sulfuric acid. Filter it through Whatman filter paper no. 41.

- The sample weight and the preparation procedure vary according to the physical properties of sample. Below mentioned step is an example for lip-guard (specific) sample. Table 1 detailed the weight and heating condition for the sample measured in this application.

- Lip guard –  
Weigh about 200 mg of sample in a beaker. Add 20 mL 0.05 M sulfuric acid. Warm the solution until the sample melts (about 3 minutes) using the heating mantle set at 60 °C (i.e. above the melting point of sample). Transfer the dissolved sample solution to a 25 mL volumetric flask. Cool it to room temperature. Fill up to the mark with 0.05 M sulfuric acid. Filter it through Whatman filter paper no. 41.

Sample	Sample weight (mg)	Heating (°C)
Shower Gel	1000.0	NA
Body Lotion	110.9	NA
Petroleum Jelly	1018.4	70
Lip-Guard	191.2	60

Table 1: Sample weight and heating condition

#### Procedure

- Determine the blank value using 0.05 M sulfuric acid, the standard solutions and the samples using a Quant method
- In case of foaming samples like shower gel, fill the cuvette slowly from sidewall to avoid bubble formation.

#### Measurement parameters

Method	Quant
Wavelength	289 nm [3]
Standards	2, 4, 6, 8, 10, 12
Unit	mg/L
Calculation	Sample Conc.*Dilution Volume/Sample Weight
Unit	mg/g

#### Results

The calibration curve in figure 2 is obtained using the absorbance values of six hydroquinone standards with concentrations ranging from 2 to

12 mg/L. The results show a good coefficient of determination  $R^2 = 0.99916$ .

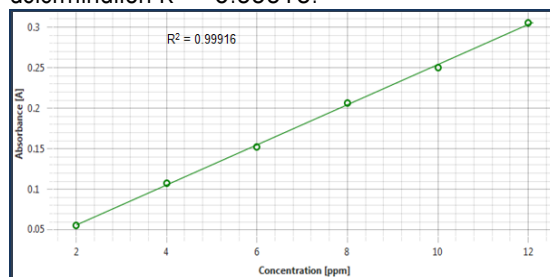


Fig.2: Calibration curve of hydroquinone standards

The concentration of hydroquinone in the sample is determined in six replicates. Results are reported in mg/L for the hydroquinone concentration of sample measured in cuvette and converted to mg/g for the labelled hydroquinone content in cosmetic product. The measured concentration showed a relative standard deviation of not more than 2.00 % for different samples analyzed. The results are shown in the table below.

Sample	Mean Conc. mg/L	SD mg/L	srel (%)	Content mg/g
Shower gel	14.58	0.03	0.19	0.01
Body lotion	11.27	0.04	0.33	2.54
Petroleum jelly	5.52	0.09	1.65	0.14
Lip guard	5.75	0.08	1.47	0.75

#### References

- [1] UV-VIS Analysis & Determination of Hydroquinone in Cosmetics, Baraton Interdisciplinary Research Journal (2013) 3(1), 23-28 – ISSN 2079-4711  
<http://ueab.ac.ke/BIRJ/wp-content/uploads/2017/09/Terer-23-28.pdf>
- [2] FDA – Hydroquinone Studies Under The NTP,  
<https://www.govinfo.gov/content/pkg/FR-2006-08-29/pdf/E6-14263.pdf>
- [3] Quantitative Determination of Arbutin & Hydroquinone by HPLC, Not Bot Horti Agrobo 2012, 40(2):109-113.  
<http://www.google.com/url?sa=f&rcf=j&q=&esrc=s&frm=1&source=web&cd=2&ved=0ahUKFwiDkqCakJXAhUGKyYKHbocDP4QFgg4MAE&url=http%3A%2F%2Fnotulaeobotanicae.ro%2Findex.php%2Fnbha%2Farticle%2Fdownload%2F7987%2F7034&usq=AQvVawO4lwzy1fka4mlA6LGycxKy>

#### Further information

[www.mt.com/uv-vis](http://www.mt.com/uv-vis)