

## Accepted Manuscript

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PII: S2405-8300(18)30005-3  
DOI: [10.1016/j.cdc.2018.05.002](https://doi.org/10.1016/j.cdc.2018.05.002)  
Reference: CDC 112



To appear in: *Chemical Data Collections*

Received date: 7 January 2018  
Revised date: 28 April 2018  
Accepted date: 17 May 2018

Please cite this article as: Talaat Y. Mohamed , Mostafa Y. Nassar , Alaa S. Amin , Mahmoud M. Elnadi , Spectrophotometric determination of butylated hydroxyanisole in pure form and cream formulation via an oxidation-reduction reaction, *Chemical Data Collections* (2018), doi: [10.1016/j.cdc.2018.05.002](https://doi.org/10.1016/j.cdc.2018.05.002)

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Spectrophotometric determination of butylated hydroxyanisole in pure form and cream formulation via an oxidation-reduction reaction

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### Abstract

Three simple, rapid, and reproducible spectrophotometric methods have been developed for the quantitative determination of butylated hydroxyanisole (BHA) in pure form and cream products. These methods are based on the oxidation of the BHA in acidic medium then a known concentration of a dye was added and the unreacted oxidant was estimated using UV-Vis spectrophotometer. Method (1) is based on the oxidation of the BHA by potassium permanganate ( $1 \times 10^{-3}$  M  $\text{KMnO}_4$ , 0.6 mL) in the presence of sulfuric acid (2M  $\text{H}_2\text{SO}_4$ , 0.4 mL). Then a certain amount of methylene blue (MB,  $1 \times 10^{-3}$  M, 0.4 mL) dye was added to the previous mixture after oxidation to reduce the unreacted oxidant. While in method (2), the oxidation of the BHA is made by cerium ammonium sulfate (CAS,  $0.75 \text{ mg mL}^{-1}$ , 1.5 mL) in the presence of sulfuric acid (2M  $\text{H}_2\text{SO}_4$ , 0.5 mL) and adding certain amount of amaranth dye (AM,  $1 \times 10^{-3}$  M, 0.7 mL) after oxidation to reduce the unreacted oxidant. On the other hand, n-bromosuccinimide (NBS,  $5.62 \times 10^{-4}$  M, 0.8 mL) is used in method (3) for oxidation of BHA in the presence of hydrochloric acid (1.0 M  $\text{HCl}$ , 0.8 mL) and methyl orange dye (MO,  $1 \times 10^{-3}$  M, 0.8 mL) is added after oxidation process to reduce the unreacted oxidant. For the three methods the sequence of addition of the reagents was crucial and it was BHA-acid-oxidant-dye. Potassium bromide (1%, 0.6 mL) has a significant influence on the method (3) but for the others it has not. Beer's law was obeyed in the concentration range of 2.0-40, 5.0-110, 4.0-60  $\mu\text{g mL}^{-1}$  for method (1), (2), and (3), respectively. The molar absorptivity values were found to be  $4.371 \times 10^3$ ,  $1.616 \times 10^3$  and  $1.434 \times 10^3 \text{ L mol}^{-1} \text{ cm}^{-1}$  for methods (1), (2), and (3), respectively. The proposed methods were applied for the determination of BHA in pure form and cream samples

**Keywords:** Butylated hydroxyanisole, Spectrophotometry, Redox reaction, dye

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