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Determination of Vitamin C in Foods Using the Iodine-Turbidimetric Method Combined with an Infrared Camera

Yi Miao [1], Yuanyang Zhu [1], Wenzhu Zhao [1], Changshuai Jiao [1], Hongwei Mo [1], Xincheng Zhang [1], Sheng Liu [1,*] and Hongwen Gao [2]

[1] College of Computer Science and Technology, Huaibei Normal University, Huaibei, 235000, China; MiaoYi321@outlook.com (Y.M.); 15556116568@139.com (Y.Z.); 15212626136@139.com (W.Z.); jiaocs@139.com (C.J.); mz324@139.com (H.M.); tediouscat@126.com (X.Z.)

[2] College of Environmental Science and Engineering, Tongji University, Shanghai 200092, China; hwgao@tongji.edu.cn

* Correspondence: liurise@139.com or Liusheng@chnu.edu.cn; Tel.: +86-183-6523-9378

Received: 2 March 2020; Accepted: 8 April 2020; Published: 12 April 2020

Abstract: A novel method was proposed for the determination of vitamin C (VC) using an infrared camera combined with the iodine-turbidimetric method. Based on the redox between VC and iodine, the residual iodine was measured using the turbidimetric method with an infrared camera to obtain VC content. The light emitted by the infrared light-emitting diode (LED) was absorbed and scattered when it penetrated the residual iodine suspension. The transmitted light was captured by the infrared camera to form a digital image and the responding color components and grayscale values were obtained. The obtained color components and log-grayscale were fitted to the VC concentration, and the fitted relation expressions were used to measure the unknown VC solution. A VC measuring device equipped with an infrared camera and processing software was designed to obtain the color components corresponding to the images of the iodine suspensions. Compared with the spectrophotometry, the method based on the color component of brightness had a higher accuracy for measuring the VC standard solution. For VC measurements in tomatoes, nectarines, and VC tablets, our proposed method was highly consistent with spectrophotometry. Therefore, this method could potentially be implemented in the determination of VC in fruits and tablets, or other foods.

Keywords: food analysis; analytical method; vitamin C; iodine suspension; infrared camera; image processing

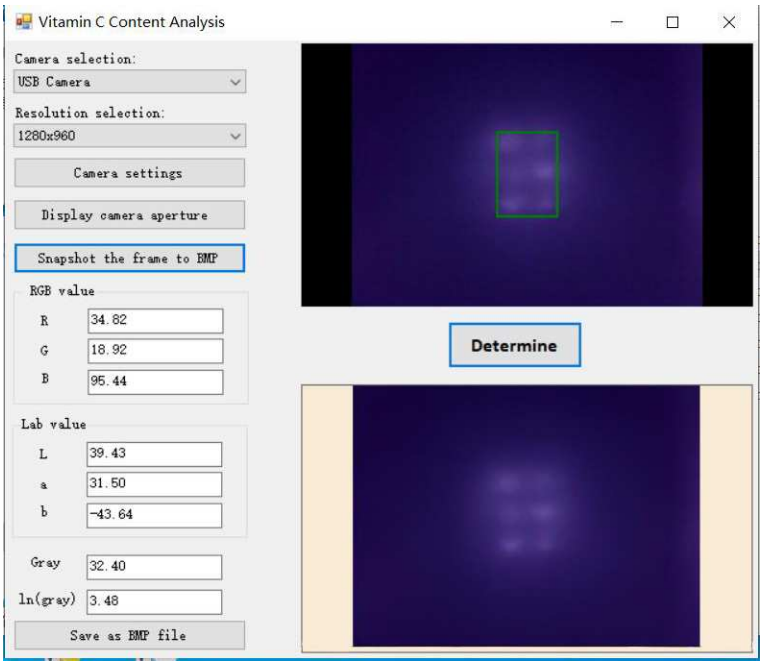
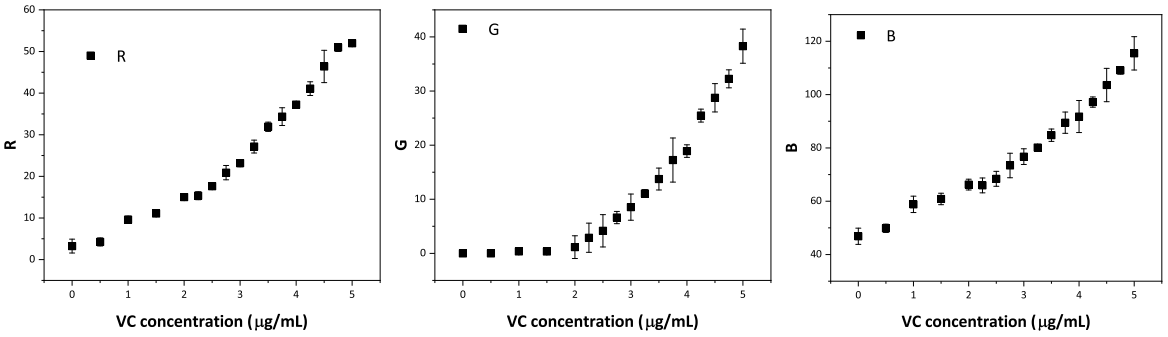
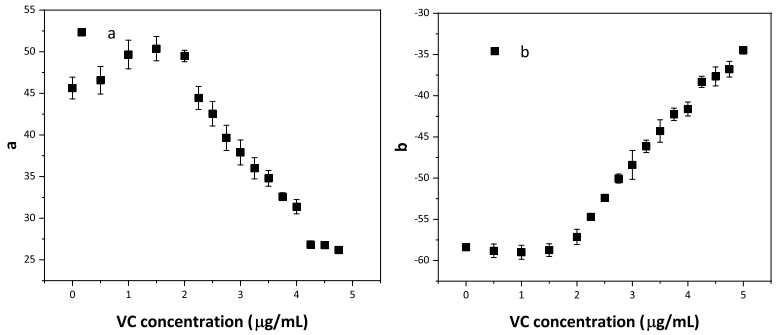


Figure S1. The software interface that can obtain the image taken by the infrared camera, the set camera parameters, to compute grayscale and log-grayscale, and convert RGB to Lab. The region of interest (ROI) covers 3500 pixels, which includes the imaging area of the six LEDs in the center of the frame image.



(a) (b) (c)

Figure S2. (a) The relationship between the R value and VC concentrations. (b) The relationship between the G value and VC concentrations. (c) The relationship between the B value and VC concentrations.



(a) (b)

Figure S3. (a) The relationship between the a value and VC concentrations. (b) The relationship between the b value and VC concentrations.

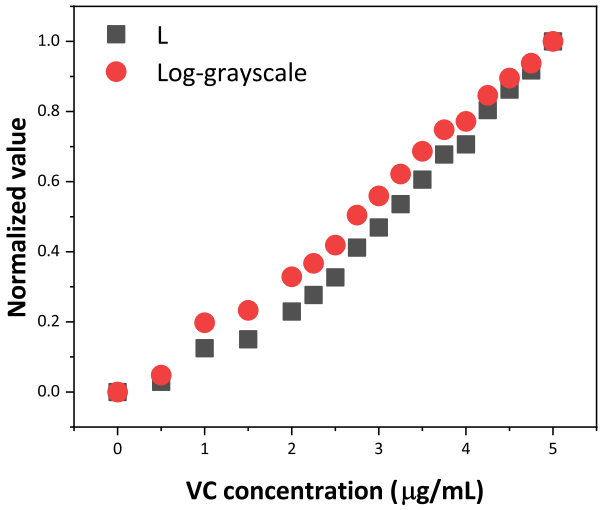


Figure S4. The comparison between L and log-grayscale with the VC concentrations.