

Original Paper ~~~~~

Evaluation of the Impact of Oxygen and Carbon Dioxide Atmospheres on Respiration Rate Measurement of Cherry Tomato

Hiroaki KITAZAWA^{1,*}, Yuki SATO-TAKABE¹, and Asako YAMADA¹

Understanding the original respiration properties of each fresh produce is necessary to appropriately design controlled atmosphere storage and modified atmosphere packaging. The oxygen (O₂) and/or carbon dioxide (CO₂) concentrations of produce in gas-tight containers are often measured to achieve this. However, the measured respiration rate might be underestimated when the time at the start of measurement and/or the volume of the headspace of gas-tight containers are inappropriate; the condition of lower O₂ and/or higher CO₂ concentrations decreases the respiration rate. In this study, we investigated the effects of manipulated O₂ and CO₂ concentrations on the measured respiration rates of cherry tomato (*Solanum lycopersicum*) stored at 25 °C, using two experiments examining the differences obtained with the closing time and volume of a gas-tight cylinder. The results demonstrated that the measured respiration rate of cherry tomatoes was underestimated by both lower O₂ and higher CO₂ atmospheres in gas-tight containers. These results help initiate a discussion regarding the appropriate enclosure time, volume of gas-tight containers, and/or samples used to measure fresh produce respiration rates in gas-tight containers.

Keywords: accuracy, controlled atmosphere storage, fresh produce, gas-tight container, modified atmosphere packaging

1. Introduction

The respiration of fresh produce continues during the post-harvest process with the consumption of respiratory substrates, such as sugars and organic acids^{1),2)}. Therefore, desirable commercial qualities are often lost, and continuing respiration may increase food loss. Controlling post-harvest respiration in fresh produce is thus essential. To this end, many technologies related to the reduction of respiration in fresh produce during storage and distribution have been developed, including controlled atmosphere (CA) storage³⁾ and modified atmosphere packaging (MAP)⁴⁾. For these technologies, lower oxygen (O₂) and/or higher carbon dioxide (CO₂) around the produce play an important role in the reducing respiration^{5), 6)}, along with temperature control. For the appropriate design of the CA and MAP, determining the original respiratory properties of each fresh produce is

¹Department of Food and Nutrition, Faculty of Human Sciences and Design, Japan Women's University, 2-8-1, Mejirodai, Bunkyo-ku, Tokyo 112-8681, Japan

*Corresponding author: Hiroaki Kitazawa. Tel./Fax. +81-3-5981-3431, E-mail: kitazawah@fc.jwu.ac.jp
The authors declare no conflict of interest.

109, p. 73 (2015)

- 18) A. Eshima, N. Sugino, T. Watanabe, H. Kitazawa, Comparative analysis of the effects of storage temperature and oxygen concentration on radish (*Raphanus sativus* var. *sativus*) quality, J. Pack. Sci. Tech., **31**(1), p. 33 (2022)

(Received: 13 July 2023)

(Accepted: 1 September 2023)

ミニトマトの呼吸測定における 酸素および二酸化炭素雰囲気の影響評価

北澤 裕明^{1,*}、高部（佐藤）由季¹、山田 麻子¹

青果物の呼吸特性を把握するために、しばしば密閉容器を用いた呼吸速度の測定が行われる。しかし、青果物の呼吸速度は低酸素および高二酸化炭素環境では低下することから、密閉容器を用いた測定において容器の密閉時間や空隙の体積が不適切な場合には、そのような雰囲気が生じ、呼吸速度を過小評価してしまう可能性が考えられた。そこで本研究では、酸素と二酸化炭素濃度の違いが25℃で貯蔵したミニトマトの呼吸速度の測定値に及ぼす影響を、容器の密閉時間と空隙の体積の違いに関する2つの実験により検証した。その結果、ミニトマトの呼吸速度は密閉容器内が低酸素および高二酸化炭素環境となった場合に、本来よりも低く見積もられる可能性が見出された。それらの結果は、密閉容器を用いた青果物の呼吸速度の測定における、最適な密閉時間および容器の体積またはサンプル重量の検証といった新たな議論の発端となる。

キーワード：精度、CA貯蔵、青果物、気密性容器、MA包装