Popular Scientific Summary

Vegetables and fruits hold a vast amount of air within their structure. Vacuum impregnation is a process used to remove the air from plant tissues and replace it with an external solution. For impregnation, vacuum is applied to the plant tissue helping air to escape through the plant´s pores. Then by restoring the atmospheric pressure, the solution surrounding the plant will penetrate the plant tissue replacing the air.

Some applications of vacuum impregnation are: increasing the nutritional value, antioxidants, antimicrobial, preserving color change, enhancing texture, and even as a pre-treatment before other processing techniques such as drying or freezing.

Some of these impregnated substances may well affect both the respiration and color of fruits and vegetables resulting in improved certain quality characteristics during the storing period. Moreover, some of the impregnated substances might affect the metabolism of the plant tissues, which might increase or decrease the metabolic activity of the plant tissue.

Indeed, the results of the metabolism of plant tissue treated with impregnation are still not well understood. All what we know is that increasing the metabolic activity of the plant tissue is negative to products ‘quality during the storage period.

All plant activities such as the metabolism, respiration, and so forth produce heat. Isothermal calorimetry can measure the heat production of a particular process, which might give an explanation of the metabolism of the plant tissue and how the impregnated substance might affect it.

In this study, vacuum impregnation was used to investigate the influence of different substances such as sucrose, calcium lactate, ascorbic acid and gamma-aminobutyric acid on the quality of the packed baby spinach during the storage period. To begin with, we prepared two types of samples of packed spinach leaves. The first samples were packed and untreated. The second ones were packed and treated with one of the mentioned four substances by using vacuum impregnation. Then both packed treated and non-treated samples were stored at two different conditions 21 °C, and 7.5 °C. All samples were stored for eight days. Then the influence of impregnated substances on the quality of the packed leaves were evaluated by

measuring weight gained after treatment, color changes during the storage period, and gaseous composition in the spinach bags.

The influence of gamma-aminobutyric acid impregnated into baby spinach leaves was studied further for 22 days at a storage temperature of 7.5 °C, to find out its effect on the shelf life of the spinach leaves.

Heat production of the leaves impregnated with gamma-aminobutyric acid was measured during the first 14 hours of the storage period, using Isothermal calorimetry at 7.5°C. The aim of this measurement was to get a better view of the changes that might occur on the metabolic activity of the spinach leaves after the impregnation.

Results showed that respiration of baby spinach leaves increased after vacuum impregnation, and this increase depended on both the different solutions and storage temperature. Sucrose treated samples displayed the most changes in the gas composition of the spinach bags along with the storage period at both temperatures. Also, ascorbic acid treated samples led to the faster deterioration of packed spinach leaves in comparison to the other substances used. On the other hand, gamma-aminobutyric acid treated samples extended the shelf life of the packed baby spinach leaves stored at 7.5°C. These baby spinach leaves kept fresh for 22 days, unlike the non-treated samples which expired after only ten days. Concerning the metabolic activity, gamma-aminobutyric acid treated samples reduced the respiration which resulted in less heat production from the leaves over 14 hours of storage. Furthermore, packed leaves showed less heat production compared to unpacked leaves in both treated and untreated leaves.