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UV-VISIBLE SPECTROPHOTOMETRIC EVALUATION OF CARBOHYDRATE & ASCORBIC ACID LEVELS IN IRRADIATED KIWI FRUIT OF UTTARAKHAND REGION

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ABSTRACT

UV-Visible Spectrophotometeric study was done for the evaluation of carbohydrates and ascorbic acid levels present in the kiwi fruit exposed to gamma radiations of 1-3 kGy. The sample extract of unirradiated and irradiated kiwi fruit were subjected by using anthrone as reagent for the quantitative estimation of the carbohydrate. These samples absorbance was read in UV-Visible spectrophotometer at the wavelength of 750nm. For ascorbic acid investigation both the unirradiated and irradiated samples of kiwi fruit were subjected to sulphuric acid and acetic acid treatment for UV-Visible spectrophotometric analysis. Irradiation of kiwifruit up to 3 kGy had negative effects onVitamin C (Ascorbic Acid) content. Carbohydrate level initially showed an increase upto 1 week of storage but significantly decreases thereafter till 3 weeks of storage.

Keywords: Ionizing Gamma Radiation, UV-Visible spectrophotometer, absorbance, ascorbic acid, carbohydrate.

INTRODUCTION

Vitamin C is an important vitamin for the human health .Ascorbic acid is reversibly oxidized to form L-dehydroascorbic acid (DHA) which also exhibits biological activity. Dehydroascorbic acid has been converted into acetic acid in the human body. For

determining the activity of Vitamin C, its important to determine both the acetic acid and Dehydro ascorbic acid in fruits and vegetables. Vitamin C is the real water-soluble antioxidant within the body. It lowers blood pressure and cholesterol levels . Recently many articles have shown that the Vitamin C reduces the risk of developing cancers of breast, colon, rectum, lung, mouth. Vitamin C is generally non- Toxic. It is very important for formation of bone and tissue repair.

Carbohydrates act as the primary source of energy which is converted into glucose to generate energy essential for metabolism in every cell of the body. Carbohydrates perform numerous roles in living things. Polysaccharides serve for the storage of energy (e.g., starch and glycogen), and as structural components (e.g., cellulose in plants and chitin in arthropods). The 5- carbon monosaccharide ribose is an important component of coenzymes (e.g., ATP, FAD, and NAD) and the backbone of the genetic molecule known as RNA. The related deoxyribose is a component of DNA. Saccharides and their derivatives include many other important biomolecules that play key roles in the immune system, fertilization, preventing pathogenesis, blood clotting and development.

Though there is no absolute requirement of carbohydrates, they are essential to ensure that energy is available to the body to perform its normal functions.To maintain a good and sound health and the prevention of cold, the human must remain saturated with Vitamin C. Keeping in view their importance; the estimation of Vitamin C and carbohydrate levels has gained great significance.

"Total carbohydrates" include all types of carbohydrate found in the food or beverage. Total carbohydrates consist of multiple nutrients, including dietary fiber, sugars and starches. Though rich in Vitamin C, kiwifruit is a very good source of dietary fiber. The fiber in kiwifruit has also been shown to be useful for a number of conditions. Researchers have found that diets that contain plenty of fiber can reduce high cholesterol levels, which may reduce the risk of heart disease and heart attack. Fiber is also good for binding and removing toxins from the colon, which is helpful for preventing colon cancer. In addition, fiber-rich foods, like kiwifruit, are good for keeping the blood sugar levels of diabetic patients under control. Sugar in fruit is called fructose. When we eat fruits, our body turns fructose into glucose, which it then uses for energy.

Kiwifruits have become a product of interest in recent years due to its high level of Vitamin C and its strong antioxidant capacity due to a wide number of phytonutrients including carotenoids, lutein, phenolics, falvonoid, and chlorophyll (Cassano et al., 2006). Based on these characteristics, kiwifruits offer benefits for specific health conditions and has a great potential for industrial exploitation (Cano Pilar, 1991). In the world of phytonutrient research, kiwifruit has fascinated researchers for its ability to protect DNA in the nucleus of human cells from oxygen-related damage. Researchers are not yet certain which compounds in kiwi give it this protective antioxidant capacity, but they are sure that this healing property is not limited to those nutrients most commonly associated with kiwifruit, including its Vitamin C or beta-carotene content. Since kiwi contains a variety of flavonoids and carotenoids that have demonstrated antioxidant activity, these phytonutrients in kiwi may be responsible for this DNA protection. Kiwifruit is an excellent source of Vitamin C which is the primary water-soluble antioxidant in the body, neutralizing free radicals that can cause damage to cells and lead to problems such as inflammation and cancer. In fact, adequate intake of Vitamin C has been shown to be helpful in reducing the severity of conditions like osteoarthritis, rheumatoid arthritis, and asthma, and for preventing conditions such as colon cancer, atherosclerosis, and diabetic heart disease.

The literature survey indicates that there hardly seems any information available till date regarding the radiation processing of kiwifruit of Uttarakhand origin. In the present study, fruits have been exposed to radiation doses of 1-3 kGy so that ripening of the fruit and hence decaying can be delayed resulting in significant increase in shelf -life of the fruit and maintaining its nutritional values after post harvest. The carbohydrate and ascorbic acid levels of the irradiated samples were studied by UV-visible spectrophotometric method.

MATERIALS AND METHODS

Mature but unripe kiwifruits were collected from different orchards of Uttarakhand region. The fruits were packed in polythene film at 0^{o}C and kept at room temperature for 1 day before irradiation. The packed samples (5 per pack) were irradiated in a cobalt-60 irradiator at BARC, New Delhi with 0, 1, 2, 3kGy absorbed doses. The samples were turned 360^{o} continuously during the irradiation process to achieve uniform target doses and the non-irradiated control was placed outside the irradiation chamber to have the same environmental temperature effect with the irradiating samples.

After gamma irradiation, kiwifruits were stored and ripened at room temperature (20 ± 2°C), refrigerated condition and post refrigerated condition for 3 weeks. All samples were evaluated at 0(irradiation day), 1, 2 and 3 weeks after irradiation. Then the irradiated samples were studied by UV-visible spectrophotometric method for the carbohydrate and ascorbic acid levels.

Ultraviolet-visible spectroscopy refers to absorption spectroscopy or reflectance spectroscopy in the ultravioletvisible spectral region. It uses light in the visible and adjacent (near-UV and near-infrared (NIR)) ranges. The absorption or reflectance in the visible range directly affects the perceived color of the chemicals involved. In this region of the electromagnetic spectrum, molecules undergo electronic transitions.

Determination of Carbohydrate level by UV-Visible spetrophotometry (Vavilala 2012)

The procedure of the proposed Sulfuric Acid–UV method for determination of carbohydrates in kiwi fruits is as follows. 0.2 grams of anthrone was weighed accurately and dissolved in concentrated sulphuric acid and make the volume up to 100ml and finally transferred to a 100ml of reagent bottle. Pipette out 1ml of each extracted sample into a 25ml of volumetric flask and add 2ml of freshly prepared anthrone reagent in each volumetric flask and finally make the volume up to the mark with distilled water. Reference was prepared by taking 2ml of anthrone reagent in a 25ml of volumetric flask and make up the volume up to the mark with distilled water. To the above prepared samples wavelength was checked using UV-visible spectrophotometer. Wavelength was set at 750nm. At this wavelength, the developed colour absorbance was noted for the above mentioned samples.

Determination of Ascorbic Acid level by UV-Visible spetrophotometry (Majidi 2016)

For ascorbic acid analysis, both un-irradiated and irradiated kiwi fruits with different doses have been taken for investigation. All samples have been blended and then filtered using Buchner. 10 gm of each sample was transferred into a 100ml volumetric flask homogenized by using 50ml acetic acid, 4-5 drops of bromine water have been added until the solution became colored. Then a few drops of thio-urea solution were added to remove the excess bromine and thus the clear solution was obtained. Then 2, 4-Dinitrophenyl hydrazine solution was added thoroughly with all standards and also with the oxidized ascorbic acid. Then complete the solution up to the mark with acetic acid. The absorbance for all samples have

been measured using UV-visible spectrophotometer to determine the concentration of ascorbic acid in the fruits samples under testing.

RESULTS AND DISCUSSIONS

Carbohydrate Analysis

In Fig. 1, UV-Visible absorbance spectra for total carbohydrate level in un-irradiated and 1-3 kGy irradiated Kiwi fruit for 0-3 week storage time have been shown. All the samples show maximum absorbance at 310 nm. It was observed that the kiwi fruit treated with radiation dose of 3 kGy shows maximum absorbance even more than the un-irradiated sample. However, the samples treated with lower radiation doses of 1-2 kGy shows absorbance less than the un-irradiated samples for 0-3 week storage at ambient room temperature conditions. This showed that irradiation dose of 3 kGy was found to maintain the carbohydrate nutrient level better in the kiwi fruit as compared to the un-irradiated sample and the other lower doses. In fig. 2, the carbohydrate level exhibited an increasing trend for 1 week storage followed by a decrease in all the treatments under 2-3 week storage time at ambient room temperature conditions. The increase in carbohydrate level is attributed either to enzymatic conversion or radiation induced degradation of higher polysaccharides such as starches and pectins in to simple sugars, whereas the subsequent decrease is attributed to oxidation of sugars during respiration (Hussain et al., 2008). Hence, towards the end of the storage, dose of 3 kGy proved effective in retention of significantly higher levels of carbohydrate levels compared to other treatments under ambient storage conditions.

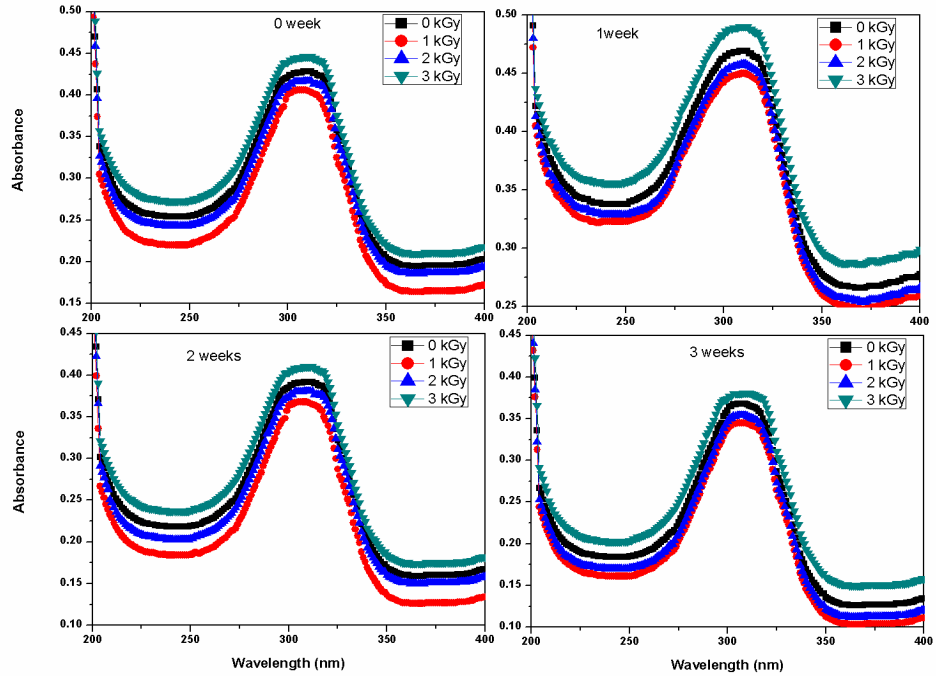

Fig. 1 UV-Visible absorbance spectra for total carbohydrate level in un-irradiated and 1-3 kGy irradiated Kiwi fruit for 0-3 week storage time.

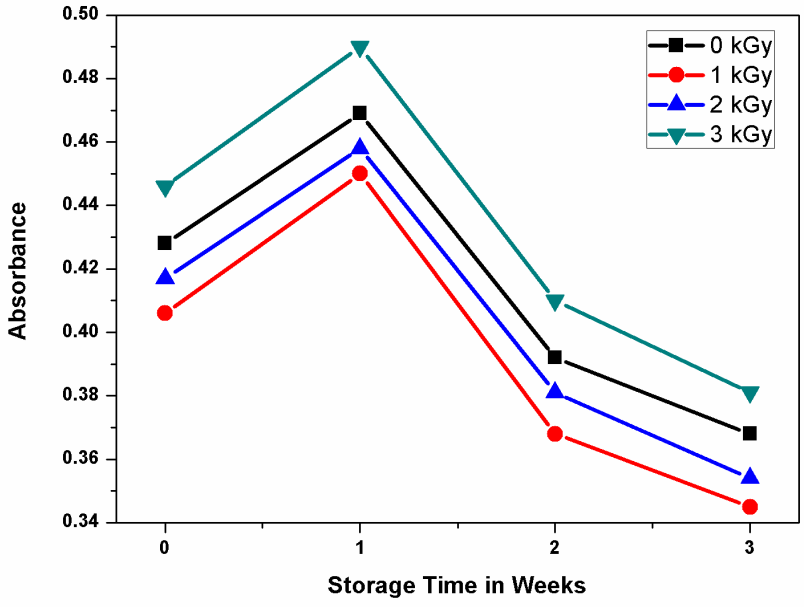

Fig. 2 Variation of total carbohydrate level in kiwi fruit with storage time.

Ascorbic Acid Analysis

Irradiation of kiwifruit up to 3 kGy had negative effects on Vitamin C content and antioxidant activity. In Fig. 3 UV-Visible absorbance spectra for ascorbic acid level in un-irradiated and 1-3 kGy irradiated Kiwi fruit for 0-3 week storage time have been shown. All the samples show maximum absorbance at 262 nm. Though irradiation had negative effects on the Vitamin C content yet radiation dose of 3 kGy showed better absorbance compared to lower doses of 1-2 kGy. In fig. 4 variation of ascorbic acid level in kiwi fruit with storage time is shown. The ascorbic acid level in kiwi fruit showed a decreasing trend with increase in storage time upto 3 weeks. During the entire storage period, irradiated fruits had lower ascorbic acid content than the control.

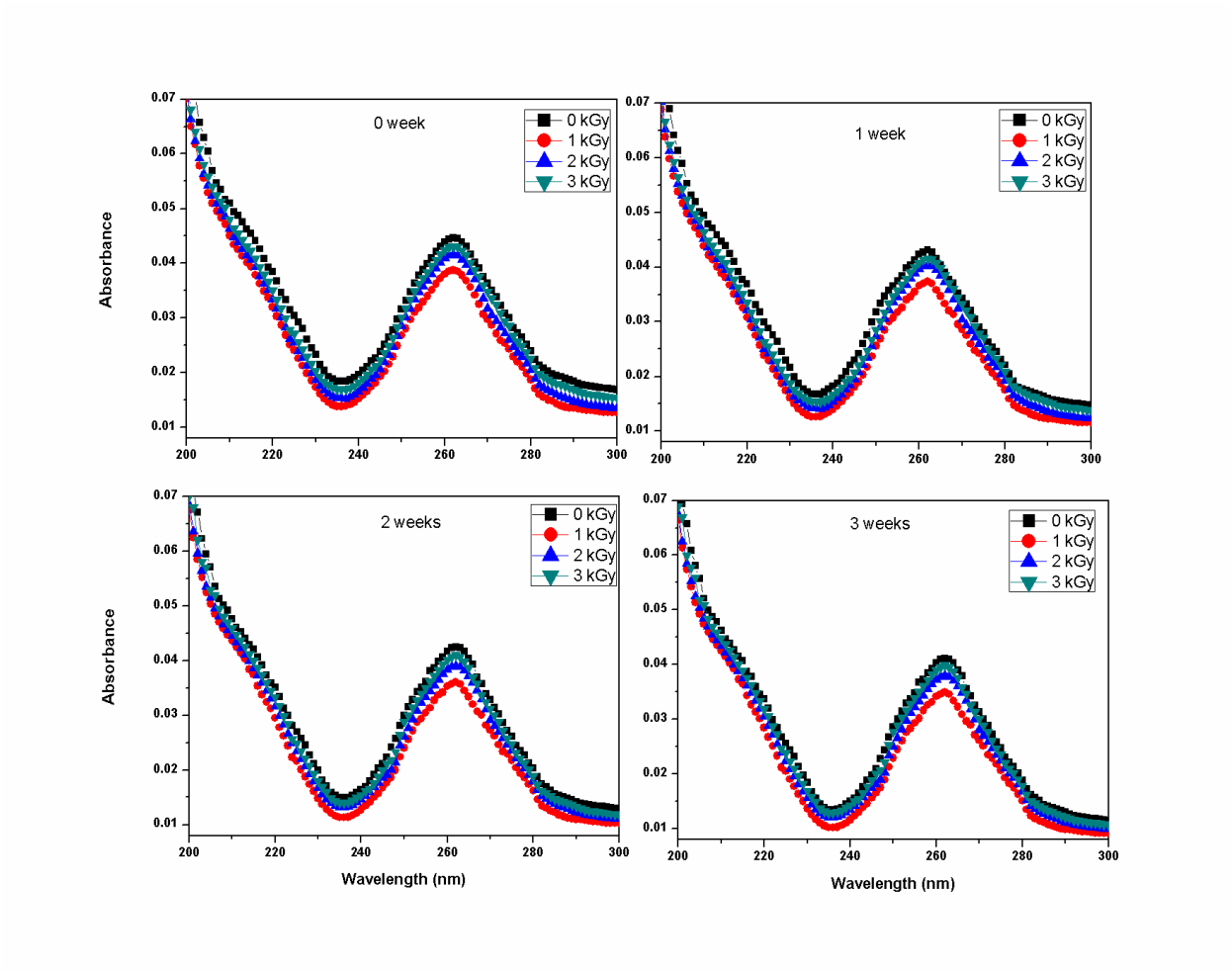

Fig. 3 UV-Visible absorbance spectra for ascorbic acid level in un-irradiated and 1-3 kGy irradiated Kiwi fruit for 0-3 week storage time.

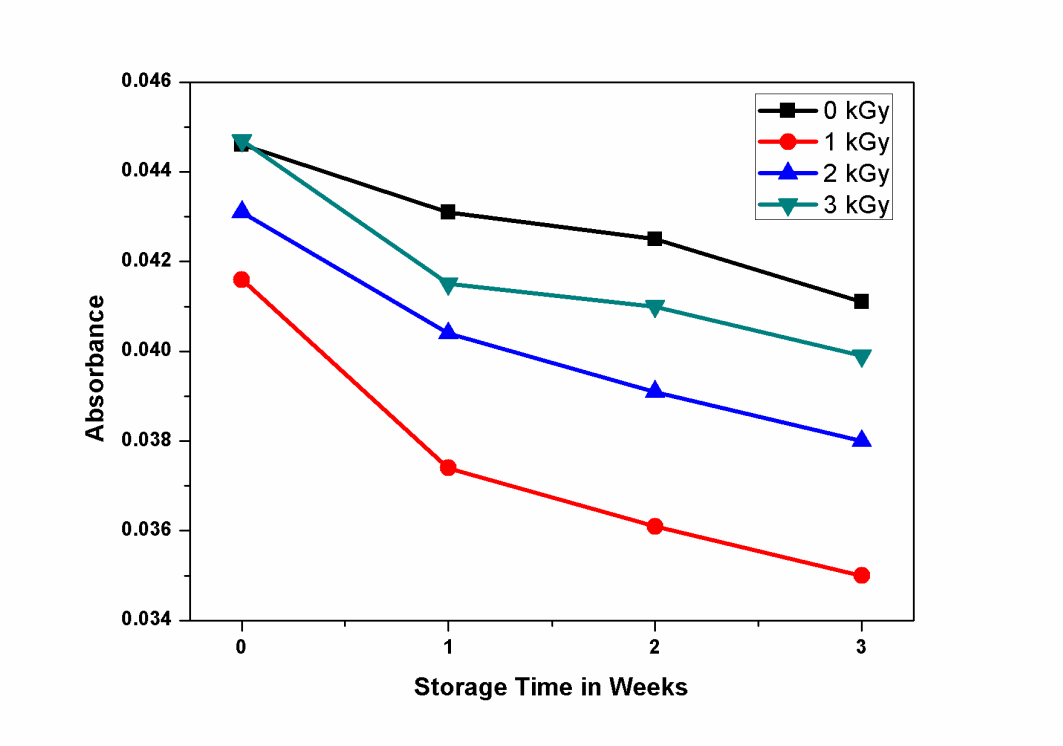

Fig. 4 Variation of ascorbic acid level in kiwi fruit with storage time.

CONCLUSIONS

The present study showed that gamma irradiation treatment of kiwifruits at doses 1& 2 kGy was not found to be effective w.r.t total carbohydrate level and ascorbic acid level in kiwi fruit. However, irradiation dose of 3 kGy was found to maintain the carbohydrate nutrient level better in the kiwi fruit as compared to the un-irradiated sample and the other lower doses. Irradiation of kiwifruit up to 3 kGy had negative effects on Vitamin C content and antioxidant activity but since irradiation showed promising results in delaying the plant fungal pathogen growth and shelf life extension, it was established that irradiating kiwifruit with dose of 3 kGy can prove beneficial in facilitating the marketing of the fruit to distant places other than the local markets, thereby benefiting the growers.

REFEERENCES

1. [Cano Pilar1991] Cano Pilar, M., (1991) “HPLC separation of chlorophyll and carotenoid pigments of four kiwi fruit cultivars” *J. Agric. Food Chem.*, 594–598, 40.

2. [Cassano 2006] Cassano, A., Figoli, A., Tagarelli, A., Sindona, G., Drioli, E., 2006, "Integrated membrane process for the production of highly nutritional kiwifruit juice" *Desalination* 189, 21–30.

3. [Hussain 2008] Hussain P. R., Dar M. A., Meena R. S., Mir A. M., Shafi F. and Wani A. M. (2008). Changes in quality of apple due to gamma irradiation and storage conditions, *J. Food Sci. Technol.*, 45(1), 44-49.

4. [Majidi 2016]Majidi M. I. H. AL and Hazim Y-ALQubury, "Determination of Vitamin C(ascorbic acid) Contents in various fruit and vegetable by UV-spectrophotometry and titration methods" *Journal of Chemical and Pharmaceutical Sciences,* 9 (4),2972-2974.

5. [Vavilala 2012] Vavilala P. K., Ch. M., Kavya M., Asha V.S., Rao A. S., Prasad M. S., 2012 "Quantitative Evaluation of Carbohydrate Levels in Fruits by UV-Visible Spectrophotometer" *Asian J. Pharm. Tech*.; 2(3), 99-100.