

# **EFFECT OF GAMMA RADIATION ON THE STRUCTURE AND CONCENTRATION ANALYSIS OF CHLOROPHYLL AND CAROTENE OF CORIANDER SEEDS**

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**Abstract:** This work investigates mainly the effect of gamma radiation on chlorophyll and carotene of the coriander seeds. The coriander seeds were irradiated at different doses of gamma radiation (10, 20, 40 Gy). After irradiation, the coriander seeds were grown and the plant pigments as chlorophyll and carotene were extracted by mashing method. Different parameters such as solvent extraction, contact time and weight of plant were studied before and after irradiation to determine the best irradiation dose and optimum condition of extraction of these pigment. It can be concluded that the optimum conditions for extraction of these pigments were as the following; 2gm coriander plant, reaction time of 45 min and 85% concentration of acetone for solvent extraction. From the FTIR spectrum of chlorophyll and carotene, it can be concluded that the irradiation of coriander seeds with 10 Gy dose had no effect on coriander plant.

**Keywords:** gamma irradiation, coriander seeds, plant pigments, irradiated food .

## **I INTRODUCTION**

In recent years, ionizing radiation such as gamma rays has been used as an effective way to maintain the quality of food for a long time. In addition, radiation treatments of food can kill and sterile insects as well as they can prevent reproduction of food-born parasites. However, the effect of the irradiation of gamma rays on the plants pigments has not been deeply investigated yet (Ganapathi, et al., 2008) . Moreover, changes may be happened on the structure and concentration of pigments certainly chlorophyll and carotene, where chlorophyll act on production of red blood cells and carotene act as antioxidant for human .Therefore, the aim of this work is to investigate the change in concentration and structure of chlorophyll and carotene before (irradiated) and after exposure (irradiated) at

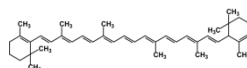
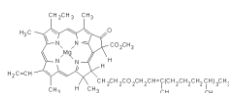
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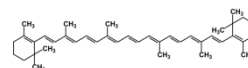
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different dose of gamma radiation. The effect of irradiation on the structure of chlorophyll and carotene was determined by using infrared spectroscopy. Coriander plant (*Coriandrum sativum*), also known as cilantro, or dhania is an annual herb in the family Apiaceae. Coriander is native to regions spanning from southern Europe and North Africa to southwestern Asia. It is a soft plant growing to 50 cm (20 inch) tall. The leaves are variable in shape, broadly lobed at the base of the plant, and slender and feathery higher on the flowering stems. The flowers are borne in small umbels, white or very pale pink, asymmetrical, with the petals pointing away from the centre of the umbel longer (5–6 mm) than those pointing toward it (only 1–3 mm long). The fruit is a globular, dry schizocarp 3–5 mm (0.12–0.20 in) in diameter. Although sometimes eaten alone, the seeds often are used as a spice or an added ingredient in other foods. All parts of the plant are edible, but the fresh leaves and the dried seeds are the parts most traditionally used in cooking. Coriander is common in South Asian, Southeast Asian, Indian, Middle Eastern, Caucasian,

The structures of chlorophyll is shown in fig (1) and carotenoids are shown in Figure(2) , (Nool., 1997)



α-Carotene



β-Carotene

Fig (1): Chemical structure of Chlorophyll

Fig(2): Chemical structure of carotene

## II. EXPERIMENTAL

**Sample preparation:** The coriander seeds was irradiated at different doses of gamma radiation (0, 10, 20, 40 Gy), using a Co-60 gamma irradiator, (100 kCi point source AECL, IR-79, MDS Nordion International Co.Ltd., Ottawa, ON, Canada ) with a dose rate of 2.5 KGy/h at room temperature . The absorbed dose was verified with a ceric \cerous dosimeter (Bruker Instruments , Rheinstetten, Germany ) with a dose uniformity of 1,05 (Dmax\Dmin (ASTM, 1995). National Center for Research and Radiation Technology, Egyptian Atomic Energy Authority, Cairo, Egypt. Then the plant pigments were extracted by grinding leaves with a mortar and pestle in a different solvents, different time of mashing and different weight of plants.

Factors affecting the extraction of plant pigments:

- Effect of different solvents: To extract the pigments from plants, the leaves were ground with different solvent ( 30% acetone, 85% acetone, 70% ether , 70% ethanol ).
- Effect of different time : The plant pigments were extracted at different mashing time (1, 5, 10, 15, 30, 45, 60 min), to determine the best time for extraction of pigments.
- Effect of different weight of planet: The pigments were extracted at different weights (0.1, 0.5, 1, 2, 3, 4, 5 gm) of planets.

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• **Experimental results**

Table (1) : Effect of different solvents

different solvent	Before radiation		after radiation by 10 Gy		after radiation by 20 Gy		after radiation by 40 Gy	
	Concentration of chlorophyll	Concentration of carotene	Concentration of chlorophyll	Concentration of carotene	Concentration of chlorophyll	Concentration of carotene	Concentration of chlorophyll	Concentration of carotene
30% acetone	1.170	0.339	1.106	0.456	0.195	0.563	0.057	0.093
85% acetone	2,736	1.715	2.686	1.675	0.280	0.800	0.134	0.426
70% petroleum ether	1.994	0.598	1.573	0.448	0.091	0.515	0.021	0.061
70% ethanol	1.001	0.740	1.241	0.900	0.237	0.440	0.085	0.032

Table (2): Effect of different contact time

Different time, m	Before radiation		after radiation by 10 Gy		after radiation by 20 Gy		after radiation by 40 Gy	
	Concentration of chlorophyll	Concentration of carotene	Concentration of chlorophyll	Concentration of carotene	Concentration of chlorophyll	Concentration of carotene	Concentration of chlorophyll	Concentration of carotene
1	0.824	0.016	0.900	0.703	0.776	0.023	0.022	0.002
5	0.913	0.071	0.958	0.081	0.921	0.072	0.065	0.007
10	1.004	0.150	1.001	0.120	1.001	0.102	0.076	0.017
15	1.274	0.214	1.411	0.276	1.009	0.119	0.167	0.039
30	1.801	0.306	2.022	0.499	1.121	0.146	0.190	0.103
45	2.936	0.607	2.475	0.598	1.544	0.190	0.882	0.135
60	1.936	0.011	1.510	0.015	1.499	0.189	0.140	0.016

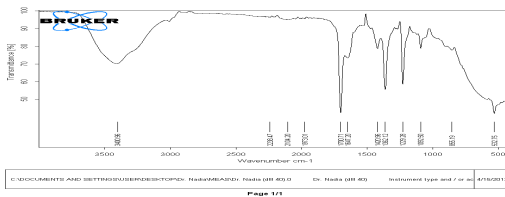
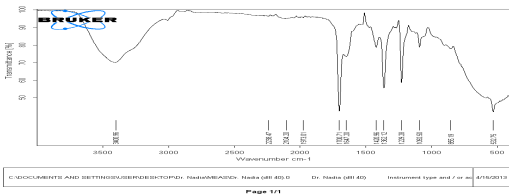
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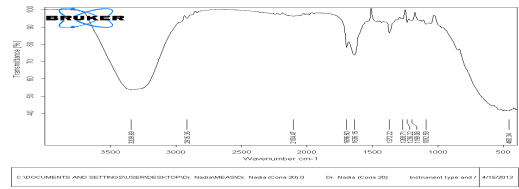
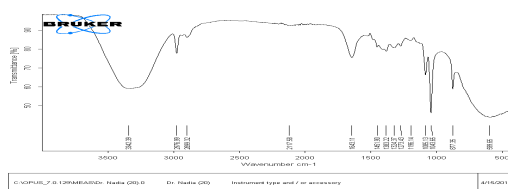
Table(3) : Effect of different weights of plants

Different weights of plants, gm	Before radiation		after radiation by 10 Gy		after radiation by 20 Gy		after radiation by 40 Gy	
	Concentration of chlorophyll	Concentration of carotene	Concentration of chlorophyll	Concentration of carotene	Concentration of chlorophyll	Concentration of carotene	Concentration of chlorophyll	Concentration of carotene
0.1	0.774	0.041	0.510	0.071	0.111	0.008	0.018	0.001
0.5	1.026	0.044	0.954	0.074	0.630	0.033	0.080	0.004
1	1.253	0.223	1.012	0.183	0.896	0.092	0.087	0.006
2	2.652	0.681	2.833	0.561	1.515	0.214	0.367	0.108
3	1.498	0.125	1.111	0.027	1.150	0.169	0.162	0.016
4	0.846	0.088	0.580	0.015	0.839	0.059	0.057	0.012
5	0.368	0.025	0.392	0.014	0.131	0.013	0.044	0.005



Fig(3): The Spectrophotometer spectrum of carotene and chlorophyll for coriander plant before irradiation

Fig(4): The Spectrophotometer spectrum of carotene and chlorophyll for coriander plant after irradiation by 10Gy



Fig(5): The Spectrophotometer spectrum of carotene and chlorophyll for coriander plant after irradiation by 20Gy

Fig(6): The Spectrophotometer spectrum of carotene and chlorophyll for coriander plant after irradiation by 40Gy

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## • Experimental discussion

Table (1) summarized the effect of different solvents for extraction of chlorophyll and carotene pigments before and after radiation at different dose. The concentration of two pigments were increased using 85% acetone, the pigments are released in a protein-free form by grinding plant tissue in a solvent such as acetone. Since chlorophyll and carotene are readily soluble in organic solvents and they are biochemically classified as lipids (Kume, T. et al., 2009). Effect of different contact time was shown in table (2), the results indicated that the concentration of chlorophyll and carotene increase with increasing the contact time up to 45 min and after that the concentration of pigments decrease by increasing the time this may be because of the pigments were destroyed after that. Effect of different weights of plants appears in tables (3), where the data represented that the concentration of plants pigments increased with increasing the weights of coriander up to 2 gm and after that it decreased, this may be due to strict hindrance effect (Artk, C. and Peksen, E., 2006). Effect of gamma radiation on the structure of pigments was studied using IR spectrum where Fig (3,4) indicated that there is no effect of radiation (at 10 Gy) on the structure of each pigment but Fig (5,6) indicated that the structure of chlorophyll only mainly changed.

## IV. CONCLUSION

In conclusion, we can say that the irradiation of plants at dose 10 gray gamma radiation doesn't effect on the concentration and structure of carotene and chlorophyll pigments. On the other wise at (20,40 Gy), there are different effect of radiation on the structure of carotene and chlorophyll (Noes, C. 2009). Finally we can concluded that for irradiated food by gamma radiation to prevent it from bacteria or any parasites to using it for long time, we must to be sure that this dose of gamma radiation don't effect on this pigments because it is very important for human health, where it prevents the human from many of Cancer disease (KHattak et al., 2009). Nearly the complete similarity between chlorophyll and hemoglobin this study recommended that the persons who work in the radioactive waste management must be not exposed to dose higher than 20 Gy (Murcia, M.A et al., 2008). Due to effect of gamma irradiation on its hemoglobin. The radioactive source must be having an enough shield to prevent the gamma radiation from spread and affect on the environment Dhankhar, B.S and Dhankhar, S.K., 2003).

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