

## Phytochemical profile and thin layer chromatographic studies of *Daucus Carota* peel extracts

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### Abstract

The oxidative stress caused by free radicals is responsible for causing chronic diseases such as Diabetes Mellitus, Cardiovascular diseases and cancer. Phytochemicals are bioactive compounds present in plant foods which protects the body from the damaging effects of free radicals. Due to the beneficial effects of phytoconstituents in contributing to human health, scientists are exploring newer and cheaper sources of these bioactive compounds such as food industries by-products, agricultural bio wastes etc. The objective of the research study was to investigate the presence of various phytochemicals in the methanol and acetone extracts of *Daucus carota* (carrot) peel. Thin layer chromatography (TLC) was performed for both the extracts to detect the presence of active compounds. The phytochemical analysis of carrot peel showed positive results for Diterpenes, steroids, flavonoids, and phenolic acids in both the extracts. Saponins were present only in the methanolic extract of carrot peel.

**Keywords:** *daucus carota* peel, phytochemicals, diterpenes, thin layer chromatography

### 1. Introduction

FAO's <sup>[1]</sup> data on analyses of food waste showed that fruits and vegetables, along with roots and tubers represent the category that has the highest wastage rates, followed by cereals, oilseeds, dairy and meat. The peels and pomace of fruits and vegetables are a source of sugars, minerals and organic acids, dietary fibers and phenolics which have a wide range of actions which includes antioxidants, antimutagenic, cardio preventive, antibacterial and antiviral activities <sup>[2]</sup>. In most cases the waste by-products such as peels and seeds can present similar or even higher contents of antioxidant compounds than the pulp <sup>[3, 4, 5]</sup>.

It is well supported that the phytochemicals present in plants are of high biological importance in humans, as these invariably contribute to human health. Epidemiological studies and associated meta-analyses strongly suggested that long term consumption of diets rich in plant phytochemicals offered some protection against development of cancers, cardiovascular diseases, diabetes, osteoporosis and neurodegenerative diseases <sup>[6, 7]</sup>. Phytochemical is able to exert its beneficial effects against chronic diseases because it has good antioxidant potential. Presently the search for effective and non-toxic natural compounds with antioxidant activity has intensified; it provides means for reusing the waste which contains high levels of antioxidant compounds and also economically advantageous <sup>[8]</sup>. One such food processing waste which is of high biological value is carrot peel. Carrot (*Daucus carota*) is a good source of natural antioxidants, especially carotenoids and phenolic compounds <sup>[9, 10]</sup>. Among vegetables, carrot is the single major source of  $\beta$ -carotene providing 17% of the total vitamin A consumption <sup>[11]</sup>. The different carrot tissues have similar composition, but the individual phenolic content differs and it decreases from the exterior (peel) to the interior (xylem) <sup>[10]</sup>. After processing, carrot residues, e.g. peels, pomace, are usually discarded or used as animal feed. However, carrot by-products still contain high contents of beneficial substances, especially bioactive compounds with antioxidant activities <sup>[10]</sup>.

The present study was attempted to assess the phytoconstituents of methanolic and acetone extract of *Daucus carota* (carrot) peel and to perform TLC to analyze various bioactive components.

### 2. Materials and Method

#### 2.1 Preparation of *Daucus carota* (carrot) peel extracts

Healthy, disease free and mature carrots were purchased from the local market. The carrots were washed under running tap water to remove the dust and soil. The carrots were manually peeled using a sterilized peeler and the peels were then shade dried at room temperature for 5 days. The shade dried carrot peels were powdered in a laboratory blender and was kept in airtight bottles until further use. The powdered carrot peel was soaked in methanol or acetone for 72 h by maceration technique. The supernatant were filtered through Whatman No.1 filter paper and concentrated using rotary evaporator and dry residue was preserved at 5°C in airtight bottles until further use.

#### 2.2 Qualitative phytochemical screening

The qualitative phytochemical tests were performed to screen the presence of bioactive components in methanolic and acetone extract of carrot peel. The screening was performed for triterpenes/steroids, alkaloids, anthraquinones, coumarins, flavonoids, saponins, tannins, and phenolic acids according to standard method described by Mace <sup>[12]</sup>, Wagner <sup>[13]</sup>, Wagner *et al.* <sup>[14]</sup>, Evans <sup>[15]</sup>, Kokate <sup>[16]</sup>.

#### 2.3 Test for carbohydrates

The extract (100 mg) was dissolved in 5 mL of water and filtered. The filtrate was subjected to the following tests described Ramakrishnan *et al.* <sup>[17]</sup>.

#### Fehling's test

One mL of filtrate was boiled on water bath with 1 mL each of Fehling solutions I and II. A red precipitate indicated the presence of sugar.

### Benedict's test

To 0.5 mL of filtrate, 0.5 mL of Benedict's reagent was added. The mixture was heated on a boiling water bath for 2 min. A characteristic coloured precipitate indicated the presence of sugar.

### 2.4 Test for proteins

The extract (100 mg) was dissolved in 10 mL of distilled water and filtered through Whatmann No.1 filter paper and the filtrate was subjected to tests of proteins and amino acids [18, 19].

### 2.5 Thin Layer Chromatography

The thin layer chromatography method was performed for the detection of active compounds, based on the results (Retention factor)  $R_f$  value of the separated compounds can be calculated easier. Thin layer chromatography (TLC) was performed on pre coated 20cm × 20cm and 0.25mm thickness. Aliquots of the extract were spotted on the TLC plates which was 0.2 mm above

from the bottom with the help of a capillary tube. Then the sample spotted sheets were placed in the respective solvent system adopted as mobile phase. The solvent system used for methanolic extract was toluene: ethyl acetate: methanol in the ratio 1:0.8:0.2. The solvent system used for acetone extract was toluene: ethyl acetate: acetic acid in the ratio 1.01:0.9:0.1. The spots in the chromatogram were well observed.

## 3. Result and discussion

### 3.1 Qualitative phytochemical screening

The results of phytochemical analysis of carrot peel for methanol and acetone extracts are illustrated in the Table 1. The phytochemical screening for carrot peel showed positive results for Diterpenes, steroids, flavonoids, saponins, and phenolic acids. The major phytochemicals present in the carrot peel are hydroxycinnamic acids and derivatives such as chlorogenic acid, caffeic acid, 3'-caffeoylquinic acid, 4'-p-coumaroylquinic acid, 3', 4'-dicafeoylquinic acid, 3', 5'-dicafeoylquinic acid [10].

**Table 1:** Phytochemical screening of beetroot (*Beta vulgaris*) peel

S. No.	Tests	Methanol Extract	Acetone Extract
1.	Tests for Alkaloids		
	a. Mayer's Test	-	-
	b. Wagner's Test	-	-
	c. Hager's Test	-	-
2.	Tests for Saponins		
	a. Froth Test	+	-
	b. Foam Test	+	-
3.	Tests for Phenol		
	Ferric Chloride Test	+	+
4.	Tests for Tannins		
	Gelatin Test	-	-
5.	Tests for Flavonoids		
	Alkaline Reagent Test	+	+
6.	Tests for Diterpenes		
	Copper Acetate Test	+	+
7.	Tests for Proteins		
	Xanthoproteic Test	-	-
8.	Tests for Glycosides		
	a. Legal Test	-	-
	b. Modified Brontgrer's Test	-	-
9.	Tests for Phytosterols		
	Salkowski Test	+	+

Phenolic compounds are secondary metabolites that can act as antioxidants due to their ability to donate hydrogen, quench singlet oxygen and act as metal chelators [20]. Phytochemicals are of biological significance as various studies support its role in disease prevention. For example, phytosterols have been found to reduce intestinal cholesterol absorption [21] and serum LDL-cholesterol concentrations in body [22, 23]. Therefore, National Cholesterol Education Program (NCEP) Adult Treatment Panel III recommends adults to consume 2 g phytosterols daily to reduce LDL cholesterol and cardiovascular disease risk [24]. Similarly Saponins also decrease blood lipids as well as lower cancer risks, and lower blood glucose response. A high saponin diet can be used in the inhibition of dental caries and platelet aggregation and in the treatment of hypercalciuria in humans [25]. A limited number of intervention trials of flavonoids have documented cancer preventative effects. Proposed anticancer mechanisms for flavonoids are inhibition of proliferation, inflammation, invasion, metastasis, and activation of apoptosis

[26]. Diterpenes have been used in traditional medicine for anti-cancer, anti-diabetic and various other ailments [27, 28]. The presence of various phytochemicals in carrot peel lends itself to be used as a functional food.

### 3.2 Test for carbohydrates and proteins

The carrot peel showed positive for carbohydrates but showed negative for proteins. The results obtained for protein is contradictory to the findings by Chantaro *et al.*, (2008) [29] who reported that protein content in blanched and hot air dried carrot peel was in the range 9.6 -12.87 g/100g. This difference could be due to the carrot variety studied, solvent used and method of extraction.

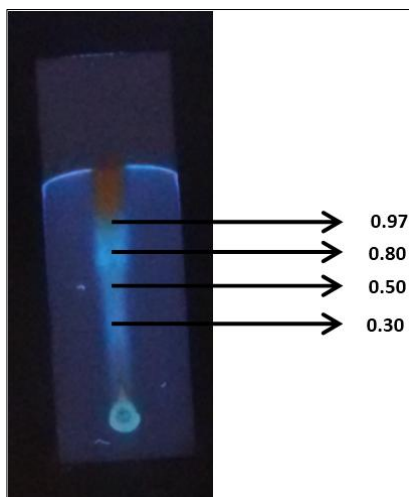
### 3.3 Thin Layer Chromatography

The presence of various phytoconstituents was further detected by thin layer chromatography technique. The number of spots observed and their corresponding  $R_f$  values are presented in table

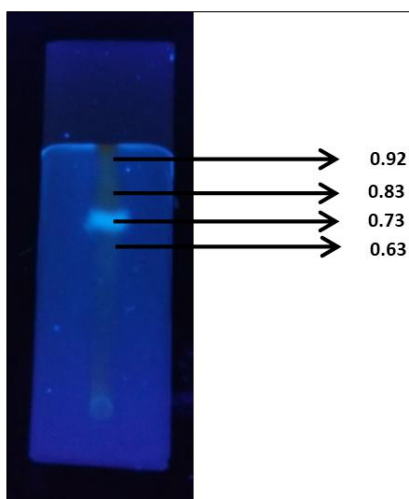
2. Both methanol and acetone extracts yielded four spots. Data obtained from TLC analysis helps in selection of appropriate solvent system for separation of pure compounds by column chromatography. Mixture of solvents with variable polarity in different ratio can be used for separation of pure compound from plant extract<sup>[30]</sup>.

**Table 2:** R<sub>f</sub> values of methanol and acetone extracts of *Daucus carota* peel

Compounds observed under UV @ 235nm	R <sub>f</sub> value	
	Methanol	Acetone
1	0.97	0.92
2	0.8	0.83
3	0.5	0.73
4	0.3	0.63



**Fig 1:** TLC of methanol extract of *Daucus carota* peel



**Fig 2:** TLC of acetone extract of *Daucus carota* peel

#### 4. Conclusion

This study supports the presence of various phytochemicals of biological significance in carrot peel. Therefore the inclusion of carrot peels as part of the diet can be encouraged among people for promoting their overall health. Some of the ways in which carrot peel can be consumed are, as oven baked carrot peel chips and carrot peel extracts powders in soups and cookies as flavouring agent.

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