

Activity Screening of Selected Fruit Peels to Check its Efficacy in Commercial Paneer

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Abstract

The aim of this investigation was to evaluate the activity of some selected fruit peel extracts (*Punica granatum*, *Malus domestica*, *Citrus sinensis*, *Vitis vinifera* and *Citrullus lanatus*) as potential source of natural antioxidant in Paneer to improve its shelf life, replacing the synthetic products. The ethanol extract of selected fruit peels were analyzed to check the peroxide value reduction in paneer. In the results obtained, the ability of 2% antioxidant extracts to perform peroxide reduction in Paneer after 8 consecutive days was in the following order, *Punica granatum* > *Malus domestica* > *Vitis vinifera* > *Citrus sinensis* > *Citrullus lanatus*. Concluding, the peels of selected fruits can be considered as a potential source of antioxidants that can be utilized in food, pharmaceutical and agricultural industries instead of toxic synthetic antioxidants.

Keywords antioxidant activity, ethanol, fruit peels, paneer, peroxide

Introduction

Fruits and vegetables wastes yield 25% - 30% of non-edible products and currently have become the cause of a serious disposal problem. However, majority of fruit peels exhibited 2 to 27-fold higher antioxidant activity than the fruit pulp [1].

Paneer is an important Indian traditional coagulated dairy product that provides sound nutrition, variety, novelty of flavor, portability and probability to consumers. About 5% of milk produced in India is converted into paneer. The main problem which we encounter during the

production of commercial paneer is its short shelf life period due to peroxide activity.

The shelf life period and stability of various food products, especially those containing fat can be improved by the addition of antioxidants. Synthetic antioxidants such as butylated hydroxyl anisole (BHA), butylated hydroxyl toluene (BHT) and propyl gallate (PG) are widely used as food additives. These synthetic antioxidants used in food additives are carcinogenic and are toxic to humans upon degradation. This increases the demand for a natural and safe antioxidant.

The present study was undertaken with the following objectives- (a) To compare the activity of selected fruit peels in enhancing the shelf life period of paneer; (b) To find out a cheap, easily available, eco-friendly alternative for synthetic antioxidants and (c) To find out a better option to manage the wastes in industrial processing of fruits.

Methodology

Samples used

Malus domestica, *Citrus sinensis*, *Vitis vinifera*
Punica granatum, *Citrullus lanatus*

Chemicals used

Chloroform, Ethanol, Glacial acetic acid, 0.01N Sodium thiosulphate solution, Starch solution.

Preparation of fruit peels

The fruits with no apparent physical or microbial damage were procured from local market, Trivandrum, India. The peels were manually separated from the pulp. The selected fruits were then washed under tap water in order to remove adhered impurities on the surface. It was then followed by separating the peels from pulp

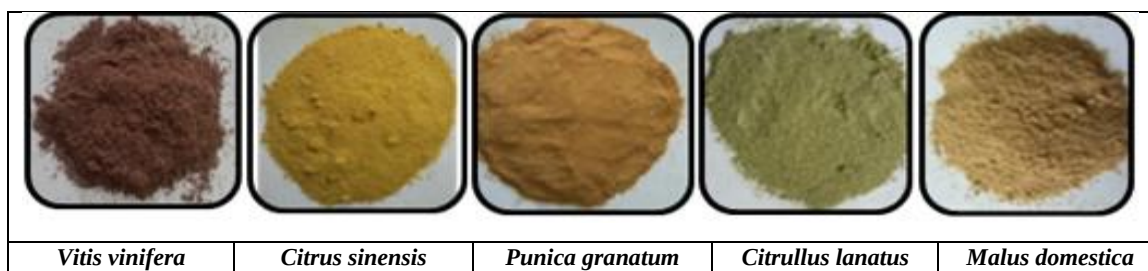


Figure 1. Dried fruits peel samples

manually, removing any amount of edible portion. The peels were directly sun dried for one week and then, ground to fine powder (Figure 1). The dried powders of selected fruits peel were extracted by cold percolation method [2]. Initially, 100 ml of ethanol was taken in a conical flask and 10 g of the dried peel powder was added. The extraction mixture was further kept in an orbital shaker at 120 rpm for 24 hours. After 24 hours, the peel residues were removed by passing through Whatman filter paper No 41. The extract was then concentrated by air drying for 5 days. The dry extract was stored at 40°C till use.

Preparation of paneer with fruit peel extract

Further, 1-2% of the prepared fruit extracts in solution form were added to 3 g of paneer sample. Control was prepared without fruit peel extract.

Method for the determination of peroxide value of paneer

Two grams of potassium iodide was added to 3 g of paneer taken in a boiling tube. To this mixture, 20 ml of solvent (2 volume glacial acetic acid + 1 volume chloroform) was added. It was then allowed to boil vigorously by placing it in a water bath for 60 seconds. The boiled mixture was then quickly poured into a flask containing 25 ml of water. This was finally titrated with 0.01N sodium thiosulphate solution using starch as an indicator. A blank was performed without paneer sample.

$$\text{Peroxide value} = [(S-B) \times N \times 100 / W] \quad [3]$$

*S= the volume of titrant of sample

*B = Volume of blank

*N= normality of sodium thiosulphate

*W= weight of sample respectively.

Results and Discussion

The present study on selected fruit peel extracts revealed the presence of a maximum extraction yield of 80% in *Malus domestica* peel (in accordance with Kim and Roh [4]) and a minimum of 19% was shown by *Citrullus lanatus* (similar to the result reported by Hannah and Krishnakumari [5]). Based on the results achieved, an extraction yield of 20% was shown by *Vitis vinifera* (in agreement with Butkhup et al. [6]). *Punica granatum* showed an extraction yield of 35%, (which was in agreement with Sharmin [7]) and *Citrus reticulata* gave an extraction yield of 27%, (which was covenant with Hegazy and Ibrahim [8]) (Table 1) (Figure 2).

Malus domestica > *Citrullus lanatus* > *Punica granatum* > *Citrus reticulata* > *Vitis vinifera*.

The solvent composition, extraction temperature, solvent to solid ratio, pressure and extraction techniques were mentioned as the main factors responsible for the extraction yield in a study conducted by Anagnostopoulou et al. [9]. The current result obtained in this study can be related to those findings.

Effect of addition of 1-2 % antioxidant extract

The peroxide value of each paneer sample with 1% fruit peel extract showed an increase with the storage period (Figure 3). The maximum ability to

Table 1. Yield percentage of different fruit peel extractions

S.NO.	Fruit peel samples	Extraction yield %
1	<i>Malus domestica</i>	80
2	<i>Vitis vinifera</i>	20
3	<i>Citrus sinensis</i>	27
4	<i>Punica granatum</i>	35
5	<i>Citrullus lanatus</i>	19

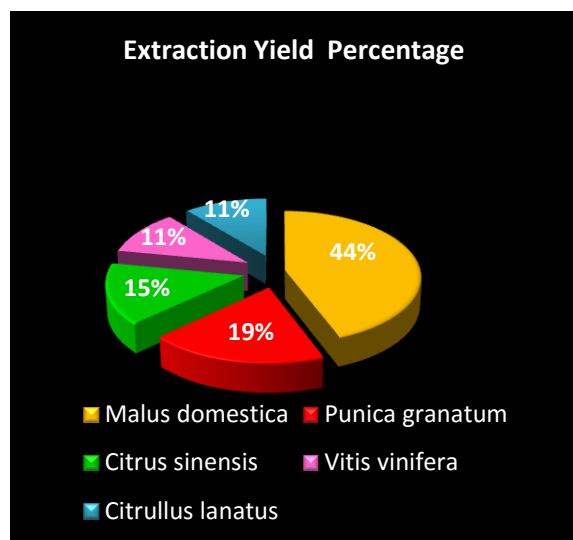


Figure 2. Graphical representation of extraction yield percentage of fruit peel extracts

reduce peroxide effect of paneer after 8 days was shown by *Punica granatum* where the peroxide value was only 1.35, whereas control showed a peroxide value of 2.6. The antioxidant extract from *Citrullus lanatus* showed the lowest reduction in peroxide value when compared to the other selected fruit peels. *Malus domestica* extract reduced the peroxide value from 2.6 to 1.65. *Vitis vinifera* extract showed a reduction in peroxide value from 2.6 to 1.85. *Citrus sinensis* extract reduced the peroxide value of paneer from 2.6 to 2.32 after 8 days.

Two percent of the selected antioxidant extracts was added to the paneer sample and the peroxide value reduction in paneer was periodically checked (0, 2, 4, 6, 8) (Figure 3). The maximum ability to reduce peroxide effect in paneer was

shown by *Punica granatum*, the peroxide value was only 1.31, whereas control showed a peroxide value of 2.56. However, the antioxidant extract from *Citrullus lanatus* showed the lowest reduction in peroxide value when compared to the other selected fruit peels. It showed minimum reduction from 2.56 to 2.35. *Malus domestica* extract reduced the peroxide value from 2.56 to 1.63. *Vitis vinifera* extract showed a reduction in peroxide value from 2.56 to 1.82. *Citrus sinensis* extract reduced the peroxide value of paneer from 2.56 to 2.16. (Table 2) (Figure 2).

Punica granatum > *Malus domestica* > *Vitis vinifera* > *Citrus sinensis* > *Citrullus lanatus*.

The initial peroxide value of paneer was 0.09, which increased gradually in 0-8 days. This result was alike the one conducted by Singh et al. [10]. A lowering in the peroxide value was observed in those samples to which 1% fruit peel extracts were added. The maximum reduction in peroxide value was shown by *Punica granatum* on 8th day. Peroxide values were much lowered in those samples with 2% extract. In this case also, *Punica granatum* showed the lowest peroxide formation. Most of the fruit peels exhibited higher antioxidant activity than the fruit pulp (Li et al. [1]). The antioxidant activity increases with the increase in extraction time because an increase in extraction time increases the amount of bioactive compounds extracted from the fruit peels. The reducing property of polyphenols makes them potent free radical scavengers. This property helps in the reduction of peroxide (Shahidi et al., [11]).

Table 2. Effect of 1-2 % selected fruit peel extract in peroxide value of paneer

S. No	Fruit Sample	Effect of 1% extract in paneer in Consecutive Days					Effect of 2% extract in paneer in Consecutive Days				
		0	2	4	6	8	0	2	4	6	8
1	Control	0.09	1.45	1.64	2.38	2.6	0.09	1.43	1.62	2.34	2.56
2	<i>Malus domestica</i>	0.09	0.4	0.8	0.82	1.65	0.09	0.34	0.73	0.8	1.63
3	<i>Vitis vinifera</i>	0.09	0.5	0.85	1.2	1.85	0.09	0.44	0.82	1	1.82
4	<i>Citrus sinensis</i>	0.09	0.6	1.56	2.3	2.32	0.09	0.4	1.2	1.4	2.16
5	<i>Punica granatum</i>	0.09	0.3	0.5	0.52	1.35	0.09	0.23	0.4	0.6	1.31
6	<i>Citrullus lanatus</i>	0.09	1.2	1.6	2.35	2.36	0.09	1.1	1.55	2.32	2.35

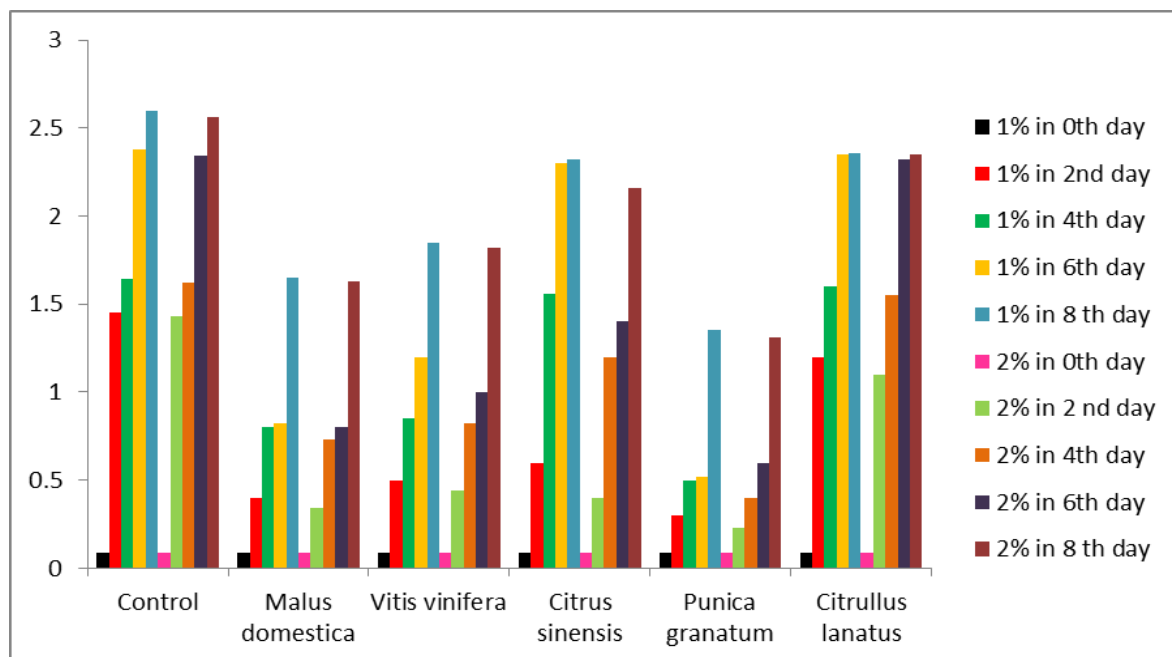


Figure 3. Effect of 1-2 % selected fruit peel extract in peroxide value of paneer

Conclusion

Fruits by-products are a good source of bioactive compounds that could be used to obtain product benefit. In short, fruit peels are a great repository and are cheap source of bioactive compounds, especially antioxidants. The presented study demonstrated the antioxidant properties of certain fruit peels that can protect against free radical damage. It can be concluded that the selected fruit peels can be successfully employed in reducing the peroxide formation in food products containing fat. Hence, the selected peel extracts, owing to their antioxidant properties can be a better substitute for widely used synthetic antioxidants for extending the shelf life.

To achieve this goal, future development efforts should address several objectives- a) Optimize and scale up the extraction procedures of bioactive constituents and identify the optimal extraction procedure on the composition and activity of obtained extracts without accepting the sensorial acceptability. b) Evaluate the economic feasibility of the alternative process of production of bioactive extracts from the fresh cut by-products, contemplating the percentage and composition of the disposed material.

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