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## Extraction of pectin from acid lime peel

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### Abstract

The investigation entitled “Extraction of Pectin from Acid Lime Peel” was carried out at Post-harvest and Analytical laboratory, Department of Fruit Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during 2020-21. The main objective of conducting this research was to determine the total pectin obtained from different maturity stages of acid lime Cv. PDKV Lime fruits. Pectin was extracted from dried peel powder of immature, mature and ripe fruit peels using hydrochloric acid (HCl 0.01 N) as reagent medium in distilled water, where, pH was maintained at 1.5. Optimum extraction conditions with extraction time of 80 minutes and an extraction temperature of 50 °C was employed. Pectin recovery of 35.57 percent of pectin was pertained from immature acid lime fruit peels, followed by, 27.05 percent in mature fruit peels and recovery percentage of 21.93 was obtained from ripe fruit peels attributing to the afore mentioned extraction conditions. The preliminary results inferred towards immature acid lime fruit peels attaining as a rich source of pectin in terms of recovery.

**Keywords:** Acid lime, maturity stages, pectin, extraction conditions

### Introduction

Acid lime (*Citrus aurantifolia* Swingle) stands as one of the important fruit crops of the *Citrus* group. Having originated in India, it is commercially grown in various tropical and subtropical regions of the country especially Vidarbha region of Maharashtra. Acid lime belongs to family Rutaceae pertaining chromosome number of  $2n=18$ . It is a good performer in all the three bahars (Ambia, Hasta and Mrig), however, variation in fruit yield differs significantly with cultivars, location, agro-climatic conditions, soil type etc. It is a regular bearer which has year-round crop along with good yield and maintained agricultural practices. Peels of lime possess various components viz. pectin, numerous phytochemicals, phenols and terpenes (Thirugnanavel *et al.*, 2007) [11]. Pectin is a naturally occurring biopolymer having vast applications in the food, pharmaceutical and biotechnology industry. It makes up about one third of the cell wall of the dry substance of higher plants (Harholt *et al.*, 2010) [3]. The highest concentrations of pectin are found in the middle lamella of cell wall, with a gradual decrease as it passes through the primary wall towards the plasma membrane (McNeil *et al.*, 1984) [8]. It has been used successfully for many years in the food and beverage industry as a thickening agent, gelling agent and a colloidal stabilizer. It also has several unique properties that have enabled it to be used as a matrix for the entrapment of a variety of proteins and cells. As a natural food additive, it is used extensively in the food industry, and its world market demand is in excess of 30,000 tons annually with a trend of growing by about 4-5 percent per annum (Harholt *et al.*, 2010) [3]. Being one of the most valuable products pectin is found naturally in most of the fruit crops and is predominantly available in *Citrus* viz., oranges (30%), lime (18%) and lemon (15%) (Kute *et al.*, 2020; Twinomuhwezi *et al.*, 2020) [7, 12]. Emphasizing on acid lime peels, when they are treated as waste materials they create environmental issues, particularly pertaining to water pollution due to the presence of biomaterials such as peel oil, sugar etc. they stimulate aerobic bacteria to decompose the biodegradable organic matters into products such as carbon dioxide, nitrates, sulfates and phosphates in water (Hasan *et al.*, 2022) [4]. Potentially marketable bio-product pectin can be extracted from acid lime peels which in turn establish usage of peels without any occurrences of wastage.

## Materials and Methods

### Sample Collection

The present study was conducted at Post-harvest and Analytical Laboratory, Department of Fruit Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during the years 2020-21. The fresh acid lime Cv. PDKV Lime fruits were collected at different maturity stages (immature, mature and ripe stage) on the basis of size and colour, from All India Coordinated Research Project on fruits (Dr. P. D. K. V).

### Sample Preparation

Fruits harvested at different maturity stages were thoroughly washed with clean water and were air dried. A sterilized sharp knife was used to carefully separate the peels. The separated peels were further washed with distilled water and ethanol in 1:1 ratio to remove external impurities. The peels were dried in hot air oven at 45-60 °C until the moisture was completely lost. Dried peels were grinded to a fine powder, sieved and stored in air tight containers for further use.

### Extraction of Pectin

Optimized extraction conditions were incorporated for recovering pectin from acid lime Cv. PDKV Lime fruit peels. Distilled water (1litre) and HCl solution (0.01 N) was prepared keeping the pH of the solution @ 1.5. 10 g dried peel powder was added to the solution and mixed well. The solution was boiled at 45 °C using hot plate for 80 minutes. The solution was then allowed to cool at room temperature and filtered using Whatman filter paper (No. 2). The obtained filtrate was cooled at 4°C and 96% ethanol was added on equal volume basis. The filtrate was further transferred into falcon tubes for centrifugation @ 3500 RPM for 30 minutes to separate pectin. The obtained jelly pectin is furthered with drying in hot air oven at 30-45 °C. Dried pectin is grinded to a fine powder, sieved and stored in air tight containers.

### Pectin recovery

Amount of pectin recovered is compared with the initial amount of whole peel sample. It is a measure of efficiency of the solvent to extract specific components from the original material. Recovery of the extract obtained was calculated and presented in percentage according to the describing of Ranganna (1995)<sup>[9]</sup>.

$$\text{Pectin recovery (\%)} = \frac{\text{Weight of extracted pectin (g)}}{\text{Weight of dry peel powder (g)}} \times 100$$

## Results and Discussion

The data from Table 1 revealed that, immature, mature and ripe peels of acid lime fruits recovered 35.57 percent, 27.05 percent and 21.93 percent pectin respectively. The obtained findings had similar results in premature, mature and overripe lemon pomace with 13.13 percent, 10.83 percent and 10.33 percent pectin (Azad *et al.*, 2014)<sup>[1]</sup>. Unripe and ripe banana peels fell in the same path as lemon pomace attaining 16.54 percent and 11.87 percent pectin respectively (Israel *et al.*, 2015)<sup>[5]</sup>. Bhardwaj *et al.*, (2014)<sup>[2]</sup> reflected on the decrease in pectin recovery as maturity proceeded in *Prunus armeniaca*, where, immature green stage attained enhanced recovery (0.76 %), followed by mature green stage (0.64 %), pre-ripe stage (0.58 %) and

fully ripe stage (0.35 %). Maximum recovery percentage of pectin attained in immature stage of acid lime fruit peels was primarily attributed to the conversion of pectin molecules, which are tightly cross-linked in unripe fruits to protopectin, sugar and other constituents as softening of cell wall occurs in the process of ripening. Pectin recovery decreases as maturity stages proceed (Rha *et al.*, 2011; Azad *et al.*, 2014)<sup>[10, 1]</sup>.

**Table 1:** Influence of different maturity stages of acid lime peels on recovery of pectin

Composition	Immature fruit peel	Mature fruit peel	Ripe fruit peel
Pectin recovery (%)	35.57	27.05	21.93

## Conclusion

This study primarily emphasized on extraction of pectin from acid lime Cv. PDKV Lime peel. Pectin was recovered successfully from different maturity stages (immature, mature and ripe) of acid lime fruits. In general, the research attributed in obtaining pectin from all the three maturity stages, with optimized extraction conditions, utilizing distilled water and HCl solution (0.01 N) at 1.5 pH and extraction temperature of 45 °C along with the extraction time of 80.05 minutes. 35.57 percent pectin was recovered from immature peels, 27.03 percent from mature peels and 21.93 percent from ripe peels. The results obtained gave a clear inference, where, acid lime peels can add for being the potential source of pectin, especially pertaining to the immature stage, whereby it can be considered in commercial production of pectin alongside *Citrus* and other fruit sources.

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