



How to Make Use of the *Citrus* Peels in Pakistan

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Abstract

Citrus fruits are prized in Pakistan and some species such as Kinnow belonging to *C. reticulata* with high quality were popular. Nowadays, the usages of *Citrus* fruits are mainly focused on the eating value, and peels as agro industrial byproduct usually are thrown as garbage. In fact, such peels are abundance in biological ingredients such as essential oils, flavonoids, limonoids, alkaloids, fatty acids, coumarins, etc., which have important usages in pharmaceuticals, foods, cosmetics, etc. As a result, how to make full use of *Citrus* peels is a challenging task in Pakistan also in the world. The work focuses on use and awareness of the importance of *Citrus* commercially as well as best community health provider.

Keywords: *Citrus*; Peels Essential Oils; Flavonoids; Limonoids; Alkaloids; Pakistan

Introduction

Citrus L. including about 20 species [1] is the most important genus of Rutaceae [2], in which eight important species are mandarins or tangerines (*C. reticulata*), sweet oranges (*C. sinensis*), limes (*C. aurantifolia*), lemons (*C. limon*), grapefruits (*C. paradisi*), pummelos or shaddocks (*C. grandis* or *C. maxima* (Burm.) Merr.), sour orange (*C. aurantium*), and citron (*C. medica*). *Citrus* are recognized as one of the world's major fruit crops. They are produced in many countries all around the world with tropical or subtropical climate. Brazil, USA, Japan, China, Mexico, Pakistan, and countries of the Mediterranean region are the major *Citrus* producers [3].

Citrus is a prized fruit of Pakistan and holds number one position among all fruits both in area and production in the country [4]. Pakistan with respect to annual production of *Citrus* fruits stands among the ten top *Citrus* producing countries of the world [2,3].

In Pakistan, mainly, 8 species and some their varieties are planted, which were listed in table 1. Among them, Kinnow is a very famous *Citrus* plant known for delicious juicy fruit. Hence the kinnow is a prime export fruit of Pakistan which is in great demand due to its juicy, soft, scented and refreshing fruit not found anywhere else in the world [5].

No.	Common Name	Botanical Name
1	Chakutra [6]	<i>C. grandis</i> [6]
2	Kinnow [3,5-7]	<i>C. reticulata</i> [3,5-7]
3	Musambi [6] or Mosambi [7] or Mussami [3]	<i>C. sinensis</i> var musambi [6] or var mosambi [7] or var mussami [3]
4	Narangi [6]	<i>C. mitis</i> [6]
5	Red blood orange [6]	<i>C. sinensis</i> [6]
6	Rough lemon [5,6]	<i>C. jambhiri</i> Lush. [5,6]
7	Feutrell [6] or Fewtrell's early [7]	<i>C. reticulata</i> [6,7]
8	Valencia late [6]	<i>C. sinensis</i> var valencia late [6]
9	Succari [6] or Shukri [8]	<i>C. sinensis</i> var succari [6] or var. shukri [8]
10	Honey [9]	<i>C. reticulata</i> cv. Murcot [9]
11	Grapefruit [3, 7]	<i>C. paradisi</i> [2,3,7]
12	Malta [7]	<i>C. sinensis</i> [7]
13	Eureka lemon [7]	<i>C. limon</i> [7]
14	Mitha [3]	<i>C. limetta</i> [3]

Table 1: Following *Citrus* cultivars are planted in Pakistan [2,3,5-9].

In addition to large scale consumption, the *Citrus* fruits are mainly processed to produce juice and the waste of this industry such as peels, seeds and pulps which represent about 50% of the raw processed fruit are a potential source of valuable by-products [3]. *Citrus* peels have many important and valuable medicinal ingredients such as EOs, pectins, flavonoids, limonoids, alkaloids, fatty acids, coumarins, and etc. [8-15]. Subjects who reported consumption of both hot black tea and *Citrus* peels had a significant marked decrease risk of skin squamous cell carcinoma [16]. In Pakistan, the fresh rind of *C. sinensis* var. shukri is rubbed on the face to cure acne, the dried peels are used in the treatment of anorexia, colds, coughs, etc. [8]. The peels of some varieties of *C. reticulata* collected in different time can be used as two kinds of Chinese materia medica (CMM) such as Citri Reticulatae Pericarpium Viride (CRPV) and Citri Reticulatae Pericarpium (CRP) [17,18]. CPRV and CPRV have the function as regulating the flow of vital energy and removing obstruction to it [17,18]. The EOs extracted from *Citrus*

peels have a wide range of potential activities in food, perfumery, sanitary, cosmetics and pharmaceuticals [2,7,11].

During a survey at countryside in mid April 2021, the people were asked questions related to the use of *Citrus* fruits and its peels. Most answered the use of fruits or fruits juice only while its peels are thrown as garbage or used as a fodder for domesticated milk giving animals. It is also known that in urban communities its juice is used while its peels medicinal use is almost negligible. As compared to Pakistan, the peels are more valued in China. Teas prepared from the dried peels of some varieties of *C. reticulata* in China are not only popular but also expensive. While in Pakistan there is no concept of *Citrus* teas, due to unawareness about its medicinal and health values. The people in Pakistan like the peels taste in some meals like cooked rice decorated with thin cut peel bands during wedding food. Similarly, the peels usage is very less common in baked foods.

Results and Discussion

As a result, the *Citrus* peels of Pakistan can be dried and stored, then they can be used to make tea, food, etc. For the deep and thorough use of these peels, they can be used to extract the bioactivities ingredients such as EOs, pectins, flavonoids, etc.

Conclusion

In conclusion, how to make full use of *Citrus* peels in Pakistan is a tough challenge. If it can be used properly, the related science and technology would be advanced some, and some profits would be gotten, which would do some benefits to the local people and the world's population.

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Conflict of Interest

The authors claim no financial conflict of interest.

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