

Original Research Article

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Post-Harvest Losses of Lemon Fruits: An Assessment of Microbial Floral Strength during Post-Harvest Handling

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ABSTRACT

Keywords

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A study was conducted to assess the microbial load on lemon fruits at different post-harvest handling stages. After harvesting, there are six different post-harvest handling stages were identified and they are collection, grading, packaging, transportation, wholesaler and retailer stages of fruits. And it was found that the microbial load was suddenly increases at Transportation stage and after it the microbial load continuously increases at subsequent stages i.e. at wholesaler and retailer level. Not only plant pathogenic microorganisms but also the human pathogenic microbes such as *E. coli*, *Salmonella* etc. were also found on the surface of fruits which were not found before the transportation stage. And it might be due to mis-handling of fruits as well as during transportation, some agricultural and non-agricultural products are transported along with the fruits.

Introduction

Lemon belongs to family *Rutaceae*. It is cultivated widely in the tropical and subtropical regions. The origin of lemon fruit is Asia. Lemon (*Citrus × limon.*) is one of the important citrus fruits appreciably not only for its beautiful appearance and pleasing flavour but also for excellent food qualities. There are many states of India cultivated the lemon.

Gujarat has the production area of lemon are 40.80 thousand ha with production of 433.12 thousand metric tonnes during the year of 2012-13 (NHB-database-2013). Lemon

(*Citrus × limon.*) act as minor fruit but the productivity near about area of Junagadh region (i.e. in vanthali, bhesan, kesod and visavadar taluka etc.) is in a great way.

Post-harvest losses of Lemon Fruits

Major causes of post-harvest losses of citrus lack of maintenance of orchards, Faulty harvesting methods, Miss handling of the produces, Mould growth and rotting, Shriveling and weight loss, Loss of firmness, Improper means of distribution, Improper storage facilities (<http://www.slideshare.net/manzarhussain007/post-harvest-handling-of->

citrus-fruit-in-north-east-india). The mature fruits after harvest ripen quickly and become excessively soft within 2 to 3 days at ambient condition and become unfit for consumption during post-harvest handling i.e. Harvesting, Collection, Grading, Packaging, Transportation, Storage / Wholesaler, Retailer. Post-harvest losses in lemon: 18-25 % (www.fao.org/docrep/005/Y4358E/y4358e05.htm).

Materials and Methods

The lemon fruits purchase from the farmer near by the Junagadh region.

Microbiological analysis

The homogenate from sample preparation in distilled water were used for the following procedures: Total viable counts on N-agar plate (himedialabs.com/TD/M002.pdf), yeast and mould counts on Potato Dextrose Agar (PDA) medium (Himedia M096, India-

reference), growth of *E. coli* on EMB agar plate (Himedia, M022S India), growth of *Salmonella* on Salmonella-Shigella agar (SS) medium.

Results and Discussion

At different Post Harvest Handling stages it was tried to analyze the various microbiological parameters (Table 1 and 2).

Determination *E. coli*

E. coli bacteria was found Wholesaler and Retailer Stage. And it was clear to see that first six stages *E. coli* bacteria was not found. At Wholesaler and Retailer Stages bacteria were found due to air pollution, improper handling of stages or any another reason. However, the contamination of *E. coli* bacteria was tolerable i.e. the limit $\leq 10^2$ per gram for the fresh fruits (Stannard, 1997).

Graph.1 Total Plate Count (CFU/g)

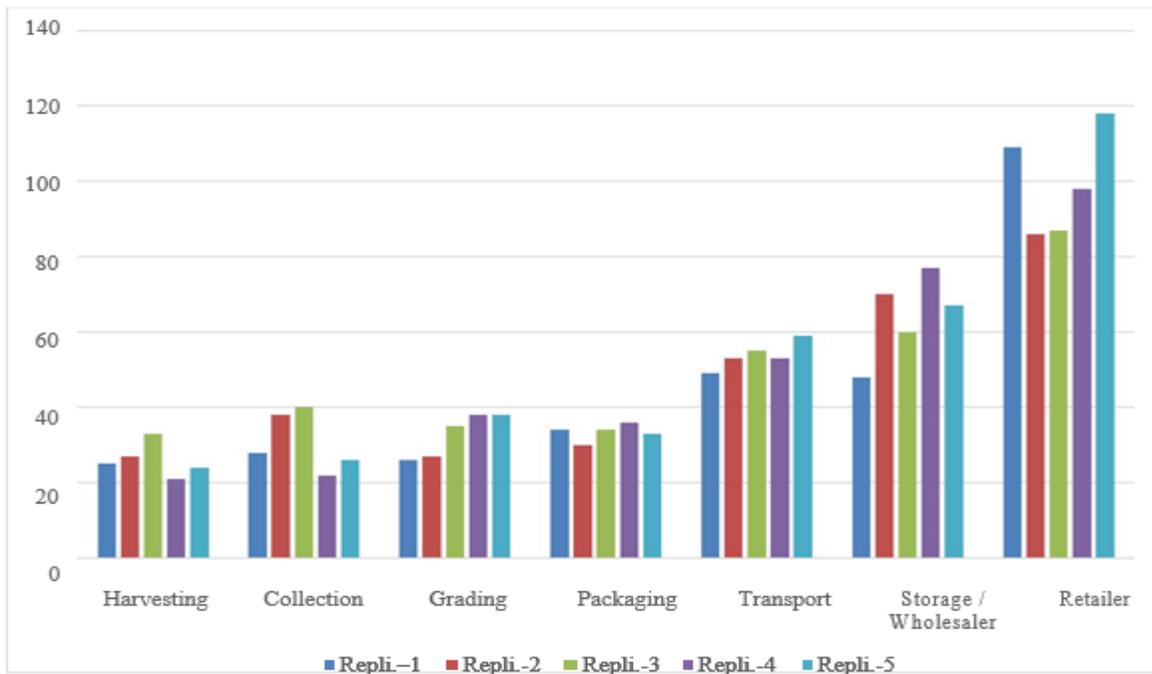


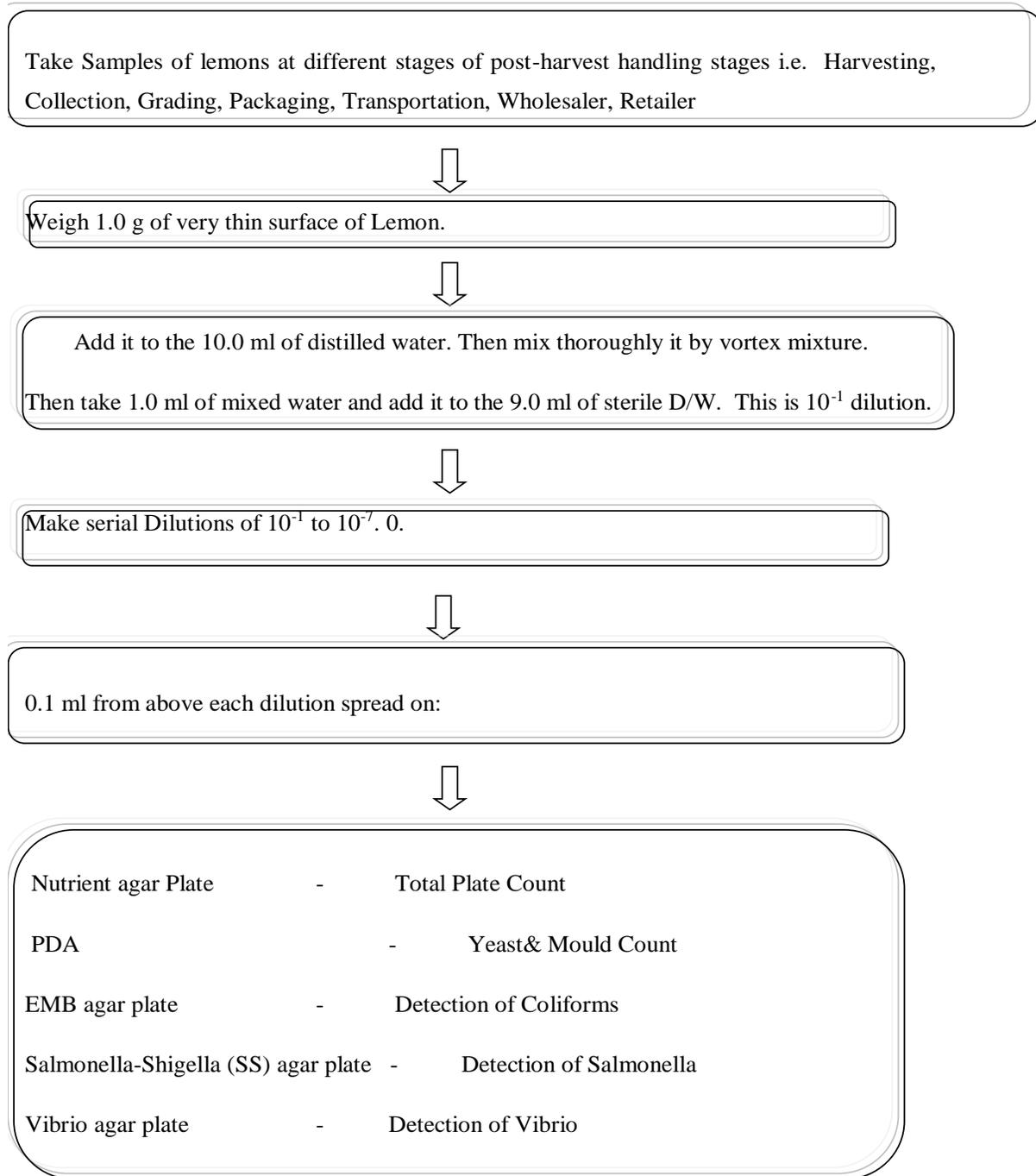
Table.1 Microbial limit for fresh Fruits and vegetables category no. 5 [According to Center for Food Safety (C.F.S.), a govt. department of Hong Kong (accredited by WHO)]

Total Plate	Yeast & Mould	<i>E.coli</i>	<i>Salmonella</i>	<i>Vibrio</i>
Count (cfu/g)	Count (cfu/g)	(cfu/g)	(cfu/g)	(cfu/g)
N/A	N/A	(1) < 20 : <u>Satisfactory</u>	(1) N/A : <u>Satisfactory</u> (2) N/A : <u>Acceptable</u>	
		(2) 20 - < 100 : <u>Acceptable</u>	(3) N/A : <u>Unsatisfactory</u> (4) Present on Fruits or Vegetables : <u>Unacceptable</u>	
		(3) ≥100 : <u>Unsatisfactory</u>		
		(4) N/A : <u>Unacceptable</u>		

Table.2 Yeast and mold count (Fungi) result of yeast and mold count (Fungi) should be consider at dilution rate of 10⁻¹

No.	Post-Harvest Handling Stages	Repli.-1	Repli.-2	Repli.-3	Repli.-4	Repli.-5	Y/M Value	Mean X
							10 ²	
1	Harvesting	5	8	4	0	0	3.4	
2	Collection	0	5	8	9	0	4.4	
3	Grading	0	9	7	6	8	6	
4	Packaging	15	8	12	10	0	9	
5	Transport	25	33	20	18	17	22.6	
6	Storage Wholesaler	38	42	48	36	40	40.8	
7	Retailer	68	76	73	81	66	72.8	

Process flow chart



Determination of *Salmonella*

As per the Result, at last stage, *Salmonella* bacteria were not found at any Stage. And it was clear to see that at first to seven stages *Salmonella* bacteria was not found.

Determination of *Vibrio*

As per the Result, at last stage, *Vibrio* bacteria were not found at any Stage. And it was clear to see that at first to seven stages *Vibrio* bacteria was not found.

Improper handling, an environment surrounding area of fruits and vegetables, irrigation water etc. factors was responsible for increasing the level of surface microbes. *E. coli* microorganisms were also found highest of both round samples.

These kinds of gram negative bacteria act as pathogens for the human being. They also might be harmful for humans.

The dominant micro flora on lemon fruits consists of pathogens leading to *E. coli*, *Mucor spp.*, *Rhizopus spp.* and *Aspergillus spp.*

By the study of result we can conclude that the lemon fruits samples from the local market contain lots of microbes on the surface.

In first phase local market of Junagadh showed less number of fungi and high number of bacteria while in a second phase, local market of Vanthali showed more number of bacteria and less number of fungi. All over result we can make conclusion that at each and every step more or less number of microbes affect the fruits.

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