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International Journal of Current Research
Vol. 7, Issue, 06, pp. 16760-16764, June 2015

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

MICROBES-PROOF FILTER FOR JUICE SHOPS

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ARTICLE INFO

Article History:
Received 19th March, 2015
Received in revised form
12th April, 2015
Accepted 23rd May, 2015
Published online 27th June, 2015

Key words:

Juice, Filter,
Physico-chemical parameters,
Microbial parameters

ABSTRACT

The present investigation was undertaken to design and develop efficient filter with coast effectiveness and easy handling for juice shopkeepers. The filter was designed with easily available materials and the physico-chemical parameters of water were analyzed to verify the alterations. Mean while total coliform, fecal coliform, Standard Plate Count (SPC) and Most Probable Number (MPN) of juices along with water sample were estimated so as to confirm the reduction in microbial load. The study revealed that physico-chemical parameters of water remains unaltered while all microbial estimations shown considerable reduction in contamination. Hence, present filter is efficient in removal of contamination with an average 62.75 % with coast effectiveness.

Citation: Rahul Shivaji Patil, Sachinkumar R. Patil and Sonali Subhash Sathe, 2015. "Microbes-proof filter for juice shops", *International Journal of Current Research,* 7, (6), 16760-16764.

INTRODUCTION

Water is basic as well as primary need of all vital processes and it is now well established that the life first arose in aquatic environment (Patil *et al*. 2013). In rural and urban areas of India about 80% of water is from bore-wells, rivers, lakes, dug-wells, ponds, etc. These resources are fundamental and have great importance as no living things can survive without water due to its metabolic role (Khandare *et al*., 2013). Unfortunately clean, pure and safe water only exists briefly in nature and is immediately get polluted by some environmental factors and human activities. Water from most sources is therefore unfit for immediate consumption without any treatment (Raymond, 1972). Hence contamination of drinking water from any respective source has prime importance due to risk of water borne diseases (Edema *et al*., 2001). In India the chance of transmission of diseases through the fruit juices are due to adulterations and unsatisfactory hygiene. Micro-organisms are present inside as well as outside of fruits. The inner tissues of fruits are generally considers as sterile. However, few bacteria may be present as a result of the uptake of water through certain irrigation, washing procedures (Bagde and Tumane 2011) and unhealthy handing.

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Juices can be obtained by mechanical extractions of fruits or by reconstitution of concentrated fruit juice with the potable water. Usually water is used for preparation of variety of juices and this may add microbial load into juice. There are a wide range of treatment methods but, they have limitations such as effectiveness in removing contaminants, disinfecting water and high operation, maintenance costs (Earwaker, 2006) and hence there is a need for the development of such more efficient filter to remove at least microbial contaminants from the polluted water and juices. No any test for the water and juices could comply with the safety limits as prescribed by WHO. This fact certainly cannot be ignored, hence, there is an immense need to prescribe and follow stringent regulations regarding microbiological quality of juices and water preparations. In India most of the juice shop keepers doesn't take much precautions for avoiding microbial contamination which may cause harm and affects to consumers. So, the present investigation was undertaken to design and develop efficient filter with coast effectiveness and easy handling for juice shopkeepers.

MATERIALS AND METHODS

Design of Filter

I] Container: It contains the raw sample and exerts pressure as it is top by creating gravitational force.

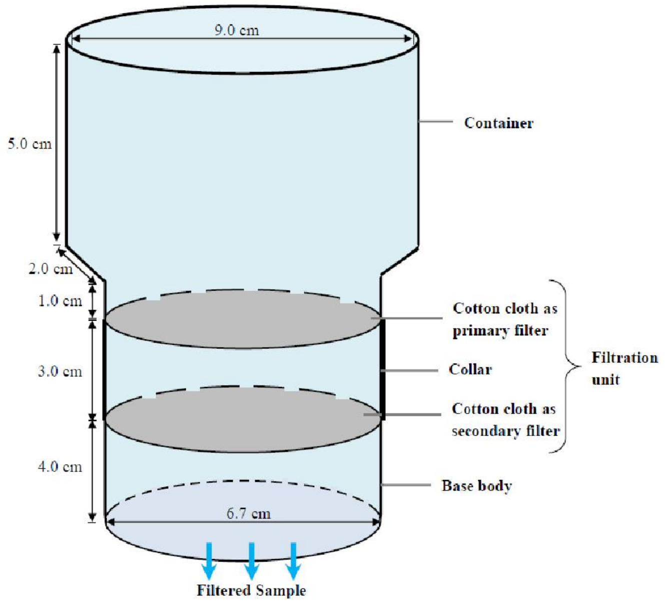
II] Filtration unit: includes two stages of filters

a)Primary filter- It is made up of cotton cloth which traps the microbes.

b)Secondary filter-It is also made up with cotton cloth and traps the microbes escaped from primary.

III] Base body: It gives support to the filter and creates way for filtrate.

IV] Way for filtered sample: By which one can collect the filtered sample in to final collector.



Collection of Samples

The samples of fruit juice were collected in sterile screw cap containers from local market of Gadhinglaj city and immediately transported to the Microbiology Laboratory in an ice packed container. The drinking water sample was collected from Municipal supply. All samples were homogeneously mixed before the microbial analysis.

Analysis of Physico-Chemical Properties (For water)

For the Physico-Chemical analysis, standard methods were used. The parameters like pH, E.C., Total hardness etc. were carried out. The sample for DO was fixed in the BOD bottle, while BOD was determined after 5 days keeping the bottles in dark. Winkler's method was followed for this analysis, while remaining analysis was made by the standard methods recommended by APHA (2005) and Trivedy and Goel (1984).

Analysis of Microbial Parameters

The Standard Plate Count (SPC) and Most Probable Number (MPN) were estimated as per the methods of Greenberg *et al*. (1992). Colony counter was used for enumerate the bacterial colony count. Membrane filtration technique was used for the enumeration of fecal coliform in the samples on MacConkeys agar in sterile petri plates. Total coliform were enumerated by using pour plate and serial dilution technique, on a Nutrient Molten agar as a medium.

RESULTS AND DISCUSSION

The variations in Physico-chemical parameters of water sample are presented in Table 1, whereas the microbial parameters of all the samples were noted in Table 2.

Table 1. Physico-chemical properties of water sample

Parameters	Before filtration	After filtration
Color	Colorless	Colorless
Odor	Odorless	Odorless
pH	07.71	07.53
E.C.	0.30 mho/cm	0.29 mho/cm
Total hardness	92.00 mg/l	88.00 mg/l
Chloride	18.21 mg/l	17.80 mg/l
Alkalinity	23.00 mg/l	21.00 mg/l
Total Dissolved Solids	208.0 mg/l	196.0 mg/l
Free CO_2	04.40 mg/l	04.40 mg/l
D.O.	07.20 mg/l	07.00 mg/l
B.O.D.	02.00 mg/l	0.80 mg/l

Odor and Color

The filter doesn't alter the odor and color of sample.

pH

The pH of water is highly governed by CO_2, along with carbonates and bicarbonates equilibrium. The pH value of water sample observed 7.71 while after filtration it was 7.53.

Electric conductivity

Electrical conductivity is an excellent indicator of Total Dissolved Solids, which is a measure of solubility which effects on the taste of potable water (WHO 1984). The E.C. values before and after filtration were 0.30 mho/cm and 0.29 mho/cm respectively.

Alkalinity

Alkalinity is dependent on release of CO_2, carbonates and bicarbonates in water. The total alkalinity values before and after filtration of water sample were 23 mg/l and 21 mg/l respectively.

Table 2. Microbial parameters of various samples

Sample/ Parameter	Water		Sugarcane Juice		Mango Juice		Mix fruit Juice	
	Raw	Filtered	Raw	Filtered	Raw	Filtered	Raw	Filtered
SPC	15 x 10^5	6 x 10^5	9 x 10^5	2 x 10^5	11 x 10^5	4 x 10^5	20 x 10^5	9 x 10^5
MPN	27 ± 1.0	09 ± 3.0	17 ± 1.0	05 ± 1.0	23 ± 1.0	08 ± 3.0	43 ± 1.0	11 ± 2.0
Total coliform	51 ± 2.0	19 ± 3.0	50 ± 1.0	20 ± 2.0	57 ± 2.0	19 ± 3.0	62 ± 1.0	30 ± 2.0
Fecal coliform	21 ± 1.0	10 ± 2.0	18 ± 2.0	7 ± 1.0	19 ± 3.0	8 ± 1.0	24 ± 2.0	10 ± 4.0

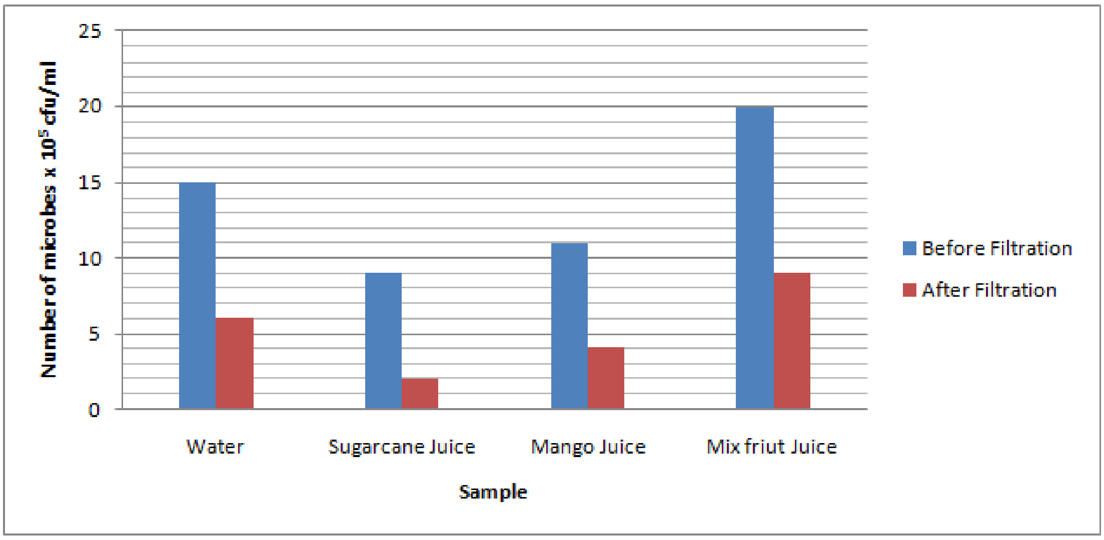


Fig. 1. Comparative status of SPC from various samples

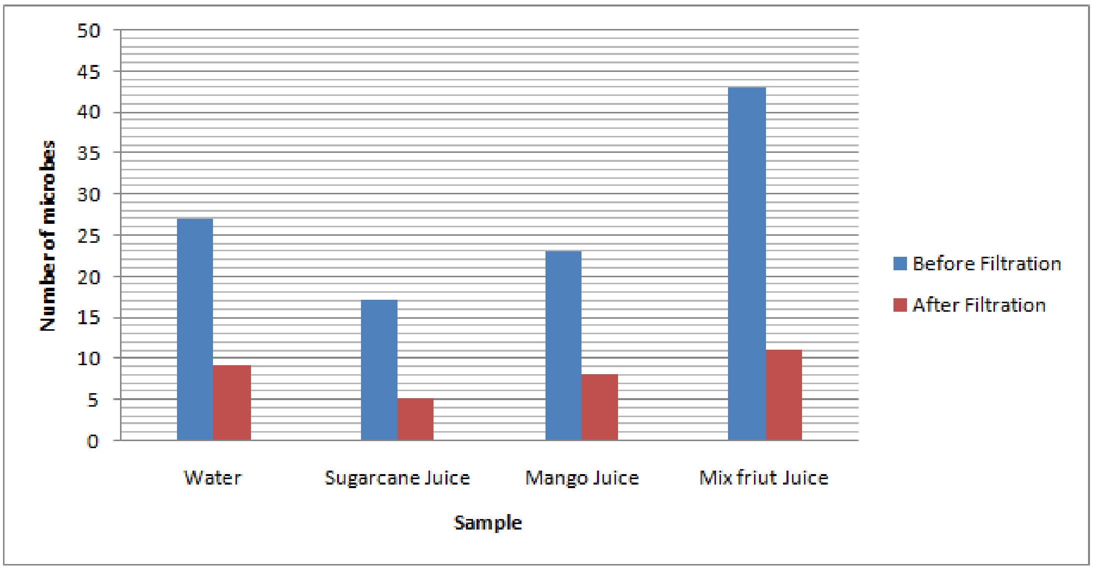


Fig. 2. Comparative status of MPN from various samples

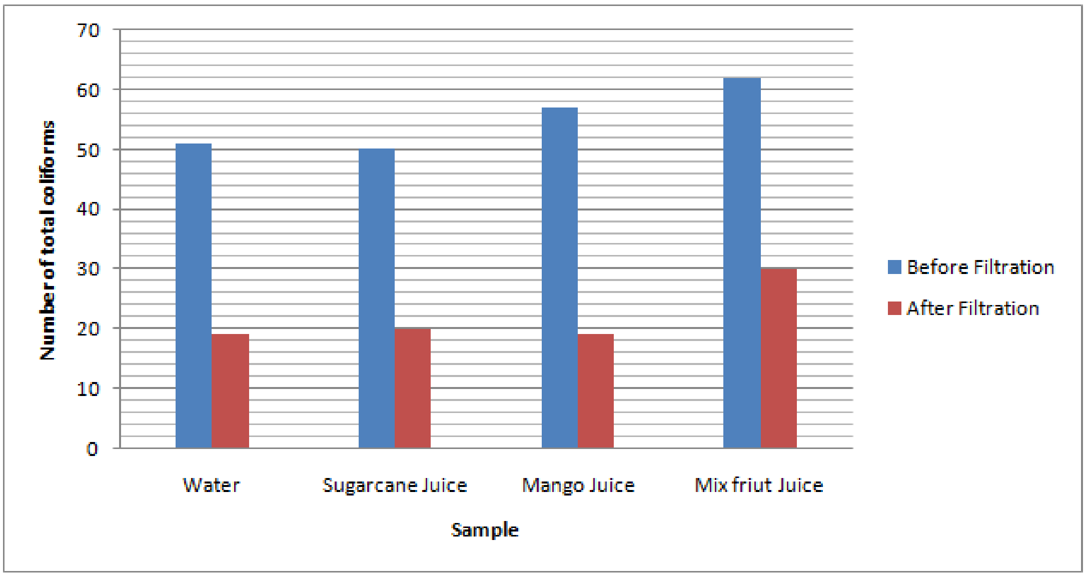


Fig. 3. Comparative status of Total coliform from various samples

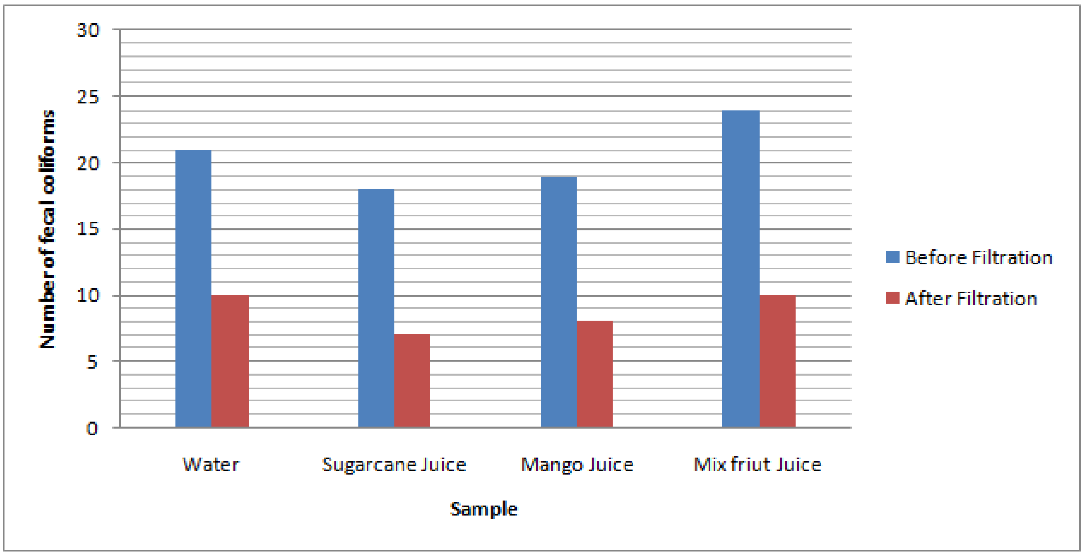


Fig. 4. Comparative status of fecal coliform count from various samples

Total Hardness

Total hardness is a sum of Ca and Mg concentration and it is expressed as $CaCO_3$. The total hardness for water sample observed 92 mg/l while after filtration it was 88 mg/l.

Chloride

The measure factor for accessing the water quality is chloride which acts as nutrient source for living organisms (Patil *et al.*, 2015). Chloride more than 250 mg/l impart a salty taste to water and people who are not accustomed to high chlorides might be subjected to laxative effects (Jadhav *et al.*, 2012). The chloride for water sample noted as 18.21 mg/l while after filtration it was 17.80 mg/l.

Total Dissolved Solids

The TDS of water is due to carbonates, bicarbonates, chlorates, sulphates, phosphates, nitrates and also due to the other ions. The TDS of water sample was found 208 mg/l while it found 196 mg/l after filtration.

Free CO_2

Free CO_2 of water is the result of temperature, depth, rate of respiration, chemical nature of bottom, decomposition of organic matter, and water body. The Free CO_2 evaluated before and after filtration was 4.4 mg/l.

Dissolved Oxygen

The regulation of aquatic life is depends on the presence of dissolved oxygen in water. D.O. is due to the assimilation of green plants. The D.O. of water sample was 7.20 mg/l and after filtration it was 7.00 mg/l.

Biological Oxygen Demand

Biological Oxygen Demand is the measure of decomposable organic matter present in the water. BOD value varies from 2.0mg/l to 0.8 mg/l for water sample before and after filtration, which shown minimization of microbial activity by the filter.

SPC; MPN; Total coliform and Fecal coliform

The standard Plate count, Most Probable Number, Total coliform and fecal coliform were analyzed for water and juice samples are presented in Table 2 which shown the filter is efficient to reduce the microbial load. The comparative status is represented in Figure 1, 2, 3 and 4. The filter is effective to reduce 60.46 % microbial load from water sample, for Sugarcane juice it is 67.37 % effective while for Mango juice and Mix fruit juice its shown efficiency up to 63.35 % and 59.84 % respectively (Table 3).

Table 3. Reduction rate of Microbes showing efficiency of filter

Reduction rate of microbes in / Parameter	Water	Sugarcane Juice	Mango Juice	Mix fruit Juice
SPC	60.00 %	77.78 %	63.64 %	55.00 %
MPN	66.70 %	70.59 %	65.22 %	74.42 %
Total coliform	62.75 %	60.00 %	66.67 %	51.62 %
Fecal coliform	52.39 %	61.12 %	57.90 %	58.34 %

Conclusion

The filter doesn't alter the physico-chemical properties of water. It is efficient to reduce the microbial contamination from water and Juices with an average 62.75 %. It is easy to construct, handle and coast effective.

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