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Cleaning and sanitization efficiency of some cleansing agents of natural origin

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Abstract

The study is conducted to identify the cleaning and sanitization efficiency of natural plant sources i.e. lime, aloe vera and soapnut. Different tests including solubility, pH, surface tension, foaming stability test, foam performance test, cleaning performance test, test for sanitization property were done to determine the cleaning and sanitization efficiency of these natural plant sources. The result reveals that the cleaning and sanitizing efficiency of lime was greater than aloe vera and soap nut. In the present study comparison among standard local detergent and natural plant sources were performed, wherein the chances of contamination due to synthetic detergents was overcome by using naturally available plant sources.

Keywords: Cleaning, sanitization, lime, aloe vera and soapnut

Introduction

The primary purpose of using a dishwashing detergent is to clean food remains off of dishware and cooking utensils. This soil removal process can occur via several mechanisms, including roll-up, emulsification, direct solubilisation, and formation of micro emulsion or liquid crystalline phases. It is hypothesized that solid inorganic soils are removed through a wetting and suspension mechanism, whereas solid organic soils, such as grease, are broken up and suspended in the water bath by the detergent. A cleaning compound is applied to remove remaining organic deposits. Detergents reduce the surface tension of water so that the solution can more effectively wet and penetrate soils adhering to the surfaces and facilitate subsequent removal. A sanitizer will help to kill remaining microorganisms. We use harmful chemicals as dish washing solutions which are available in wide varieties and brands a detailed study is necessary to identify the amount of residues that is being left behind in utensils and plates that we use for cooking purposes. It is said that cleanliness starts at home but the level of residues left behind with us and the effect of these chemicals in our ecosystem is a big upcoming problem. The objective of this study is to find alternatives to this problem at hand. That is to test the efficiency of the traditionally used substances such as lime, Soap nut solution and aloe vera with a standard solution that is commercially available in the market for cleaning and sanitization at home and dairy processing units.

Materials and Methods

Some of the commonly used materials that are used traditionally in household cleaning which were used in the study are listed below

Lemon juice (10%), Soap nut solution (10%) and Aloe Vera gel (10%)

A standard detergent solution was also prepared in order to create the comparison of the above proposed materials to be used as cleaning agents and sanitizing agent. The soil required to evaluate the cleaning efficiency of the cleaning agents were prepared from heat fixing of acid coagulated milk proteins. This material was spread evenly on glass slides which was the food contact surface in this study. The studies were performed at room temperature, in duplicates and values were recorded.

Soil preparation

Taken 5 ml of pooled milk sample in a petri plate, then add few drops of concentrated hydrochloric acid to the milk. Precipitated milk solids were transferred to a grease free pre weighed glass slide. Then heat fix it using flame and this glass slides is used to estimate the cleaning efficiency tests.

Evaluation of the cleaning agents

Solubility

Solubility test was done by taking 2% solution of each detergent in a conical flask. Each solution flask was heated in a water bath at 40 °C for 3 minutes. It was then left undisturbed for 2 minutes. The solution was filtered on pre weighed Whatmann filter paper 1 on Buchner funnel using vacuum pump. The filter paper with residue was carefully picked up and dried in oven at a temperature of 100 0C ±5 0C until a constant mass was obtained, and then final weight was taken. (Nitsch *et al.*, 2002)^[6]

pH

pH was determined by using digital pH meter.

Surface tension

Surface tension was determined by drop number method using Traube’s Stalagmometer apparatus. 0.1% solution of each detergent was used. Water was used as reference. (Nitsch and Huttman, 2002)^[6]

Foaming stability test

Foam stability was measured using Ross and Miles criteria. 10 mL of 0.1% detergent solution was taken in a test tube and shaken 10 times. The time for disappearance of 2 mm foam was recorded and compared. (Nitsch and Huttman, 2002)^[6]

Foam Performance test

The standard test for measuring foam volume has long been the Ross-Miles foam test. In this test, foam is generated under low agitation and controlled conditions, and both foam formation and foam collapse are assessed. Modifications of the principles of this test allow for quicker or simpler test procedures. Foam volume can be measured simply by inverting a graduated cylinder containing the diluted product. (Nitsch and Huttman, 2002)^[6]

Cleaning performance test

Cleaning static soak tests can be performed in three different ways that by agitation, dipping and rubbing. Here we use cleaning by agitation at orbital shaker for 7 minutes at 100 rpm to avoid any kind of bias. Milk soil removal was determined by the weight difference of a soiled surface before

and after agitating in test solutions. Clear glass slides were soiled with the above mentioned milk soils and immersed in test solutions (10%) taken in a beaker and agitated in a orbital shaker for 7 minutes at 100 rpm. The same was done with the standard detergent solution and compared with the standard. The cleaning property of the test solution used was validated with the standard clean plate.

Test for sanitization property

The official definition of sanitizing for food product contact surfaces is a process which reduces the contamination level by 99.999% (5 logs) in 30 sec. the objective in this study is to identify the sanitizing property of the test solution selected. Plate count agar (Merck, Johannesburg, South Africa) was used for the enumeration and detection of total viable count after incubation at 36 °C for 24–48h. Mainly two sampling methods were used, they are direct surface sampling or swab method and rinse method. Here we use rinse method.

After agitation in test solution wash it with 10 ml sterile distilled water before drying and this rinse solution was used to check the total viable count by pour plate method at 1 in 10 dilutions. It is the most commonly used method for validation of the sanitization property of detergents used for cleaning the utensils. The colony forming units will be estimated after the plate count agars with the sample kept in incubator overnight. The standard plate count agars are compared and the colony forming units are evaluated to find the efficacy for sanitization of the cleaning agents.

Result and Discussion

Qualitative analysis of the test solutions including pH of samples, solubility, surface tension, foam stability test, foam performance test, cleaning performance test and test for sanitization were done and results were recorded. All the test solutions selected for analysis including lime (10%), aloe vera gel (10%), soap nut (10%) and standards have pH 2.45, 4.32, 4.54 and 5 respectively. Solubility, foam stability test, foam performance test was high for soap nut when compared with lime and aloe vera. Surface tension was high for lime when compared with aloe vera and soap nut. The cleaning performance test using milk solids (MS) and test for sanitization using microbial count (TVC) are represented in tabular form and its statistical analysis are given below.

Table 1: Result of cleaning performance test in percentage

Sample	Milk Solids Reduced From Slides (In Percentage)						
	1	2	3	4	5	6	7
Standard	91	100	100	100	100	100	93
Lime	84	90	87	88	85	88	90
Aloevera	83	100	98	92	84	83	77
Soap Nut	61	87.5	72	79	82	73	90

Table 2: Result of test for sanitization

Samples	Microbial Count Obtained From Rinse (Tvc In Cfu/MI)						
	1	2	3	4	5	6	7
Standard	0	0	1	2	0	2	3
Lime	20	20	20	30	10	90	70
Aloe Vera	5.9×10 ²	9×10 ²	8.3×10 ²	6.4×10 ²	6.9×10 ²	7.6×10 ²	9.6×10 ²
Soap Nut	1.04×10 ³	9.8×10 ²	6.5×10 ²	6.9×10 ²	8.7×10 ²	9.3×10 ²	7.3×10 ²

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of ms is the same across categories of trt.	Independent-Samples Kruskal-Wallis Test	.001	Reject the null hypothesis.
2	The distribution of mc is the same across categories of trt.	Independent-Samples Kruskal-Wallis Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Fig 1: Result of statistical analysis of data using kruskal - wallis test

Treatment		Total viable count	Milk solids removed
1	Mean \pm Std. Error of Mean	1.14 \pm .459 ^c	97.714 \pm 1.4915 ^a
2	Mean \pm Std. Error of Mean	37.14 \pm 11.488 ^{b,c}	87.429 \pm 8.690 ^{a,b}
3	Mean \pm Std. Error of Mean	767.14 \pm 51.719 ^{a,b}	88.143 \pm 3.2618 ^{a,b}
4	Mean \pm Std. Error of Mean	841.43 \pm 57.588 ^a	77.786 \pm 3.7826 ^b
Total	Mean \pm Std.	411.71 \pm 77.972 ^a	87.768 \pm 1.8419 ^b
	Error of Mean		

Mean with different superscript will differ significantly from each other

A new cleaning technology of house hold cook wares by using traditionally available things like lime, soap nut and aloe vera which help to eliminating the use of harmful chemical cleaners and sanitizers causing residue formation were tested in this study. The study had tested the efficiency of the traditionally used substances such as lime juice, Soap nut solution and aloe vera gel with a standard solution that is commercially available in the market for cleaning and sanitization of precipitated milk protein from glass slides after heat fixing. From the result and statistical analysis it is clear that surface tension for lime juice (54.84 dynes/cm) was more when compared with aloe vera (29.7 dynes/cm) and soap nut (44.55 dynes/cm) which will improve its penetration power and wetting action for easy cleaning of milk solids from the slide under study. pH of lime (2.45) was low and which will improve its sanitizing power better than aloe vera and soap nut solution.

Conclusion

Study proved that the lime have more efficiency in cleaning and sanitization. Cleanliness starts at home but the level of residues left behind with us and the effect of these chemicals in our ecosystem is a big upcoming problem so to avoid this, it's better to follow the use of traditionally available plant juices, extracts etc for cleaning and sanitization processes.

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