PHILIPPINE SCIENCE HIGH SCHOOL WESTERN VISAYAS
Doña Lawaan H. Lopez Campus
Iloilo City

DIRT-REMOVAL CAPACITY AND ALLERGIC REACTIVITY OF ORANGE FRUIT RIND EXTRACT AS FACIAL CLEANSER

A Research Paper Presented to the
Faculty of Philippine Science High School Western Visayas
Iloilo City

In Partial Fulfillment
of the Requirements
in Technology Research II

by

Julter John S. Lacson
Trisha Marie J. Panes
Paul Christian L. Sobrevega

February 2004

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APPROVAL SHEET

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Abstract

This study aimed to show the effectiveness of orange fruit rind extract as facial cleanser compared to a commercial one. It specifically determined the dirt-removal capacity in terms of area and allergic reactivity of the extract on the face. The independent variable is the extract under different concentrations and the dependent variables are the dirt-removal capacity in terms of area and the allergic reactivity on the skin. The extract was categorized under different extract-water concentrations and each was applied on an assigned region of the face. After having done on three trials, results were observed, taken down and compared to the results of the commercial cleanser.

The outcome of this study showed that all the extract-water solutions under different concentrations except the 25%-75% have a significant difference compared to the commercial cleanser in

the dirt-removal capacity. They are capable of cleansing however they are inefficient.

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DIRT-REMOVAL CAPACITY AND ALLERGIC REACTIVITY OF ORANGE FRUIT RIND EXTRACT AS FACIAL CLEANSER

Chapter 1

Introduction to the Study

Background of the Study

Oranges are abundant in our country for large amounts are exported here in the Philippines. If sold at a normal price, they are almost always sought for their delicious taste. Oranges also are very good sources of Vitamin C and most Filipinos use them as prevention for common colds. They are believed to increase the resistance of the body against viruses causing colds.

Oranges are either eaten as table fruit or processed into related products; the most important is freezing the concentrated juice. Some products are chilled and are canned like canned juice, canned sections, and dehydrated powder. The peel, seed, and pulp, by the product of production, are used in cattle feed, molasses, and special products such as peel oil. Different types

of oil are abundant in our country having several sources existing. Sources are natural and could be artificial, too. It is known that production of oil is spontaneous, that is why uses can be obtained from this product.

This study focuses on essential oil, which is commonly extracted from plants, from their flowers, fruits, leaves, roots, seeds, and bark of some trees.

Essential oil may be grouped into five classes namely: alcohols, esters, aldehydes, ketones and lactones & oxides.

There are approximately 200 commercially produced essential oils, all obtained from oil-bearing leaves, flowers, bark, seeds, and wood of aromatic plants. These are the chemicals that form the aromatic essences of plants. The oil is a volatile substance, rarely soluble in water but otherwise on alcohol, either vegetable or mineral oil. They are usually not oily to touch.

The roots, seeds, pieces of bark, the flowers and leaves are very inconvenient to be extracted because there are too many of them which are capable of producing a variety of oils. We chose a certain fruit as a specimen, because it could be eaten before it could serve its use. We decided on the orange citrus fruit (*Citrus sinensis*), because large amounts are exported here in the Philippines. Pressing the orange rind produces this peel

oil. As of the present, orange oil is used in wood furniture surface conditioning, grease removal, hand-cleansing and is environmental friendly and non-toxic.

In society today, the rind is actually thrown away and considered useless. But going deeper, past researches proved that the oil extracted might possess some benefits to mankind. That is where this experiment should result. Using the peel in this experiment, it could lighten the load of environment a bit.

The independent variable of this study is the essential oil orange fruit rind extract concentrations of, while the dependent variables in this study are the dirt-removal capacity area, and allergic reactivity.

The relationship in these variables is presented in Figure 1.

Statement of the Problem and the Hypothesis

This study determined the effectiveness of the orange fruit rind extract in different concentrations as facial cleanser.

Specifically, it answered the following questions:

1. What is the dirt-removal capacity of extract-water solution with concentrations (a)100%-0%, (b)75%-25%, (c)50%-50%, (d)25%-75%, (e)0%-100% and (f) commercial cleanser in terms of area?

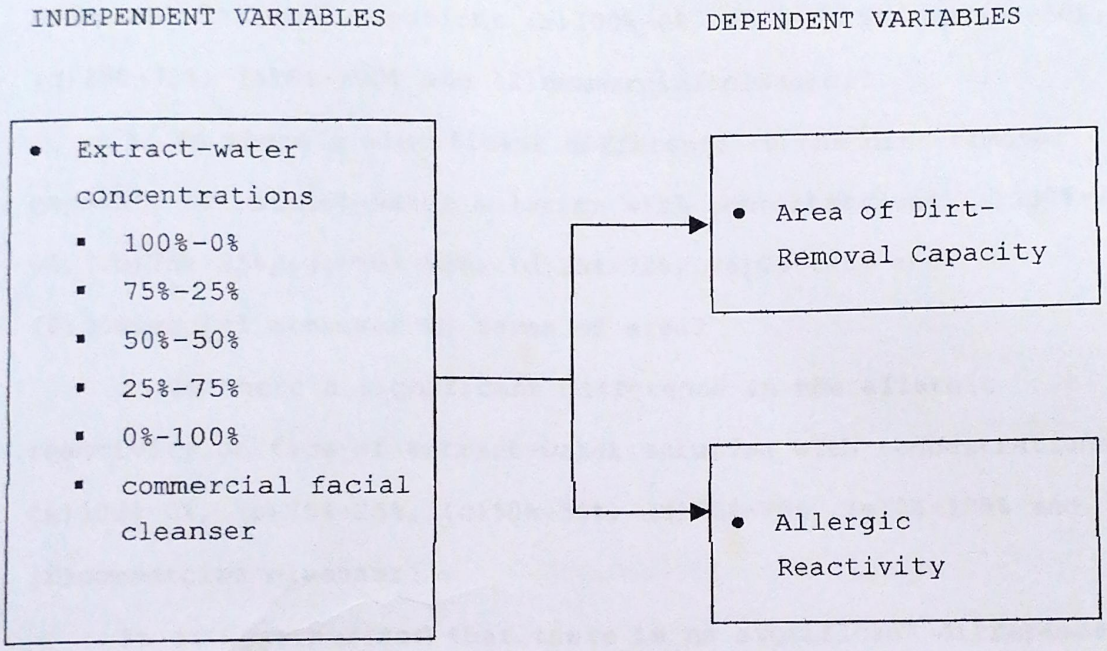

Figure 1. Dirt-removal capacity, and allergic reactivity of the orange fruit rind extract in different concentrations and commercial cleanser.

2. What is the allergic reactivity on face of extract-water solution with concentrations (a)100%-0%, (b)75%-25%, (c)50%-50%, (d)25%-75%, (e)0%-100% and (f)commercial cleanser?

3. Is there a significant difference in the dirt-removal capacity of extract-water solution with concentrations (a)100%-0%, (b)75%-25%, (c)50%-50%, (d)25%-75%, (e)0%-100% and (f)commercial cleanser in terms of area?

4. Is there a significant difference in the allergic reactivity on face of extract-water solution with concentrations (a)100%-0%, (b)75%-25%, (c)50%-50%, (d)25%-75%, (e)0%-100% and (f)commercial cleanser?

It is hypothesized that there is no significant difference in the dirt-removal capacity of extract-water solution with different concentrations and commercial cleanser in terms of area.

It is also hypothesized that there is no significant difference in the allergic reactivity of extract-water solution with different concentrations and commercial cleanser on the skin.

Significance of the Study

The implementation of this study and experiments showed mutual benefits for humans and nature. The orange rind is usually thrown away however, in this research experiment, having it undergone a process of extraction, reused it. Essential oil, which was extracted, was processed until it was tested for its cleanser qualities and effectiveness as disinfectant, which is discussed further in this paper.

When the extracted oil cleanser and disinfectant passes the standards of removing dirt, then a natural product is proved useful. The researcher is assured that the yielding process is natural compared to the commercial ones that were artificially produced. It is possibly advantageous, in financial means.

Definition of Terms

The following terms used in this study are given their conceptual and operational meanings.

Allergic Reactivity - an unusual or strong reactive response by the body to a foreign substance, especially to an infection, medication, food, or something that causes allergy.

(Microsoft Encarta Encyclopedia 2002. United States of America: 1993-2001 Microsoft Corporation). In this study, it is the formation of blemishes on the face after the different extract concentrations were applied.

Cleanser - cleaning product: a substance for cleaning something thoroughly; a cosmetic product for cleaning the face (Encarta Reference Library Dictionary (2003). Our cleansing agents used in this study are the commercial cleanser and the different extract-water concentrations.

Concentration - the amount of a substance dissolved in another. (Microsoft Encarta Encyclopedia 2002. United States of America: 1993-2001 Microsoft Corporation). In this study, we set the extract under different extract-water concentrations: 100%-0%, 75%-25%, 50%-50%, 25%-75%, 0%-100%.

Dirt-Removal Capacity - ability or the measure of the amount contained in taking away or getting rid of dirt. In this study, Dirt-Removal Capacity referred to the area of the face that was cleansed.

Extract - a substance obtained from a compound by an industrial or chemical process. Our extract in this study is the juice extracted from the orange fruit rind.

Rind - the skin or outer coat that may be peeled or taken off, as of fruit, cheese, bacon, plants, etc. (Webster's

Illustrate Contemporary Dictionary, 1992). Rind we used in this study is the outer covering of the orange fruit.

Scope and Delimitation of the Study

This study had a simple and practical oil extraction from the orange fruit rind. Oil extract was categorized under different extract-water concentrations and was tested on human face with results compared with those of a commercial cleanser. The effectiveness of the orange rind extract was measured in terms of dirt-removal capacity (area of dirt cleansed), and allergic reactivity on human skin. It also determined if the effectiveness passed the standards of Department of Health in Dermatology through comparing the results with those of the commercial cleanser.

The study included One-Way Analysis of Variance involving the comparison of substances, oil extract with different concentrations and commercial cleanser. Experiment was performed on three trials, requiring much time. The experiment was conducted in the laboratory of Hawaiian Philippine Company in Silay City, Negros Occidental.

Chapter 2

Review of Related Literature

This chapter consists of five topics, namely, (1) Orange (2) Orange Rind, (3) Essential Oil, (4) Latest Breakthrough 5) D-Limonene

The orange fruit has a sweet-sour taste and is commonly peeled and eaten fresh, or squeezed for its juice. It has a thick bitter rind, which is usually discarded, but can be used in cooking. The outermost layer of the rind is called the orange zest, and it has a similar flavor to the inner part of the orange. The white part of the rind is almost always discarded.

Orange oil, produced by pressing the peel, is used in surface conditioning of wood furniture and (along with other citrus oil) in grease removal, and is a hand-cleansing agent. Orange spray (extracted from orange peel) is an extremely efficient cleansing agent, which is environment friendly and non-toxic.

(http://www.wikipedia.org/w/wiki.phtml?title=orange(fruit)
2000 Wikipedia Free Encyclopedia)

Orange

Orange is the common name for the citrus fruit of several trees. Different varieties include the sweet orange, the sour orange, and the mandarin orange or the tangerine. The fruit is technically a *hesperidium*, a kind of berry.

They belong to the genus *Citrus*, of the family *Rutaceae*. The sweet orange is classified *Citrus sinensis*, the sour orange or Seville orange as *Citrus aurantium*, and the mandarin orange, or tangerine, as *Citrus reticulata*.

They grow on medium-sized evergreen trees, which under favorable conditions may yield fruit for 60 years or more. The pungent leaves have a glossy, wax-coated surface. The small white flowers, which are born in clusters, appear in the spring in the subtropics, but throughout the year in the tropical areas.

Botanically, the fruit is a berry known as *hesperidium*. Oranges are round to ovular and covered by a thick, leathery peel which turns yellow orange to deep orange when ripened in subtropical climates. In the tropics, ripe oranges are usually green to pale yellow. The inner pulp (endocarp) consists of 9 to 16 segments filled with juice vesicles. Ripe oranges normally contain 35 to 50 percent juices by weight, depending on the variety, climate, and cultural conditions. Oranges may be seedless (navel), nearly seedless, or seedy. Extracted juice

usually contain 9 to 12 percent total soluble solids (mostly sugars and citric acids); each fruit contain 20 to 60 mg (a small fraction of an ounce) of Vitamin C.

Oranges are either as table fruit or processed into related products, the most important is being frozen juice concentrate. Other products are chilled and canned juice, canned sections, and dehydrated powder. The peel of the rind, seed, and pulp by-products of the juice production are used in cattle feed, molasses, and special products such as peel oil.

The Fruit Rind

The orange rind, composed of two distinct portions, the *flavedo* and the *albedo,* is easily separated from the pulp, the edible portion of the fruit. The flavedo (epicarp), the outer portion of the peel, is composed chiefly carotenoid pigments, Vitamins, and essential oils. The albedo (mesocarp), the inner portion of the peel, is composed chiefly of cellulose, soluble carbohydrates, pectic substances (protopectin and pectin), flavanoids, amino acids and vitamins.

Essential Oils

Essential oils are several chemicals that form the odoriferous essence of a number of plants. The term essential is

also applies to similar synthetic substances prepared from natural essential oil.

Essential oil comes from the flowers, fruits, leaves, roots, seeds, and bark of many plants. Oil of lavender, for example, is derived from a flower, oil of pachouli from a leaf, and oil of orange from its fruit.

The essential oils are volatile liquids, mostly insoluble in water, but freely soluble in alcohol, ether, and vegetable and mineral oil. They are usually not greasy or oily to the touch. They may be grouped into five classes according to their chemical structure: alcohol, esters, aldehydes, ketones, and lactones and oxides.

Essential oils are obtained by one of the five methods: steam distillation, extraction by volatile solvents, expression by hand or machines, cold pressing, and enfleurage, a process in which fat is used as solvent.

Essential oil is the basic ingredient in the manufacture of perfumes, and is also used in soaps, disinfectants, and in similar products.

Latest Breakthrough: "Dalandan as detergent"

A major breakthrough in the local production of cleansing and detergent product was made with the use of Philippine grown

"bitter orange" (also a member of Citrus family) which is more popularly known as "dalandan".

Manufacturer Justrite Philippines Inc. has successfully extracted from dalandan an active surfactant compound used in the new dishwashing liquid products, the use of "dalandan" demonstrated the Filipino ingenuity to tap and develop environmental-friendly ingredients for such household materials.

In general, most ingredients in the manufacture of cleansing and detergent products are based on, or derived from petrochemicals.

(Manila Bulletin: September 25, 2003. Philippines)

"DeLemonene 2000... Heavy Duty Citrus Cleaner"

DELEMONENE 2000 is a pleasantly scented cleaner and degreaser formulated for a wide range of cleaning uses on washable surfaces. Natural citrus extract is formulated with wetting agents, surfactants and emulsifiers that include rust inhibitor to produce a formidable cleaner for many applications. This product is very concentrated and therefore required to have the correct dilution with water. This will make it very cost effective, a marvelous cleaner for the removal of most types of graffiti. It is not hard on the lungs, throat and eyes like most other graffiti removers.

D-Limonene is the major component of the oil extracted from citrus rind. When citrus fruits are juiced, the oil is pressed out of the rind. This oil is separated from the juice, and distilled to recover certain flavor and fragrance compounds. The bulk of the oil is left behind and collected. This is food grade d-limonene. After the juicing process, the peels are conveyed to a steam extractor. This extracts more of the oil from the peel. When the steam is condensed, a layer of oil floats on the surface of the condensed water. This is technical grade d-limonene.

In the past decade, the use of d-limonene has expanded tremendously. Much of the product goes into making paint solids, used to impart an orange fragrance to products, and used as a secondary cooling fluid. But the largest growth segment has been the use of d-limonene in cleaning products. This has occurred in both industrial uses and in household/institutional products. d-Limonene can be used either as a straight solvent, or as a water dilutable product.

As a straight solvent, D-limonene can replace a wide variety of products, including mineral spirits, methyl ethyl ketone, acetone, toluene, glycol ethers, and of course fluorinated and chlorinated organic solvents. As with most organic solvents, d-limonene is not water soluble, so it can be

used in the typical water separation units. With a KB value of 67, d-limonene has solubility properties close to that of CFC's, indicating that it is a much better solvent than a typical mineral spirit. Straight d-limonene can be used as a wipe cleaner, in a dip bath, or in spray systems as a direct substitute for most other organic solvents.

By combining d-limonene with a surfactant package, a water dilutable and rinsible solution can be made. In most cases these products are used in the institutional and household settings in place of caustic and other water based cleaners. A concentrated solution of a d-limonene/surfactant solution can be made to be diluted before use, or pre-diluted solutions can be formed. The use concentrations of d-limonene in these situations are usually 5-15%. In general these solutions are used as spray and wipe cleaners. The water dilutable solutions can also be used in industrial settings where a water rinse of the parts is desired to remove any residue which may remain.

D-Limonene is a very versatile chemical which can be used in a wide variety of applications. It is extremely safe and more effective than typical cleaning solutions.

With the banning of CFC's and other ozone depleting chemicals and increased awareness of work place safety, many different solutions for the parts cleaning industry have been

tried. D-Limonene, a naturally occurring substance extracted from citrus rind, is experiencing a growing acceptance as the solvent of choice. D-Limonene can be used straight or blended with an emulsification system in order to produce a water dilutable/rinsable product. It is capable of cleaning organic dirt loads ranging from light cutting oils and lubricants to the heaviest greases, such as cosmoline, very effectively.

From a personal safety standpoint, d-limonene is a much safer product for use than most other solvents. It is much less toxic than mineral spirits. D-Limonene is also non-caustic and non-reactive to metal surfaces. It has been classified as a slight skin irritant, but it is not carcinogenic or mutagenic. D-Limonene does not contain any ozone depleting chemicals, but is currently regulated as a VOC. The VOC status of the product is being investigated. D-Limonene is listed as a non-toxic chemical in TSCA, is not a SARA Title III compound, and is not regulated by the Clean Air Act.

Chapter 3

Research Design and Methodology

This study aimed to design an oil extraction process and determine the dirt-removal capacity of the orange fruit rind extract in different concentrations as facial cleanser compared with a commercial on. This study also determined the allergic reactivity of skin on the different concentrations of the rind extract and water.

It is hypothesized that there is no significant difference in the values and results of dirt-removal capacity and allergic reactivity on face using different concentrations of orange fruit rind extract and water and commercial cleanser.

The Research Design

The One-Spot Case Study was employed in achieving the aim of the study. The independent variable was the different orange fruit extract concentrations with water, 100%-0%, 75%-25%, 50%-50%, 25%-75%, 0%-100% and the commercial cleanser with the same volume. The dependent variables were the dirt-removal capacity and the allergic reactivity of these different concentrations on human skin. All concentrations had the same volume and differ

only in proportions with water. Same amount will be put on pieces of cotton similar in size and shape to be wiped on the face. Areas of the visible dirt were tabulated and analyzed. These results were used to determine the best proportion of extract and water to be used as facial cleanser and to compare its effects with the commercial one.

Methodology

Gathering the Materials and the Process

Orange fruits were prepared to gather the peelings that were required. After the peelings were removed, they underwent hand pressing, a manual process, to have the oil extract sprayed out. The oil extract was collected in a syringe which is a good substitute for a dropper. This is for the purpose of measuring small amounts of volume of the extract-water solution. Different concentrations of extract and water and commercial cleanser with equal volume were prepared in 6 test tubes.

Application

Each solution was applied on a piece of cotton and wiped on the different assigned regions on the face. All pieces of cotton are equal in size and shape. Areas of the dirt cleansed were

measured and observations of allergic reactions (formation of blemishes, itchiness, etc.) were taken down.

The application process is presented in Figure 2.

Statistical Data Analysis

Data gathered from this study were treated statistically, with the mean and standard deviation as descriptive statistical tools and One-Way Analysis of Variance as inferential statistical tool.

Mean

The mean was employed to express the average of the area of dirt-removal capacity of the different concentrations in three trials.

Standard Deviation

The Standard Deviation was used to determine the differences in comparing the different extract-water concentrations and the commercial cleanser.

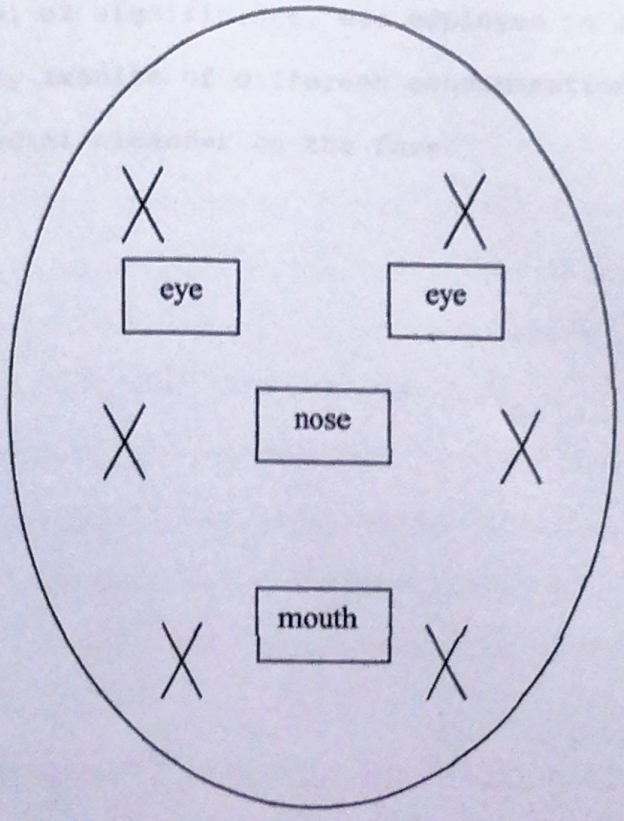

Figure 2. A diagram showing the face with assigned regions for the application of the different concentrations of extract-water solutions

One-Way Analysis of Variance

This one-way analysis of variance (One-Way ANOVA), set at 0.05 alpha level of significance, was employed to show the dirt-removal capacity results of different concentrations compared with the commercial cleanser on the face.

Chapter 4

Results and Discussion

This study aimed to design an oil extraction process and determine the dirt-removal capacity of the orange fruit rind extract in different concentrations as facial cleanser compared with a commercial one on the human face. This study also determined the allergic reactivity of skin on the different concentrations of the rind extract and water.

It is hypothesized that there is no significant difference in the values and results of dirt-removal capacity and allergic reactivity on human skin using different concentrations of orange fruit rind extract and water compared to the commercial cleanser.

Dirt-removal capacity of orange fruit rind extract in different concentrations as facial cleanser compared with a commercial one in terms of area

It is observed that the commercial cleanser has the greatest dirt-removal capacity having 2.9, 3.1, 2.7 square inches of thick-layered dirt the cotton has accumulated. Among the extract-water concentrations, having the highest mean of 2.800 square inches, the mixture with 25%oil and 75%water has the greatest dirt-removal capacity with 2.8, 3.0, and 2.6 square

inches of thin layered dirt. It is followed by 50%oil and 50%water concentration with a mean of 1.900 square inches of thin layered dirt, 0%oil and 100%water with a mean of 1.767 square inches of very thin layered dirt, 100%oil and 0%water with a mean of 1.400 square inches of thick layered dirt and lastly, 75%oil and 0%water with a mean of 1.133 square inches of very thin layered dirt. Only the pure extract accumulated thick layer of dirt among the different concentrations.

Table 1 shows the data.

Allergic Reactivity of orange fruit rind extract in different concentrations as facial cleanser compared with a commercial one

Among the different extract-water concentrations, only the 100%oil-0%water concentration showed signs of allergic reactions on the face. The rest of the concentrations including the facial cleanser showed no signs of allergic reaction.

Table 2 shows the data.

Significant difference in the dirt-removal capacity of the different orange fruit rind extract-water concentrations as facial cleanser compared to a commercial one in terms of area.

The One-Way Analysis of Variance showed that there is a significant difference in the area of dirt-removal capacity for

Table 1

Means of Dirt-Removal Capacity of Orange Fruit Rind Extract as Facial Cleanser With Different Concentrations

Concentration	N	Standard Deviation	Mean	Layer of Dirt
100%oil 0%water	3	.010	1.400	Thick
75%oil 25%water	3	.153	1.133	Very thin
50%oil 50%water	3	.265	1.900	Thin
25%oil 75%water	3	.200	2.800	Thin
0%oil 100%water	3	.153	1.767	Very thin
Commercial Cleanser	3	.200	2.900	thick

Table 2

Allergic Reactivity of Orange Fruit Rind Extract as Facial Cleanser with Different Concentrations

Different Concentrations	Allergic Reactivity
(a) 100% Oil 0% Water	YES
(b) 75% Oil 25% Water	NONE
(c) 50% Oil 50% Water	NONE
(d) 25% Oil 75% Water	NONE
(e) 0% Oil 100% Water	NONE
(f) Commercial Cleanser	NONE

the different extract-water concentrations and the commercial cleanser as referred by F(5)=45.706, Sig.Dif<0.5.

Table 3 shows the data.

All the concentrations except for the 25-75 have significant difference compared to the commercial cleanser so they don't have the same capacity.

Since there is significant difference, the Scheffe test was run.

The test showed that the 100-0,75-25,50-50,0-100 concentrations have the same potency and in comparison with the commercial facial cleanser, there is a significant difference while the 25-75 concentration has none.

Table 4 shows the data.

Table 3

One-Way Analysis of Variance for Significant Difference in the Dirt-removal Capacity of Orange Fruit Rind Extract with Different Concentrations

Variable	Sums of Squares	Df	Mean Square	F	
Area					
Between Groups	7.872	5	10574	45.706	.000
Within Groups	.413	12	.0344		
Total	8.285	17			

Table 4

Scheffe Test for One-Way ANOVA in Table 3

(I)	(J)	Mean Difference (I-J)	Standard Error	Significance
100-0 vs.	75-25	.267	.152	.688
	50-50	-.500	.152	.125
	25-75	-1.400*	.152	.000
	0-100	-.367	.152	.378
	Com	-1.500*	.152	.000
75-25 vs.	50-50	-.767*	.152	.010
	25-75	-1.667*	.152	.000
	0-100	-.633*	.152	.035
	Com	-1.767*	.152	.000
50-50 vs.	25-75	-.900*	.152	.003
	0-100	1.033*	.152	.001
	Com	-1.000*	.152	.001
25-75 vs.	0-100	1.033*	.152	.001
	Com	-.01	.152	.993
0-100 vs.	Com	-1.133*	.152	.000

Chapter 5

Summary, Conclusion, and Recommendation

This study aimed to determine the effectiveness of the orange fruit rind extract in different concentrations as facial cleanser

It specifically:

1. measured the dirt-removal capacity of (a)100%-0%, (b)75%-25%, (c)50%-50%, (d)25%-75%, (e)0%-100% extract-water solution, and (f) commercial cleanser in terms of area;

2. determined the allergic reactivity on human face of (a)100%-0%, (b)75%-25%, (c)50%-50%, (d)25%-75%, (e)0%-100% extract-water solution, and (f) commercial cleanser;

3. determined the significant difference in the dirt-removal capacity of (a)100%-0%, (b)75%-25%, (c)50%-50%, (d)25%-75%, (e)0%-100% extract-water solution, and (f) commercial cleanser in terms of area;

4. determined the significant difference in the allergic reactivity of (a)100%-0%, (b)75%-25%, (c)50%-50%, (d)25%-75%, (e)0%-100% extract-water solution, and (f) commercial cleanser;

It is hypothesized that there is no significant difference in the dirt-removal capacity of different extract-water concentrations compared to the commercial cleanser in terms of area.

It is hypothesized that there is no significant difference in the allergic reactivity of different extract-water concentrations compared to the commercial cleanser on the skin.

Summary

The findings of this study are summarized as:

1. The mean dirt-removal capacity in terms of area of (a)100%-0% is 1.400 square inches, (b)75%-25% is 1.133 square inches , (c)50%-50% is 1.900 square inches, (d)25%-75% is 2.800 square inches, (e)0%-100% is 1.767 square inches and (f) commercial cleanser is 2.900 square inches;

2. There is allergic reactivity present on face using the (a)100%-0% extract-water solution but there was none in (b)75%-25%, (c)50%-50%, (d)25%-75%, (e)0%-100% extract-water solution, and (f) commercial cleanser;

3. There is a significant difference in the dirt-removal capacity of (a)100%-0%, (b)75%-25%, (c)50%-50%, (e)0%-100%

extract-water solution compared to the(f) commercial cleanser in terms of area but there was no significant difference compared to the (d)25%-75% extract-water solution;

4. Since the value of the allergic reactivity is nominal, significant difference cannot be measured but it was observed that only the 100%-0% extract-water solution has an allergic reactivity.

Conclusions

The orange fruit rind extract, categorized under different concentrations, was proven to be capable of being a facial cleanser basing the results of its dirt-removal capacity and allergic reactivity. It is capable but not efficient considering that a 100% extract concentration can cause allergic reactivity and has a low amount of dirt-removal capacity. Other concentrations, most having no significant differences among them, can be inferred capable but inefficient except for the 25%oil and 75%water concentration because it has the highest mean and doesn't cause allergic reactions.

Recommendations

It is recommended for the 25%-75% extract water solution extract to be used as facial cleanser basing on the results of its dirt-removal capacity and allergic reactivity. It is suggested that this experiment should be subjected to further studies, experiment with more trials and varying concentrations.

Extract and water mixture couldn't maximize its potential of being a cleanser thus, this experiment requires additives. These additives are those substance possessing same characteristics of cleansing. This experiment could be improved still through other different set-ups that were not studied or tested yet.

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