Enrichment of Soap Formation from Fruit Extraction

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Abstract

In this study, three fruit waste had been used and tested to enrich the quality of soap. Some of improvements were recorded such as foaming ability, moisture content and solubility time to dissolve the soap. Only non-edible parts of the fruits were used in this study. It proves that this study is not only to enrich the soap, but it also can help to improve the waste utilization for a better recovery of the fruit waste. This study was done by crushing dried papaya seeds, pitaya peels and orange peels. The finding result from this study can be beneficial towards the human personal care and also for getting high potential of the thought on environmental guidance. Currently, over 23000 waste was generated each day in Malaysia. The soap from fruit extraction have more benefits as it comes from natural sources and does not use hazardous chemical that can have adverse effects to human health.

Keywords: fruit peels; orange; pitaya; papaya; saponification

1. Introduction

Soap is a substance that is usually used for washing and cleaning purposes. Soap can be produced by a process called 'saponification' which involved fats and oils or fatty acids. Antibacterial soap is a soap that contains chemical ingredients which is designed to kill unwanted bacteria. This soaps can enhance our health by safely remove unwanted germs and other contaminants. Many alternative ways to add antibacterial values including using waste product that contain antibacterial component into the soap. This method gives many advantages as it is a green method because it does not involve much chemical and relatively cheap as the raw material can be obtained by waste. Population increase patterns and lifestyle has been the main drives of an increased waste production and had affect the waste disposal which causes several impacts on environment thus public health (Félix et.al 2017). In the last decades the waste management become a major issue and several processes have been devised for organic waste treatment. One of waste that have been used in collecting antibacterial values is fruit peels. Fruit that is commonly used such as mangosteen have been used since the ancient times to cure sicknesses such as trauma, skin diseases, abdominal pain, dysentery and wounds. Fruit peels as basic natural source of antioxidants can increase the performance of soap. The processes in formation antibacterial soap are saponification and extraction process (Warra, 2013).

In this study, the fruits that have been used are papaya, dragon fruit and orange. Papaya can be found usually in equator of earth, including Malaysia. Climate condition in this area is the best for papaya plant to grow and supply of good papayas is easily available and the price is also low and affordable. Papaya is one of the fruits that rich sources of antioxidant nutrients such as carotenes, vitamin C and flavonoids, vitamin B and the minerals such as potassium, copper, magnesium and fibre (Septembre-Malaterre et. al 2016). It can help to reduce inflammation, fight disease and help in slow down the effect of aging process so people will look younger if they consume papaya fruits. Due to the high annual consumption, great amounts of papaya seeds are generated in the industrial processing and are considered wastes. Papaya seeds contain compounds that have antioxidant properties such as phenolic and flavonoid. Flavonoid also have anticancer properties (Majumder et. al 2017). It also has high levels of proteolytic enzymes which help to breaks down protein, parasites and their eggs in the body. People who contains a lot of toxins in their body, papaya seed also provide detoxification to metabolize any drugs or alcohol in the system to clear the toxic influence in the body. Also, to a matured married couple, in order to have a healthier embryo that leads to a healthier baby, papaya seed also provide an effect which good for human's fertility. It will make the production sperm increase for male and

for female, it will make the ovum stay in a fertile. This is why benefits in fruits are highly recommended and preferred by consumers.

Dragon fruit is also rich in antioxidant properties which is phytonutrients that can help in fighting for our health such as fighting free radicals that could lead to cancer. Fruit that loaded with antioxidants is said to keep our heart healthy and our skin will look young. Dragon fruit or known as pitaya can be obtained from several cactus species known as Cactacae and order of Caryophyllales (Nurliyana et. al 2010). Its stem provides the amazingly delicious fruit with moisture in the arid climates where it is easily can be found and grows. Dragon fruit contains betalain pigment or known as purple pitaya which gives dragon fruit purple in color that makes it more unique and different from other fruits (Priatni et. al 2015). Colors are important quality indicators that determine the consumer acceptance of foods. In recent days' market for application of synthetic colorants has decreased due to its toxic nature. Therefore, nowadays strong consumer demand for more natural product which is more safety and health benefit because of the public concern about possible or proven harmful effects of artificial food colorants in food processing industries, thus the trend toward replacement of synthetic colorant by natural product has been increasing although it has higher cost. Its peel has the high content of betalain contents and it have many uses and disposal of its peel only causes disadvantages to us. Its waste product could be utilized as a potential alternative for various sources of nutrients or antioxidants to improve human health (Thirugnanasambandham et. al 2017).

Orange is commonly known as excellent source of vitamin C and antioxidant compounds. It is beneficial as vitamin C helps to improve our immune system. Ranking after apples, oranges are the second most produced and consumed fruit in continental Portugal. However, and because of its acidity, citrus peel cannot be used in composting, generating large amounts of non-processed waste. Fruit peels like orange are normally wasted during eating thus a proper waste utilization of these peels were done. It can be used to produce an antioxidant in antibacterial soap. Orange peel contain fiber which is in the form of pectin that helps clean the intestines and control blood cholesterol levels. However, orange peels normally bitter than the flesh so it is not good to consume it regularly as it can lead to digestive problems. The process that involved in this study are saponification and extraction. For extraction process, it is one of the main process to produce antibacterial soap. The extract from this process will be added with the soap in saponification process to obtain an effective antibacterial hand washing soap. This process is using dragon fruit peel, orange peel and papaya seeds to find out the right amount of antioxidant in the fruits. The objective of this process is to identify the effectiveness of these waste products act as source of natural antioxidants towards a several types of common pathogens in the environment and also test with related factor for hand washing effect.

2. Methodology

2.1 Material Preparation

Waste peel and seeds used as a main raw material in the extraction process for hand wash formulation. Peel used are from dragon fruit and orange while seeds are from papaya. Before the extraction process, the dragon fruits peel was freeze dried in order to remove moisture content of the peels and the seeds. These waste are normally oven dried at 90°C for 1 day before further processing.

2.2 Extraction

2.2.1 Extraction of papaya seeds

Papaya seeds were washed with distilled water and it will be pressed in sieve. This is to remove the exotesta in papaya seed. Then, the seeds were washed again and stored in plastic vessels at -10°C before the drying process. After the drying, 60 gram of dried papaya seeds were put in 1000mL of volumetric flask with 300mL of hexane. The mixture was measured about 500mL (Chielle et.al 2016a)

2.2.2 Extraction of orange peels

Orange extraction oil was extracted from orange peels using rotary evaporator with temperature 100°C for the boiling point of distilled water. The internal white part of orange peels was removed. The external part of orange peel then dried and finely ground. Measured 100 g of orange peel powder were placed in a 1000mL round bottom flask and suspended in 300mL of deionized water. The mixture was refluxed and distilled to become a mixture that contain essential oil and water that has been collected for 2 hr. The extract was separated using a separation funnel and then stored in stoppered glass flask.

2.2.3 Extraction of dragon fruits peels

The dragon fruits peel that has separated from pulp of the fruits were washed. Peel of dragon fruits were dried in the oven with temperature 70°C until all the moisture is gone. The sample then was ground to get fine powder (5g) and was placed in 1000mL beaker and dissolved in 30mL of ethanol-distilled water with ratio 3:2. Then, it will subject to agitation at 150 rpm at room temperature using a shaker until it fully dissolves. The mixture from the shaker was centrifuged at 4000 rpm for 10 min and the supernatant was filtered through filter paper. After that, the residue from the mixture was re-extracted twice were both extracts were combined and concentrated in a rotary evaporator at 35°C. The crude extract obtained was then freeze-dried, vacuum packaged and stored in the refrigeration until further analysis.

2.3 Production of soap

60mL of lye was put into 100mL water and stir until it is clear. 500mL of cooking oil was heated to 120°C. Oil to simmer until 90-105°C to make sure right temperature for stirring. The lye is then added to the oil slowly and stir for 2 minutes then fruit extract added.

2.4 Performance of the soap

2.4.1 Effectiveness soap testing

The effectiveness of washing hand and effectiveness of soap produced can be determined by using glo germ. A test was conducted at infection lab by using glo germ and UV light box to detect the germ. This testing was conduct at Infection Centre Hospital Sultanah Aminah Johor. Area of glo germ presence before and after is taken as data for effectiveness of soap to remove stain from hand.

(a) (b)

Figure 2.1. (a) UV light box (b) glo germ

2.4.2 Moisture test

The moisture testing is conducted by preheating the oven to 105°C. It is important that the temperature should be above the boiling point of water but not so high as soap decomposes. After that, the evaporating dish was placed in the oven for 1 hour and beaker tongs was used to remove the dish from the hot oven and allow it to cool for 5 min. The cool dish was placed and the empty weight as XX was recorded. Then the dish was removed from the balance and 5g of soap shaving were filled in it. The dish was returned to the balance with total weight of dish and soap was recorded as YY g. The filled evaporating dish was placed in the oven for 1 hour. Beaker tongs was used to remove the dish from the oven and cooled it for 5 minutes. After that, returned the dish to balance and the total weight of dish plus dried soap, ZZ g. The moisture content was measured with three numbers are needed to calculate the moisture concentration which is the weight of the empty dish, the dish filled with moist soap and the dish filled with dry soap. Equation below shows the calculation for the moisture concentration.

Calculating Moisture Concentration Percentage

$$MC = 100\ \%\ X \left(\frac{(YY.YY - XX.XX) - (ZZ.ZZ - XX.XX)}{(YY.YY - XX.XX)} \right) \qquad \text{Eq (1)}$$

XX = weight of empty dish

YY = dish + soap weight

ZZ = dish + soap after drying weight

Initial mass before drying: (YY - XX) g

Initial mass after drying: (ZZ - XX) g

2.4.3 Foaming ability test

For foaming ability test, 0.2 g each of the soap sample was measured and put into a 100mL of measuring cylinder containing only 10mL distilled water. The mixture was shaken vigorously so as to generate foams. After shaking for 2 min, the cylinder was allowed to stand for about 10 min and the height of the foam was then measured and recorded. The steps were repeated for the other prepared soap as well as the commercial soaps.

2.4.4 pH test

The pH value for soap is determined using a pH meter. The 5.4 g soap was weighed and dissolved with 80mL distilled water and made up 100mL mark to afford 1 % homogeneous soap solution. The electrode of the pH meter was inserted into the solution. The value of the pH meter was recorded (Mendes et.al, 2016).

2.4.5 Solubility test

0.2 g of soap was added to a 100 mL measuring cylinder which contains 10 mL of distilled water. The time of the dilution of soap after continuous agitation was recorded. (Atolani et al., 2016)

2.5 Testing for oil extraction

2.5.1 Saponification Value

The saponification value is to evaluate the presence of free fatty acid and the ability of the oil in forming bubbles which indicates that the soap was made by referring to ATM D 5558 as standard method. This evaluation used sodium

hydroxide in adding to the oil. The soap is heated with distilled water. Then, the saponification test use phenolphthalein as indicator to the boiled solution. Hydrochloric acid is used to neutralize the sample.

3. Result and discussion

3.1 Effectiveness testing

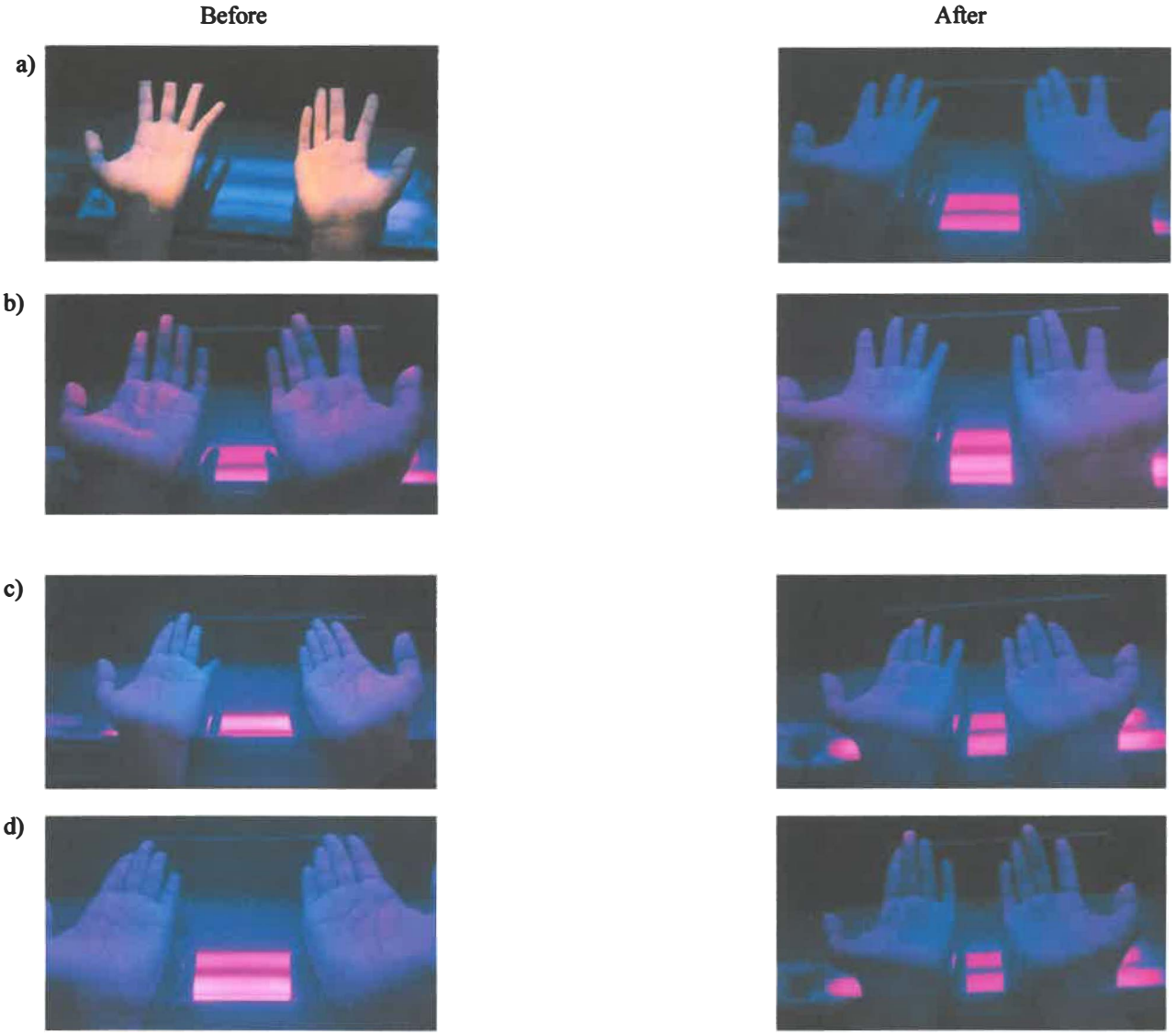

Figure 3.1. Before and after hand wash using different types of soap; (a) Dettol; (b) Papaya; (c) Orange; (d) Dragon fruit

This test was carried in Hospital Sultanah Aminah at infection centre. For effectiveness test, four types of soap is tested which is commercial soap and other three types of soap are soap from extraction of fruits. A common bar soap contain Triclocarban (TCC) which has side effects that may contain carcinogenic impurities, it can be acutely harmful, it can change the endocrine system, it is an allergen and it is one of the source for environment pollution (Kim & Rhee, 2016). Glo germ were used to test the effectiveness of the soap while scanning it in UV light box (Conover & Gibson, 2017). Figure 2 (a) shows that glo germ were squeezed on hand and was washed with commercial