

ARE LOCALLY MADE SANITARY PRODUCTS CONSUMER-COST FRIENDLY?

ABSTRACT

The COVID-19 pandemic has not only resulted in a staggering number of casualties but has also led to a significant depletion in the availability of crucial sanitary supplies worldwide. In the province of Northern Samar, this shortage was keenly felt, with essential items like face masks, rubbing alcohol, and soap becoming scarce within the first week of the gradual closure of businesses. Consequently, individuals with limited financial means encountered immense challenges in obtaining these vital sanitary products to safeguard themselves against the deadly virus. As the sole public institution of higher education in Northern Samar, the University of Eastern Philippines (UEP) took proactive measures to address the dwindling supply of sanitary goods. Leveraging its research and development unit, UEP embarked on initiatives to bolster local communities' access to essential items. Notably, these efforts included the production of antibacterial bar soap derived from *Salacia korthalsiana* Miq. (Polipog) and bioethanol extract sourced from *Nypafruticans* (Nipa) palm. These innovative products developed by UEP were subsequently distributed to underserved communities across Northern Samar. Through a comprehensive cost-benefit analysis, it was established that UEP's offerings were significantly more affordable compared to those available in commercial outlets. This underscores the potential for UEP, with adequate financial backing from both internal and external sources, to continue developing cost-effective sanitary solutions tailored to economically disadvantaged communities' needs.

Keywords: accessibility efforts, cost-effectiveness, local resilience, sustainable development, sanitary products

I. INTRODUCTION

Since the onslaught of the COVID-19 pandemic, UEP has been distributing products such as disinfectants, lab-made ethyl alcohol, and polipog liquid soap to its internal working force. These products have been distributed to the provincial and local government, stakeholders, and the UEP community. Each production has keen manufacturing and sanitary procedures that were observed during the duration of this project. All products were submitted for physicochemical tests before distribution and use. The local government was tapped in distributing the products. This project, however, does not end with the current pandemic. It is envisioned as a sustainable income-generating project of the University, once the situation normalizes, at no extra cost. It would also serve as a training ground for students. Also, the raw materials such as *Nypafruticans* (Nipa) and *Salacia korthalsiana* Miq. (Polipog) plant sample is seen to be available since it is not fully utilized in the province.

Nipa is a locally known natural resource in Northern Samar (Dagalea *et al.*, 2022). Its leaves are used as roofing, but there is little too much information on its fruit. The fruit of the nipa palm generates starch that could be used for the biosynthesis of zinc oxide nanoparticles (ZnONps). ZnONps, when reduced to nano-sized is an effective antibacterial agent, killing gram-negative and gram-positive bacteria (Dagalea, Lim, 2018; Dianito *et al.*, 2022). Although there are other metal oxides present in the market today, ZnONps exhibit different properties and are easier than other metal oxides (Lim *et al.*, 2020; Dagalea, Lim, 2021).

The different island towns of Northern Samar are home to a population of around 700,000 individuals who rely on various species of palms, such as *Nypafruticans* Wurm (Nipa), for their subsistence. Despite being surrounded by Nipa, the people of Northern Samar have not fully utilized this plant resource. Currently, the only use for Nipa leaves is for roofing, and the fruit remains economically useless. Nipa palm, also known as *Nypafruticans*, is a type of palm that is indigenous to the coastlines and estuarine habitats of the Indian and Pacific Oceans. It is unique in that it is the only palm that is suited to the mangrove biome. *Nypafruticans* is the only member of the genus *Nypa* and the subfamily *Nypoideae*, making it a monotypic taxon (Hai, 2016).

Once the fruits have matured, they are typically detached from the infructescence by the developing plumule and then carried by tidal water until they reach a suitable substrate where they can begin to grow. In this process, the radicle may not develop and the first root that emerges is likely to be an adventitious one. Initially, the seedling grows horizontally, but once it anchors to the substrate, the plumule grows upwards and additional adventitious roots appear from the lower stem. The leaves on very young seedlings are arranged distichously, but later they become arranged spirally. Typically, up to eight bladeless sheaths develop per plant before the first juvenile foliage leaves emerge, which usually happens 3-6 months after germination. As the stem grows, it inclines downwards until it reaches a depth of approximately 1 meter in the ground during early growth (Hai, 2016).

Nypafruticans undergo a fermentation process using yeast for at least 14 days to extract the bioethanol from it and was subjected to a quality test. The technical grade ethyl alcohol and bioethanol from *Nypafruticans* were the sources of raw materials in making a laboratory-made ethyl alcohol. These two raw materials were classified as to which it was distributed, the lab made ethyl alcohol from technical grade ethanol was supplied to the hospitals in the province to combat the shortage of rubbing alcohol, on the other hand, the lab-made ethanol from *Nypafruticans* was distributed to the other target beneficiaries. Laboratory-made ethyl alcohol is the sum composition of ethyl alcohol (technical grade or bioethanol), hydrogen peroxide, glycerol, and distilled water (Lim *et al.*, 2020).

Salacia korthalsiana Miq. commonly known as Polipog, is a traditional plant used to treat different diseases (Lim *et al.*, 2020). It is used as anti-inflammatory, anti-septic, antimicrobial, and others (Alvarez *et al.*, 2020; Ambida, Tonog, 2020; Somoray, Doncillo, 2020). *Salacia korthalsiana* Miq. is generally a climbing shrub with woody stems that twine into the surrounding vegetation and can be up to 18 meters long (Belga *et al.*, 2021). Occasionally the plant produces erect branches and then more shrub-like, or even a tree, growing up to 10 meters tall. The polipog plant is harvested from the wild for local uses as food and medicine. The extracts of *Salacia korthalsiana* Miq. (Polipog) was used in making the liquid and bar soap. Face mask production was supervised by the BTLED program of the University. Also, additional protective coatings were added to help the washable face mask combat the unnecessary bacteria present on the textile's surface.

II. METHODOLOGY

This research involves a descriptive-experimental research design. This includes a cost analysis of the sanitary items versus the commercially available ones. The 70% lab-made ethyl alcohol was prepared by using 833.3 mL of bioethanol from *Nypafruticans*. About 41.7% of glycerol was added to the above solution and stirred. After mixing, add 15.3mL of hydrogen peroxide, then add 252.7mL of distilled water.

The cold process for the preparation of soap was utilized in this study. A separate flask weighs about 283.5 g of coconut oil, 283.5 g of olive oil, 85.05 g of rice bran oil, and 155.93 g of sunflower oil. After weighing, place all the measured oils into the crockpot. Work in a ventilated area. Turn the crockpot on high and melt all the oils. In a separate container weigh 708.75 g of distilled water and measure about 255.15 g of potassium hydroxide. The lye solution was mixed into the weighed distilled water. After stirring, the lye solution and polipog root extract were added to the oils. The solution was stirred using a blender. The soap mixture was placed in a molder and allowed to cure for 4 to 6 weeks After unmolding the loaf of fresh soap, slice it into bars and allow them to cure in the open air for at least 4 to 6 weeks. The final product was stored in a cool area away from excess heat, sunlight, and humidity.

III. RESULTS AND DISCUSSION

The figures below explained the cost analysis of sanitary items developed by the university. In Figure 1, the cost analysis of the antimicrobial bar soap (Php9.00/piece) is much lesser than the commercially available soap which cost about Php15.00. This tells us that the developed sanitary item is customer friendly and can be acquired by less-in-life individuals. Figure 2 also provides an idea of how much cheaper our developed lab-made ethyl alcohol is. Based on the cost analysis, some 500mL of the lab-made ethyl alcohol only cost Php40.00 which is cheaper than commercially available ethyl alcohol of 500mL which cost Php95.00. Figure 3 shows the cost analysis of the antibacterial facemask which only costs Php9.00 per piece. The antibacterial facemask contains biocomposite solutions that can inhibit the growth of pathogenic microorganisms. The commercially available reusable facemask cost Php20.00/piece.

The figures explain that the sanitary items developed by UEP could be a substitute for the commercially available items. This only proves that local resources, if used properly, could generate income for the farmers and could offer cheaper products.

| ANTIMICROBIAL BAR SOAP WITH POLIPOG EXTRACT | |
|--|----------------------------|
| MATERIALS | PRICE PER BATCH PRODUCTION |
| NaOH | Php60.00 |
| Canola Oil | 325.00 |
| Distilled Water | 19.00 |
| Castor Oil | 150.00 |
| <i>Salacia korthalsiana</i> Miq. (Polipog) Extract | 150.00 |
| CDEA | 27.00 |
| NaCl | 20.00 |
| Molder | 250.00 |
| TOTAL | Php1001.00 |
| LABOR PER HOUR BASIS | |
| Lab Personnel (2) @ Php44.00/hr | Php264.00 |
| TOTAL | Php264.00 |

**In one batch production, 160 pieces of bar soap is produced. A batch production incurred two (2) hours of labor and one (1) hour packaging.

$$\text{COST per BAR SOAP} = \frac{\text{Materials + Labor}}{\text{No. of Products produced}} = \frac{\text{Php1001.00} + \text{Php264.00}}{160 \text{ pieces}} = \text{Php7.90625}$$

$$\begin{aligned} \text{Price of Antimicrobial Bar Soap in the market} &= \text{Cost} + \text{Profit} \\ &= \text{Php7.90625} + \text{Php1.09375} \\ &= \text{Php9.00 per piece} \end{aligned}$$

| LAB MADE ETHYL ALCOHOL | |
|--|----------------------------|
| MATERIALS | PRICE PER BATCH PRODUCTION |
| bioethanol from <i>Nypa fruticans</i> (Nipa) | Php100.00 |
| Glycerine | 50.00 |
| Hydrogen Peroxide | 20.00 |
| Distilled Water | 20.00 |
| TOTAL | Php190.00 |
| LABOR PER HOUR BASIS | |
| Lab Personnel (2) @ Php44.00/hour | Php88.00 |
| TOTAL | Php88.00 |

**In one batch production, 8 pieces of 500 mL of lab made ethyl alcohol is produced. A batch production incurred one (1) hour of labor.

$$\text{COST per LAB MADE ETHYL ALCOHOL} = \frac{\text{Materials + Labor}}{\text{No. of Products produced}} = \frac{\text{Php190.00} + \text{Php88.00}}{8 \text{ pieces}} = \text{Php34.75}$$

$$\begin{aligned} \text{Price of Lab Made Ethyl Alcohol} &= \text{Cost} + \text{Profit} \\ &= \text{Php34.75} + \text{Php5.25} \\ &= \text{Php40.00 per 500mL} \end{aligned}$$

Figure 1. Cost analysis on the antimicrobial bar soap

Figure 2. Cost analysis on the lab-made ethyl alcohol

| MATERIALS & PRODUCTION EXPENSES | | PRICE |
|---|--|------------------------|
| MATERIALS AND OTHER EXPENSES (in 3 months) | | |
| PVK | | Php300,000.00 |
| Glycerol | | 240,000.00 |
| Sorbitol | | 240,000.00 |
| Non-woven textile | | 900,000.00 |
| Threads | | 200,000.00 |
| Needles | | 200,000.00 |
| Distilled water | | 200,000.00 |
| Packaging Materials | | 150,000.00 |
| Cutting Materials | | 10,000.00 |
| Binders for the nipa biocomposite solution | | 100,000.00 |
| Caustic Soda | | 150,000.00 |
| Communication Expenses | | 40,000.00 |
| Utilities | | 20,000.00 |
| LABOR | | |
| Laborer (4 sewers) @ Php300.00/day x 3 months (at most there are 20 working days in a month) | | 72,000.00 |
| Honorarium (Project Leader) @ Php8,800.00 x 3 months | | 26,400.00 |
| Honorarium (Project Member) @ Php7,500.00 x 3 months | | 22,500.00 |
| TOTAL | | Php2,870,900.00 |
| COST per FACE MASK = | $\frac{\text{Materials + Labor}}{\text{No. of Products produced}}$ | |
| | $\frac{\text{Php2,870,900.00}}{380,000 \text{ pieces}}$ | |
| Production Cost | Php7.555 | |
| Mark Up | Php1.445 | |
| Price Per Unit * | Php9.00 per piece | |

Figure 3. Cost analysis of antibacterial facemask

Utilizing the resources of Northern Samar, this research and development initiative aims to assist the local community during the pandemic and beyond. The university intends to extend its community work through this project, which will provide much-needed security to the people of our province in their fight against COVID-19. In the future, once the pandemic has passed, the university plans to implement an extension program that will teach local government units how to make antimicrobial cloth facemasks using the resources available in the province.

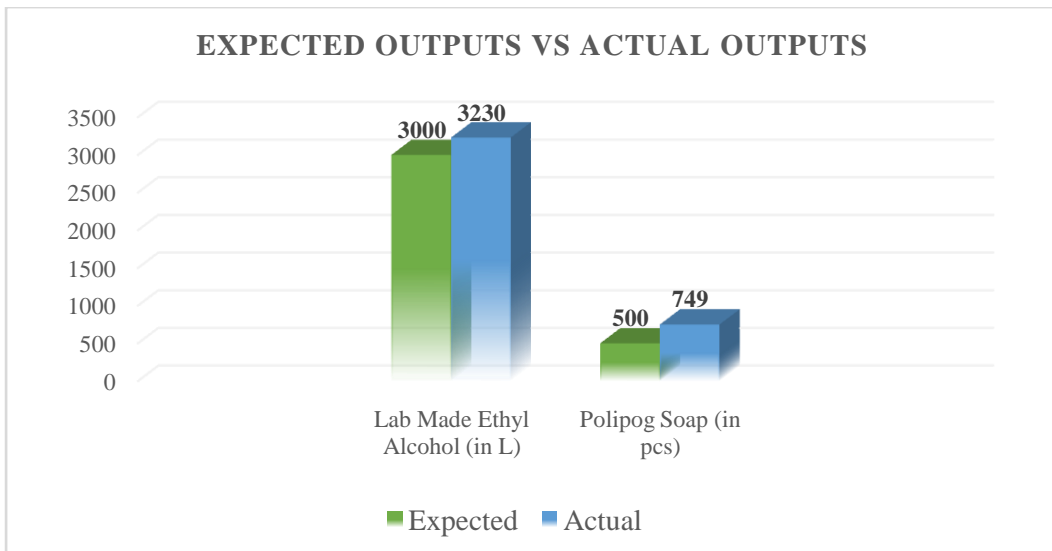


Figure 4. Visual representation of the produced sanitary items

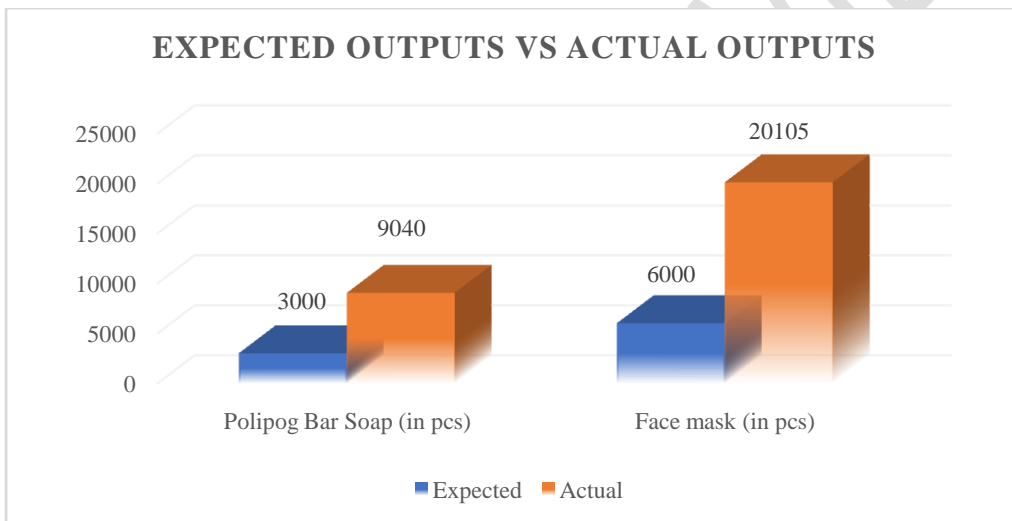


Figure 5. Visual representation of the produced sanitary items

As seen in Figures 4 and 5, the project exceeded the expected outcome. In the bar soap alone there is a 200% increase in production so the face masks had a 235% increase from their original expected output. This is because of the support of the university administration and the grant from the **Philippine Commission on Higher Education**. These sanitary items were distributed to the local communities in Northern Samar to help them combat the spread of COVID-19, luckily, with the help of the Provincial Government of Northern Samar (PGNS), distribution was soft and with ease.

IV. CONCLUSION

In the fight to combat the spread of this deadly virus, COVID-19, local resources in Northern Samar plays a vital role. *Nypafruticans* and *Salacia korthalsiana* Miq. were manufactured to produce the necessary sanitary items such as bioethanol, liquid soap, bar soap, and a face mask coated with an antibacterial solution. Harnessing the potential of these local natural resources could give a strong impact on the local communities. Data shows also

that the additional funding from CHED increases the target output of the project. A 200% increase in bar soap and face masks were seen. Manufactured sanitary items were distributed to the local communities that needed them most with the help of PGNS.

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