Rencana Antarabangsa

PINEAPPLE PEEL: ITS MILLION BENEFITS

By

DENI NOVIA

Division of Technology of Animal Products, Faculty of Animal Science, Universitas Andalas

dnovia@ansci.unand.ac.id

Editor: Dr Nor'aishah Abu Shah

RECENTLY, global fruit production kept exhibit steadily increasing point. In 2020, not less than 887 million metric tons of fresh fruits worldwide production was recorded (www.statista.com). As generally known, fruit is a great source of vitamins, minerals, antioxidants, fiber and water but it generally lows in calories, making it an ideal source for appetizer or dessert. Consuming fruit every day will have a positive impact on health; otherwise, a lack of fruit will trigger several dangerous diseases. Some fruits could be consumed directly with negligible by-products; while some others might produce significant unconsumed materials because they should be peel or cover removal before eating. The fruit peel in large enough quantities might considered as disposed waste and even as a source of new problems that will pollute the environment, cause unpleasant odors, produce methane which will cause global warming/greenhouse effect and cause several health problems.

Have you ever thought about using fruit peels from our consumption at home to be useful, or even provide a million benefits? Pineapple that structurally divided into flesh, crown, and peel is one of later fruit mentioned. Pineapple peel contains chemicals such as flavonoids, tannins, and saponins which its antibacterial benefits. The research of Romelle et al. (2016) found that pineapple peel contains 5.11% crude protein, 5.31% fat, 4.39% ash, 14.80% crude fiber, 55.52% carbohydrates, minerals Ca 8.30, Zn 6.46, Fe 25.52, and Mn 5.32 mg/100g. Anti-nutritional substances found in the peel are still safe for consumption, namely oxalates content 129.06mg **%**, hydrogen cyanides content 71.50mg **%**, alkaloids content 16.19**%**, phytates 1.99**%**, and total phenolics 1.42**%** (dry basis). It could be highlighted that pineapple peel can be used as a good ingredient in the formulation of food products due to its health benefit.

Pineapple peel, as its flesh, also contains bromelain. Bromelain is one of protease enzymes that can be used to tenderize meat, coagulate milk, and others. Pineapple peel is also useful as a source of Acetobacter, especially *Acetobacter aceti* that important in fermentation process. Acetobacter aceti is significant bacteria for its ability to produce acetic acid, characterized by its ability to convert alcohol into acetic acid (vinegar acid) with the assist of air. As commercially used, *Acetobacter* is a lactic acid bacteria species that also used in the manufacture of nata de coco, animal feed fermentation, biourine fermentation, and others. Pineapple peel fermentation can be done in a simple way by mixing sugar/molasses with water in a closed container in a ratio 2:1:10. For example, if there are 100 grams of pineapple peel then we need 50 grams of molasses and 500 ml of water. The results of fermentation or also known as indigeneous microorganisms (IMO) can be used after 4-14 days fermentation process. IMO from pineapple peel can also be used as a bio decomposer in the manufacture of organic cow fertilizer. 50 kg of dry cow dung requires 1 liter of IMO. The IMO which was added to the cow manure was first diluted with a concentration of 10%.

Then, the IMO was sprayed evenly and fermented for 21 days and every week it was inverted. Changing to soil-like odor and color to black and no longer hot temperature were specific characteristics of its organic fertilizer produced. In more detail, cow dung will be converted into organic fertilizer through IMO assistance. IMO in the form of bacteria, fungi and yeast decomposes cow dung into simpler ones through an anaerobic fermentation process. On the seventh day, stirring and homogenization processes are required to remove heat produced by microorganism activity in cow dung. Such actions are repeated another following week while heat still generated. Moreover, shorter time consumption as IMO involved in the process is one advantage obtained. The process will be changes the from 3-6 months in conventional way to 3 weeks when IMO applied.

Another use of pineapple skin is in to make eco-enzyme solution. Eco enzyme is a liquid enzyme with a million benefits obtained from fermenting fruit or vegetable peels for three months. Making eco enzyme from pineapple skin is by mixing pineapple skin, brown sugar/molasses and water in a ratio of 3:1:10 in a tightly closed container for three months. Fermentation will produce gases, so the gases must be removed every day, especially in the first two weeks by opening the lid slightly to release the gas. The characteristics of eco enzyme are dark brown in color and have a strong fresh sour aroma.

Picture 1. Potential cow dung could be transformed into organic fertilizer with indigenous microorganism from pineapple peel

The eco-enzyme from pineapple peel contains tannins and saponins and also had worthy antibacterial activity.

Tannins function as antifungals (*Aspergillus niger, Aspergillus flavius*, and *Candida albicans*) and antibacterial (*Staphylococcus aureus, Escherichia coli*, and *Salmonella typhimurium*) (Wafa et al., 2016). According to Tagousop et al. (2018), saponins is significant for its antibacterial (*E.coli, S.aureus, S.flexneri*), and antifungal effects (*Candida albicans, Candida parapsilosis, Cryptococcus neoformans*). Ramadani et al. (2022) reported that eco-enzyme produced from pineapple peel can inhibit the growth of *S. aureus*, a bacteria species that trigger the growth of acne. Its minimum concentration of inhibition was 50% but concentration 100% (v/v) resulting effective inhibition. Rusdianasari et al. (2021) found that eco-enzyme from a mixture of orange peel, pineapple, and papaya as an environmentally friendly disinfectant with the best concentration of 10% has been able to reduce bacterial growth and meet the requirements of SNI 06 – 1842 of 1995. Furthermore, the research proposed the use of eco enzyme as a hand sanitizer with a dilution ratio of 5:40 with a pH 5.

As reported by Galintin et al. (2021), eco-enzymes contain proteases, amylase, and lipase. The biocatalytic activity (lipase, amylase, and protease) in the eco-enzyme solution was determined by changing the pH to pH 6, 6.5, 7, 7.5, and 8. The optimum activity of lipase pH 7-10, amylase pH 6.5 and protease pH 6. 10% concentration enzyme solution was found to be more potent and economical in treating aquaculture sludge resulting in 89% reduction of total suspended solids, 78% volatile suspended solids, 88% chemical oxygen demand, 94% total ammonia nitrogen and 97 % of total phosphorus. In the other side, the use of eco-enzyme on agricultural land has not immediately given good results because the enzyme will improve the soil first. It took about a year to repair the soil quality. The application of eco-enzyme to the soil can be given in a ratio of 1:200 or more concentrated because there are no plants yet. While for existing plants can be routinely given at lower concentration or 1:1000 or 1:800. Young plants or horticulture are given eco enzyme with lower concentrations than old plants. The exact comparison depends on the type of plant and the experiment on the agricultural land because it is not necessarily the same for every region.

In fact, too viscous eco enzyme causes less optimum work of the enzyme. Besides, pH also influences its work since the acidic pH of the eco-enzyme causes low enzyme activity. Thus right concentration and right pH should be noticed to get optimum work the enzyme.

The production of eco-enzymes not only helps reduce waste disposal to landfills, but also becomes an alternative to reduce the use of synthetic chemicals that are harmful to human health and the environment. Awareness of processing household waste into eco-enzymes is also a step to achieve zero waste at the household level (Muliarta and Darmawan, 2021). To sum up, reuse and recycle pineapple peel into other form as discussed above have start the effort to save the world.

Picture 2. Eco enzyme prepared from combination of pineapple peel and others

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