

Review on: Its Potentials and Application of Potato Peel (Waste)

Gashaw Abebaw

Department of Food Process Engineering, College of Engineering and Technology, Wolkite University, Wolkite, Ethiopia

ABSTRACT

The increasing amount of food waste throughout the world is becoming a major problem for waste management plants. The food waste produced amounts to 1.3 million tons a year. This is a resource that could be used for production of new products. Bioeconomy is a method that can help achieve production of value-added products that use local resources and waste to manufacture products efficiently. This by-product causes environmental pollution due to decomposition. However, food byproducts like potato peel have essential organic matter. So this review introduces the potential use of potato peel as food preservative, pharmaceutical ingredient, renewable energy, and animal feed to promote ecofriendly food industries. In this review are looking at possibilities to use potatoes for production of new materials, such as bioplastics, antioxidants, proteins, instead of their conventional use for food production.

*Corresponding author

Gashaw Abebaw, Department of Food Process Engineering, College of Engineering and Technology, Wolkite University, Wolkite, Ethiopia, E-mail: gashaw11abebaw@gmail.com

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Introduction

Potato (*Solanum tuberosum L.*) is ranked among one of the chief crops producing worldwide. As per the statistics of the Food and Agriculture Organization (FAO), the annual production of potato was over 300 million tons in 2016 [1].

Besides, food processing industry is one of the most important businesses worldwide produces a large number of byproducts as organic waste that need to be handled and managed inappropriate way not only to avoid environmental pollution but also extend further apart by contributing towards economic boost from byproduct utilization. Potato peel as a byproduct of food processing industry poses to be totally inexpensive, valuable and affordable starting material for the production of economically important substances, value addition, and product extraction including dietary fibre, biopolymers, natural antioxidants, and natural food additives. Industrial processing generates between 70 to 140 thousand tons of peels worldwide annually [2].

Potatoes are one of the main food sources in the world, with 100–180 different species and thousands of varieties over the world. Potatoes are an important source of nutrients for humans and animals, but their full potential for extended use is yet to be examined. Now they are mostly used in food production because of their short growing time and potential for use, as well as their ability to adapt to different climate conditions. It is an important characteristic, because potato tubers contain starch, proteins, ascorbic acid, carbohydrates, minerals, vitamins and fibre, making it a nutrient with low fat content. Preservation of potatoes for consumption can be achieved by putting fully grown potatoes in the appropriate environment (average storage temperature, dark room) and making sure they are kept away from possible harm,

such as pressure, physical injury.

Traditionally potato peel waste is used for producing low-value animal feed, fertilizer or being the raw material of biogas, which causes waste of abundant nutritive materials within it having the properties of antioxidant, antibacterial, apoptotic, chemo preventive and anti-inflammatory. But still, the central dogma of the present study is the proper waste management with the economic feasibility of the processing development. Potato peel is being studied in various manuscripts as an effective feed for animals. Although it has to be treated prior to utilization in animal feed as for non-ruminants feed it is not well suited because of having too much fibre to be digested. On the other side, the same has been used successfully in various studies for the feed of multi-gastric animals.

The present review recapitulates applicable endeavours of potato peels exploitation in food as well as nonfood purposes including the extraction, verification and utilization of bioactive components, nutritional aspects, biotechnological usage, livestock feed and other miscellaneous use of potato peels as major potato processing industrial waste [3].

Literature Review

The composition of potato peel

For a complete understanding of the physicochemical properties of potato peel, it is necessary to focus on its physical and chemical composition. The knowledge of these properties would help in developing an environmentally friendly approach for the utilization of potato peel. Potato peel contains various polyphenols and phenolic acids which are responsible for its antioxidant activities, whereas fatty acids and lipids showed antibacterial activities [4]. Potato peel also contains starch (25%), non-starch polysaccharide (30%), protein (18%), acid-soluble and acid insoluble lignin

(20%), lipids (1%) and ash (6%) on dry basis. The lipid fraction includes long chain fatty acids, alcohols, triglycerides and sterol esters. In addition, lignin units have been found in the cell wall of potatoes. Potato peel is rich in starch (52% dry weight), but the content of fermentable reducing sugar is limited (0.6% dry weight) [5].

Utilization of Potato Peel

Food preservation

Synthetic food preservatives could be used alone or in combination with natural preservatives both synthetic and natural antioxidants been used in food industry; however, application of synthetics preservatives has potential carcinogenic effects but use of natural preservatives alone has a better advantage for human health with low side effect. As a result, attention has being given to vegetable waste with rich source phenols. Phenolic compound is found ubiquitously in plants and is of noticeable interest due to their antioxidant and antimicrobial properties, the entire tissue of fruits and vegetables is rich in bioactive compounds or phenols but the by-products have higher contents of antioxidant. Due to the suspected long-term negative health effect, use of synthetic antioxidants and antibacterial on food has become a common concern of consumer safety. Therefore, the food industry has enforced to seek natural alternatives food preservative. Potato peel is one of the most important waste products with sufficient amount of phenolic compound so this could be used as a replacement for the current synthetic antioxidant and antimicrobial [6].

Antioxidant activities

Antioxidants inhibit oxidation of lipids in foods and consumption of high concentration synthetic antioxidant has carcinogenic effect unlike the natural antioxidants [7]. The antioxidant activity of potato peel extracts has strong radical scavenging ability and prevents oxidation reaction in oily foods. The dominant phenolic compounds of potato peel extracts are chlorogenic and garlic acids. These are potent sources of natural antioxidants that prevent oxidation of vegetable oil, and this could stabilize soybean oil oxidation reaction through minimizing peroxide, totox, and p-anisidine indices. The ability on minimizing oxidation on vegetable oil, potato peel extracts has equal performance with synthetic antioxidants such as butylhydroxyanisole (BHA) and butylhydroxytoluene (BHT). *In comparison with mature potato, young potato peel has excellent source of bioactive phytochemicals nature with antioxidant potential* [8]. However, as compared to the application of synthetic antioxidants, potato peel extracts need to apply in higher amount but still looking the advantage of natural antioxidants than the synthetic, it is a *promising source of natural antioxidant that could be used as ecofriendly product on food industries*.

Antimicrobial Activities

More than three-quarter of the world's population has used medicinal plants for treatment of different disease. Herbal plants are important on prevention against highly pathogenic micro-organisms, and they are safer means of food preservation. Potato peel extracts have antimicrobial compounds against bacterial and fungal organisms. The antimicrobial nature could be due to the presence of flavonoids and terpenes organic compounds. Potato peel has bacteriostatic nature with nonmutagenic behavior and safe to use in food processing. Therefore, potato peel extract is the future and natural against foodborne pathogenic microbial and the broad spectrum nature of the plant help to discover new chemical classes of antibiotic substances that could serve as food preservative in food processing industries [9].

Pharmaceutical Ingredient

Pharmaceutical ingredient is a substance used in a finished pharmaceutical product, intended to give pharmacological activity to cure, mitigation, treatment, or prevention of disease (WHO, 2011). Peels of various fruits and vegetables are generally considered as waste product and are normally thrown away. But they have important elements, which could be used for pharmaceutical purpose. Potato peel has a number of pharmacological interest compounds like glycoalkaloid which could be used as precursory for steroid hormone. When we look, the highest amounts of Glycoalkaloids are found in potato peel than the flesh part of potato. In addition to this, potato powder has a potential of wound healing activity as antiulcerogenic agent [10].

Potato peels—as a source of dietary fiber

Dietary fibre is a bulking mediator, enhancing intestinal mobility and faecal hydration. In numerous studies, the benefits of dietary fibres are well documented. Dietary fibre, a broad term, includes various carbohydrates, hemicelluloses, cellulose, pectin, lignin, gum etc. having chief pharmaceutical application. Therefore, use of potato peel as pharmaceutical ingredient is natural, nontoxic, and environmentally friendly. So this could be one of the solutions on prevention of the current threat of drug resistance, emerging disease effective treatment and lower the health damaging side effect of synthetic drugs [11].

Dietary fibre enhances other sugars absorption by altering the emptying time of the gastric system and encourages insulin response as well so that they can be promoted as ant-diabetic drug extracted from potato peel with reduced preparation cost and efficient utilization.

Potato peel dietary fibres are believed to impart certain protective roles against carcinogenesis and mutagenesis through various mechanisms including the binding of mutagenic and carcinogenic materials, increasing faecal bulk and water absorption, reducing the intestines-transit time, and lowering the faecal pH via fermentation process through intestinal micro flora. The potatoes peel waste has been proved to be an environmentally friendly and economical choice to be considered for use as adsorbents for pharmaceutical effluents treatment [12].

Application in the Baking industry

In baking industries, dietary fibres extracted from numerous sources have been used in combination with the wheat flour, as almost 50% of potato peel consists of dietary fibre (w/w). Talking about baking industry potato peel fibre can contribute to economic boost by serving as a low-cost raw material with superior physical and chemical properties in comparison to wheat bran, studied by. The potato peel fiber has been reported to have better water holding capacity with low starch content. Furthermore, some quality defects like musty odour through the use of Potato peel fiber can be removed by using extruded potato peels [13].

Biotechnological application of potato peels

Potato peel is documented to be an exceptionally low cost and effective substrate for the production of a starch hydrolyzing enzyme, thermo-stable alpha-amylase under controlled solid-state growth conditions, which is broadly employed in various food industries [14]. Moreover, in other studies, potato peel as a low-cost medium has been used to produce alkaline protease and alpha amylase enzyme with potential application in detergents [15].

Biofertilizer from Potato Peel

Potato peel has been efficiently used for the synthesis of Biofertilizer. PP contains large amounts of proteins and starch, which after degradation by soil microorganisms produce fertilizers with high nitrogen content. Vermicompost prepared from PP earthworms (*Pheretima elongate*) showed a higher level of the bacterial count than the surrounding soil. The slurry obtained from PP biogas plant (anaerobic digester) is a useful biofertilizer for land application and these replenish nutrients in the soil. Likewise, potato peel, legume peel, cow dung, leaves and neem leaves were fermented in water for 45 days for the synthesis of biofertilizer. Application of this biofertilizer showed an overall increase in vegetative growth and the physicochemical characteristics of a strawberry fruit [16].

Biogas Production

Biogas (CH₄) from Potato peel waste is produced by anaerobic fermentation by utilizing starch from peels. The process has advantages as it has low cost and simple method that could be conducted in the same area in situ. It has been reported that each ton of starch waste produces 250 m³ of biogas [17]. In another study, the potential of anaerobic ally digested Potato peel and its residue of lactic acid fermentation was investigated for methane production. The analytical results revealed the production of 60 to 70% methane.

Food wastes for biogas production have high potential. Fruit and vegetable such as potato peel wastes took 55 days for complete digestion to produce biogas in anaerobic condition. Biogas plants also give bio-manure also of energy production and help to solve problems about waste management and providing clean environment. Potato peel waste of an industrial is a mesophilic reactor of biogas production. When chemical pretreatments applied on potato peel, the biogas and CH₄ yield improved. Therefore, to decrease natural disasters such as environmental pollution, deforestation, and desertification, use of food waste as biogas for electric generating is prompt and essential [18].

Animal Feed

The cost of livestock feed is increasing due to rising fertilizer costs and extreme weather. So food wastes are an alternative source of feed ingredients. This can cut feed cost and disposal cost and reduce environment pollution. Food wastes have a high nutritional value for livestock feed. In developing countries, the demand for livestock products is increasing. But feed deficits are the main problem, so unconventional feed resources play an important role. Fruit and vegetable processing industries generate a huge amount of wastes. Such unconventional resources are an excellent source of nutrients for livestock [19]. Potato peel is one of the prominent food wastes that could be used as alternative animal feed due to natural sources of energy and fiber with low levels of protein. Therefore, food waste materials as residual wastes used as animal feed ingredients and feed additive is essential. For a long period, wastes have also been fed to swine traditionally without processing.

Production of Lactic Acid

Lactic acid has considered an important organic acid due to its wide applications in pharmaceuticals, food, and cosmetic industry [20]. In general, Lactic acid is synthesized through carbohydrates fermentation with fungi and bacteria. More recently, potato peels serve as an alternative to producing lactic acid by anaerobic fermentation through the inoculation of potato peel waste with undefined mixed culture in a sequencing batch reactor. While the production of lactic acid from zero-value raw material, potato

peel, can significantly improve the economic status of the country.

Source of Renewable Energy

Fossil fuel demand is increasing globally. This creates rapid depletion of the fossils fuel and influence fuel price. As all knows now the main source of environmental degradation is use of fossil fuel which is a global issue. Due to this reason, interest toward use of renewable energy is increasing from time to time [21]. Therefore, considering the dual advantage of potato peel used as feed and antimicrobial for pig is important both environmental and financial sustainability of potato processing factories.

Conclusions

As a result of the world information desk, the potato peel is the most important residue generated via agro- processing sectors. Recent researches point out that the potato peel is not considered as waste longer, but it becomes feedstock for different products. Potatoes are an incredibly valuable source of starch, proteins, ascorbic acid, carbohydrates, minerals, vitamins and fibre, alkaloids, flavonoids, phenolic compounds. These contents provide a number of possible uses for a well-known food supply. To solve the future and current problems of the global environment issue, conversion of food waste into environmentally friendly product through conversion to value added products is mandatory and timely. Therefore, due to its multiple advantages of potato peel waste can serve as best response for eco-friendly industrial products. So research focus should gear toward antimicrobial, antioxidant, and other pharmaceutical ingredients from potato processing industries. Attention has given on low-cost extraction method, and further investigation should also be vested on innovative products from similar by-products. Potatoes have proved to be applicable for use in food production, pharmacy, and medicine applications and packaging. *Main potato components and their possible uses are it is possible to use potato proteins and starch to produce bioplastic with characteristics similar to low density polyethylene.* They are also suitable for different packaging, such as food packaging, capsules for medicine. The use of potato compounds in the food industry is especially favorable as it is a **gluten-free product** with no harm to the environment.

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