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Potential of Bioactive Compounds from Fruits and Vegetable Waste Processing

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INTRODUCTION

Fruits and vegetables are mainly admired due to their nutritional value worldwide and rich sources of beneficial anti-oxidants, minerals, vitamins and fibers, besides these, they are also source of health promoting biologically active compounds. The use of synthetic antioxidants in foods is discouraged due to their high levels of toxicity and carcinogenicity. So natural antioxidants from fruits and vegetables waste have received significant attention. Due to the increased consumption and industrial processing of the edible parts of fruit and vegetables the waste materials generated from these are increased in 2020, and hence these residues are generated in large quantities in metro cities. Agro-waste has become one of the foremost sources of municipal solid wastes, which is one of the hard-hitting environmental issues. However, inappropriate management of these will result in emissions of methane and carbon dioxide and incineration involves the subsequent development and releases of pollutants and secondary wastes such as dioxins, furans, acid gases as well as particulates, which pretext rigorous environmental and health risks. For these reasons, there is a critical need to seek out alternate uses for them. The economical and readily available use of agri-food industry and horticultural waste is highly cost-effective and minimizes environmental impact. One of the most exigent and advantageous approach is to recover the bioactive constituents, mainly the phenolic compounds and antioxidants, functional utilization of it in the food industry, pharmaceutical industry as well as cosmetics industry. The waste materials such as peels, seeds and stones produced by the fruit and vegetable processing can be successfully used as a source of phytochemicals and antioxidants. The entire tissue of fruits and vegetables is rich in bioactive compounds, such as phenolic compounds, carotenoids, vitamins.

The new aspects concerning the use of these wastes as by-products for further exploration on the production of food additives or supplements with value addition have gained increasing interest and their recovery may be economically attractive. The by-products represent an important source of sugars, minerals, organic acid, dietary fiber and phenolics, which have a wide range of action, which includes antiviral, antibacterial, cardio-protective and anti-mutagenic activities.

Bioactive compounds in different fruits and vegetables wastes

The various fruits and vegetables reviewed by several researchers and industrialists based upon its processing potential in industries, for the value addition towards human health. Mango (*Mangifera indica* L.) is highest processing fruit amongst food processing sector, mango peels, waste generated from fruit can used for processing, are a good source of functional ingredients such as phenolic compounds that has potential antioxidant properties. The major phenolic compounds of ripe and unripe mango peels are gallic acid, syringic acid, gentisyl-protocatechuic, mangifera, ellagic acid, and quercetin with a good source of natural antioxidant. Pomegranate (*Punica granatum* L.) is a delectable fruit consumed worldwide. The fruit is a native shrub of Western Asia and Mediterranean countries which have a maximum content of health promoting compounds. Interestingly, the nutritional parameters are not limited to the edible portion of the fruit it includes major phenolic compounds, flavanoids as well as bioactive compounds. Citrus fruit (*Citrus aurantiifolia*) is popular due to its characteristic flavour, taste, aroma and numerous health benefits. Citrus fruits are known for different health benefits and prevention of diseases in human (WHO, 2003). Processing of citrus fruits into different products or their consumption as such produce by-products such as peel, seed, and pulp which are usually wasted. This waste contains various bioactive compounds such as ascorbic acid, phenolic compounds *etc*. On the other side, pineapple (*Ananas comosus*) is one of the main agricultural commodities and now a days this fruit is main attraction in metro cities market, daily sold by local vendors. pineapple peel wastes (PPW) are the important issue of waste management of which urgently to be overcome due to huge waste collect in metro cities. PPW is therefore converted into highly valuable product, since contains considerable content of antioxidant property, sugar, phenolic compound, high fibre, protein and PPW also provides high potential bromelain enzyme as functional material. Beetroot (*Beta vulgaris* rubra) and its potential utility as a health promoting and disease preventing functional food. Beetroot is a rich source of phytochemical compounds that includes ascorbic acid, carotenoids, phenolic acids and flavonoids. Potatoes (*Solanum tuberosum*) are one of the most cultivated crops around the world after maize, wheat, and rice. Potato peels (PP) (a waste by-product of potato processing) have antioxidant activity; also, the potato peels (PP) contain several bioactive compounds. These compounds are known to provide human health benefits, including antioxidant and antimicrobial generated from fruit can processing, are a good source of functional ingredients such as phenolic compounds that has potential antioxidant properties. Tomato (*Solanum lycopersicum*) is highly consumed vegetables in the world, important sources of vitamins and minerals in the human diet, as they are rich in antioxidants and bioactive compounds, which are secondary metabolites produced by plants. Phenolic compounds, ascorbic acid, and lycopene, are examples of bioactive compounds found in tomatoes. Lycopene and other bioactive compounds, are responsible for antioxidant activity of tomatoes, which prevents the oxidation of essential molecules caused by free radicals, and contribute significantly to the upholding of human health, together with the prevention of heart disease and prostate cancer (Porto et al., 2016). Onions (*Allium cepa* L.) are the second most important horticultural crop worldwide; an increase in

demand for processed onions has led to an increase in waste production. The main onion wastes include onion skins generated during industrial peeling, two outer fleshy scales and roots, and undersized, malformed, diseased or spoilt bulbs. Due to the onion's characteristic aroma, onion waste is not appropriate for fodder in high concentrations (Schieber et al., 2001). Above novel methods of extraction of bioactive compounds from agro-processing waste can be the source to obtain natural and safe additives *i.e.* antioxidants as well as can propose the alternative to waste management through waste utilization.

Table 1: Types of waste obtained from fruits and vegetables containing phenolic compounds

S. N.	Name of fruit/ Vegetable	Type of waste	Phenolic compounds	References
1.	Beetroot	Peel	ltryptophane, p-coumaric and ferulic acids, cyclodopa glucoside derivatives	[Kujala et al., 2001]
2.	Grapes	Seeds, Skin	Catechins, anthocyanins, stilbenes, flavonol	[Mendiola et al., 2007]
3.	Citrus fruits	Peel and solid residues	Eriocitrin, hesperidin, naringin	[Coll et al., 1998]
4.	Mango	Peel	Flavonol glycosides	[Maisuthisakul and Gordon 2009]
5.	Onion	Skin	Quercetin 3,40-O-diglucoside and quercetin 40-O-monoglucoside	[Price et al., 1997]
6.	Potato	Peel	Chlorogenic, gallic, protocatechuic and caffeic acids, chlorogenic acid isomer II	[Onyeneho and Hettiarachchy 1993]
7.	Tomato	Peel	Lycopene	[Sharma and Le Maguer 1996]
8.	Pomegranate	Seeds, Peel	Anthocyanins, ellagic acid	[Akhtar et al., 2015]

CONCLUSION

Agro-processing of waste is foremost problem to environment as well as processing zone; however, agro-waste of fruits and vegetable is a source of bioactive compounds and can be utilized to extract, and utilized in techno-economic way in various value-added products. On the other hand, it could be the cheaper and safe alternative for artificial additives which implies to carcinogenicity. In current scenario waste utilization of agro-processing industry will definitely contribute to minimize food losses and for development of novel foods having therapeutic value due to bioactive compounds. Fruit and vegetable processing will be most promising way to meet the nutritional need of growing population. In future the government, and researchers should focus on modern processes which will be developed and implemented for this purpose. This will result in the smart management of localized waste co-products and urban waste. Earlier this were often disposed of relatively cheaply by landfill, land spreading, or selling as animal feed. So, it can be shifted towards processing and its production. Hence proper disposal of wastes enlightened new path to save earth from pollution the outcome of these processing methods.

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