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Potential of pineapple wastes for Pectin recovery: A path towards waste valorization

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Abstract
Majority of agricultural wastes and crop residues like cereal brans, sugarcane bagasse, peels, pomace and sugar beet pulp act as the vital sources for natural production of biochemicals. The production of natural pectin from various agro-wastes can be focused as the major biotechnological tool taking much demand against the chemical production processes. Investigation was carried out for conversion of pineapple wastes towards isolation of pectin as a part of waste management. About 60% of total pineapple fruit is regards as waste in form of peel, core, pomace and crown. Maximum pectin was detected from pomace part of the pineapple.

Keywords: pineapple, waste, pectin, pharmaceutical, pomace

Introduction
Agro-industrial waste materials produced from various food-based industries results a worldwide threat to public health. Most of these by-products are used as animal feed (Min *et al*, 2011) [5]. However, academic as well as industrial researches are currently focusing on obtaining high-value biochemicals from these wastes (Sarangi *et al*, 2009a; Sarangi *et al*, 2009b, Sarangi *et al*, 2010) [11, 12, 16]. Numerous by-products generated by agro-industries including corn-cobs, Pineapple wastes, sugarcane bagasse, bran and straw from wheat and rice, sugar beet pulp and coffee pulp have been used as cheap substrates for biological degradation to obtain value added products by an environment-friendly bioprocess technology (Sarangi *et al*, 2017; Sarangi *et al* 2019) [22, 19]. These are a cheap source for value addition into various biochemicals for different industries (Sarangi and Sahoo 2010a; Sarangi and Sahoo 2010b; Sarangi and Sahoo 2010c) [13, 14, 15]. Many of these fruit waste contains pectin which can be obtained from these fruits and vegetable wastes (Begum *et al*, 2014) [1]. Waste degradation acts as the increasingly popular alternative for the treatment of agricultural and industrial wastes towards economic and ecological benefits. Lignocellulosic biomass is a renewable resource on earth and it has attracted continuing efforts to produce biochemicals for future uses. A high proportion of these waste materials are carbohydrates and phenolic in nature. Specific sugar residues may be released from the cell-wall by the action of carbohydrases.

Pectin is a heteropolysaccharide is present in primary cell walls as well as in the middle lamella between plant cells (McCann and Roberts 1991). Pectin has been used as a gelling agent and stabilizer in various food industries (Willats *et al*, 2006) [22] along with a health-promoting characteristic (Ciriminna *et al*, 2016; Min *et al*, 2010; Peng *et al*, 2014) [3, 4]. Wide ranges of fruit wastes, pomace and peels are utilized for extraction of pectin (Munarin *et al*, 2012) [7]. Due to wide range of potentiality in the food industries, isolation of pectin is focused from various fruit wastes.

North-Eastern India having total geographical area of 2.62 million km^2, comprising total 8 states has a high potential for pineapple cultivation. This region gets immense climatic diversity, fertile and organic soil, and sufficient rainfall thereby having scope for cropping variation. About more than 40% of the total pineapple production of the country was made from the NE region and 90 to 95% of the produce is organic. 'Giant Kew' and 'Queen'.are the common cultivars grown this region. About 95% of pineapple produce from this region are regarded as organic in nature. Manipur contributes about 7.37% of the total pineapple production of India (Sarangi *et al*, 2019) [19].

Pineapple wastes like peel, core, stem, crown and leaves are generally accounting for 60% (w/w)

of total pineapple weight (Singh *et al*, 2018; Sarangi *et al*., 2015) [20, 17]. Value addition from commodities point of view, is processing raw product into a branded product that consumers are willing to pay for than the raw product. For example, a food processor could purchase fruit from farmers and process into fruit juice. This juice has added value and becomes a branded good. Due to increasing production and processing of pineapple, massive waste generations occur resulting environmental problems.

The increasing production of pineapple processed items, results in massive waste generations mainly due to the elimination of components unsuitable for human consumption. Apart from these, rough handling of fruits and exposure to adverse environmental conditions during transportation and storage can cause up to 55% of product waste (Nunes *et al*., 2009) [8]. These wastes are usually prone to microbial spoilage thus limiting further exploitation. Further, the drying, storage and shipment of these wastes is cost effective and hence efficient, inexpensive and eco-friendly utilization is becoming more and more necessary (Upadhyay *et al* 2010) [21]. Various global researches showed that agricultural wastes and by-products are used as sources for pectin extraction (Morales Contreras *et al*, 2018; Sabater *et al*, 2018; Xu *et al*, 2018) [6, 10, 23], Hence, the implementation of biotechnological approaches for sustainable utilization of pineapple by-products towards pectin may be focused as far as the industrial applications are concerned. In this paper, the potential of pineapple wastes towards pectin isolation is summarized briefly.

Materials and methods

Sample Preparation and pectin extraction

Pineapple fresh fruits were collected from nearly Market in Imphal, Manipur. The said experiments were conducted in Department of Agriculture Engineering, College of Agriculture, Central Agricultural University, Imphal under AICRP on Postharvest Engineering and Technology project. After collection from market, fresh pineapples were properly washed and waste materials were removed. During juice formation pomace part is also separated. From each part of the waste like peel, core and pomace, pectin was extracted. Acid extraction followed by ethanol precipitation was used to extract pectin. The details extraction procedure is shown in fig.2.

Results and Discussion

Pineapple wastes act as the sustainable sources for future energy and biochemical production. Processing of pineapple results different waste parts such as crown, peel, core and pomace (Fig.1). As far composition of waste products is concerned, major portion has been explored for sugar recovery. Pectin being an industrially importance biochemical was isolated from three different wastes of pineapple. Pomace is formed along with juice at the time of processing of pineapple. Yield of pectin from pomace part is showing maximum (14.21%) as compared to peel and core portion. Summary of pectin isolation from pineapple wastes is shown in fig.3. Further process analysis on these studies can be focused for characteristics of isolated pectin.

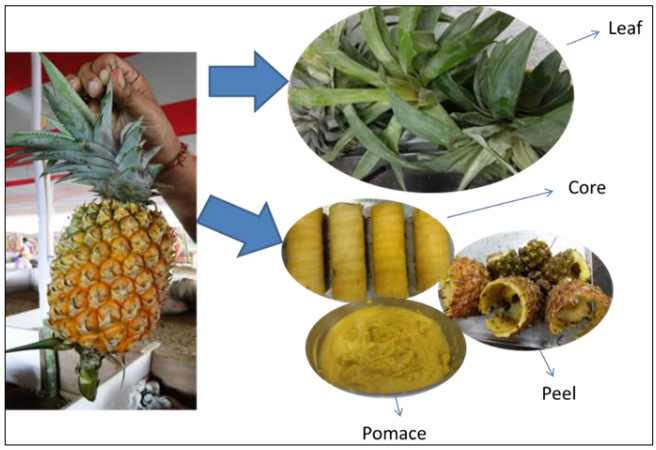

Fig 1: Waste parts of pineapple generated during processing

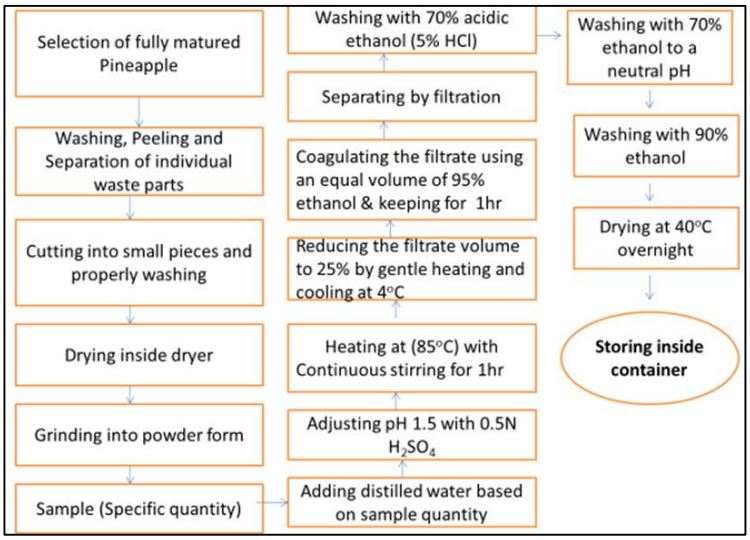

Fig 2: Flow chat for production of pectin for Pineapple wastes

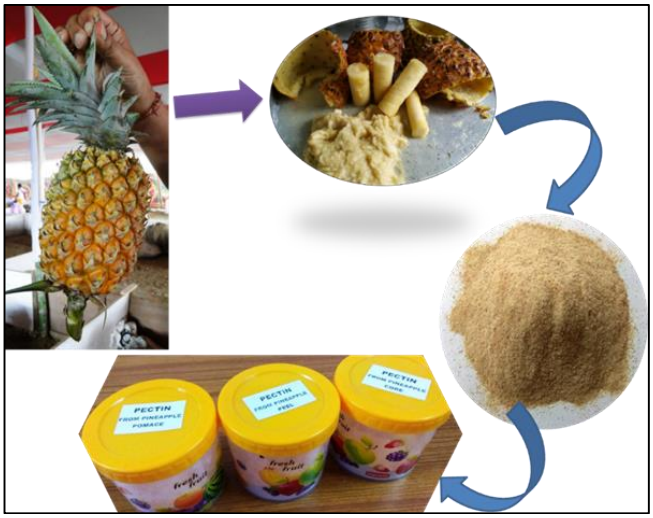

Fig 3: Pectin recovery from pineapple wastes and storage into containers

Pectin has the potential as emulsifier, gelling, thickening and stabilizing agent in various food and pharmaceutical industries. Various efforts have been carried out for isolation of pectin from wide array of food wastes. Pineapple being produced enormously and producing vast amount of waste materials can be emphasized towards pectin isolation leading to entrepreneurship development. This will definitely bring special attention for the pineapple growing farmers and processing entrepreneurs. Further study on the properties of pectin from alternative sources may also bring some new researchable issues.

References

1. Begum R, Aziz MG, Uddin MB, Yusof YA. Characterization of Jackfruit (Artocarpus heterophyllus) waste pectin influenced by various Extraction conditions. Agri. and Agri. Sci. Procee. 2014; 2:244-251.
2. Ciriminna R, Chavarria N. Pectin: A new perspective from the biorefinery standpoint. Biofuels, Bioproducts and Biorefining. 2015; 9(4):368-377.
3. Ciriminna R, Fidalgo A, Delisi R. Pectin production and global market. Food Industry Hi Tech. September. 2016; 27(5):17-20.
4. Min B, Bae IY, Lee HG, Yoo SH, Lee S. Utilization of pectin-enriched materials from apple pomace as a fat replacer in a model food system. Bioresource Technology. 2010; 101(14):5414-5418. http://dx.doi.org/10.1016/j.biortech.2010.02.022.
5. Min B, Lim J, Koa S, Lee KG, Lee SH, Lee S. Environmentally friendly preparation of pectins from agricultural byproducts and their structural/rheological characterization. Bioresource Technol. 2011; 102(4):3855-3860.
6. Morales-Contreras BE, Rosas-Flores W, Contreras-Esquivel JC, Wicker L, Morales-Castro J. Pectin from Husk Tomato (Physalis ixocarpa Brot.): Rheological behavior at different extraction conditions. Carbohydrate Polymers. 2018; 179:282-289. http://dx.doi.org/10.1016/J.CARBPOL.2017.09.097.
7. Munarin F, Tanzi MC, Petrini P. Advances in biomedical applications of pectin gels. International Journal of Biological Macromolecules. 2012; 51(4):681-689.
8. Nunes MCN, Emond JP, Rauth M, Dea S, Chau KV. Environmental conditions encountered during typical consumer retail display affect fruit and vegetable quality and waste. Postharvest Biology and Technology. 2009; 51:232-241.
9. Peng Q, Xu Q, Yin H, Huang L, Du Y. Characterization of an immunologically active pectin from the fruits of Lycium ruthenicum. International Journal of Biological Macromolecules. 2014; 64:69-75. http://dx.doi.org/10.1016/j.ijbiomac.2013.11.030.
10. Sabater C, Corzo N, Olano A, Montilla A. Enzymatic extraction of pectin from artichoke (Cynara scolymus L.) by-products using Celluclast®1.5L. Carbohydrate Polymers. vol. 90. Carbohydrate Polymers. 2018; 43-49. http://dx.doi.org/10.1016/j.carbpol.2018.02.055.
11. Sarangi PK, Sahoo HP, Ghosh S, Mitra A. Isolation of ferulic acid from wheat bran using Streptomyces isolates. International Journal of Applied Agricultural Research. 2009a; 4(1):57-62.
12. Sarangi PK, Sahoo H, Ghosh S, Mitra A. Biotransformation of ferulic acid into vanillin by a *Streptomyces* isolate S10. Asian Journal of Microbiology, Biotechnology and Environmental Sciences. 2009b; 11:273-278.
13. Sarangi PK, Sahoo HP. Biotransformation of ferulic acid into value-added products. Asian journal of Microbiology, Biotechnology and Environmental sciences. 2010a; 12(3):523-525.
14. Sarangi PK, Sahoo HP. Ferulic Acid production from wheat bran using Staphylococcus aureus. New York Science Journal. 2010b; 3(4):79-81.
15. Sarangi PK, Sahoo HP. Enhancing the rate of ferulic acid bioconversion utilizing glucose as carbon source. The Journal of American Science. 2010c; 6(5):115-117.
16. Sarangi PK, Nanda S, Sahoo HP. Maximization of vanillin production by standardizing different cultural conditions for ferulic acid degradation. New York Science Journal. 2010; 3(7):77-79.
17. Sarangi PK, Singh JNG, Singh TA. Bioconversion of Pineapple Wastes into Biotechnological Products: A Review. Journal of Pure and Applied Microbiology Vol. 2015; 9(2):1155-1162.
18. Sarangi PK, Singh TA, Singh Joy NG. Agricultural crop residues: Unutilized biomass having huge energy potential, In: Contemporary Renewable Energy Technologies for Sustainable Agriculture; Ghosal M. (Eds.) Narosa Publishing House, New Delhi, India, 2017, 47-61.
19. Sarangi PK, Singh TA, Singh NGJ. Pineapple as potential crop resource: Perspective and value addition. In: Food Bioresources and Ethnic Foods of Manipur, Northeast, India; Empyreal Publishing House, 2019, 83-91.
20. Singh TA, Sarangi PK, Singh NGJ. Tenderisation of meats by bromelain enzyme extracted from pineapple wastes. International Journal of current Microbiology and Applied Sciences. 2018; 7(9):3256-3264.
21. Upadhyay A, Prava Lama J, Tawata S. Utilization of Pineapple Waste: A Review J Food Sci. Technol. Nepal, 2010, 10-18.
22. Willats WG, Knox JP, Mikkelsen JD. Pectin: New insights into an old polymer are starting to gel. Trends in Food Science and Technology. 2006; 17(3):97-104.
23. Xu SY, Liu JP, Huang X, Du LP, Shi FL, Dong R *et al*. Ultrasonic-microwave assisted extraction, characterization and biological activity of pectin from jackfruit peel. LWT. 2018; 90:577-582. http://dx.doi.org/10.1016/J.LWT.2018.01.007.