IJBAF, October, 2023, 11(10): 143-150

ISSN: 2320 – 0774

International Journal of Biotechnology and Allied Fields (IJBAF)

www.ijbaf.com

' Connecting Researchers... '

CONVERSION OF AGRO-INDUSTRIAL WASTES INTO VALUE ADDED PRODUCTS: A REVIEW

UPPADA SR* AND NAVEENA K

Department of Microbiology, St. Anns college for women, Mehdipatnam, Hyderabad, Telangana, India

***Corresponding Author: Dr. Sita Ramyasri Uppada: E Mail: u.s.ramyasree@gmail.com**

Received 8th July 2023; Revised 9th Aug. 2023; Accepted 7th Sept. 2023; Available online 1st Oct. 2023

ABSTRACT

Increased population and urbanization has led to the demand for food, feed, and chemicals that have in turn augmented the use of fossil-based resources and generation of agro-industrial waste. Several industrial wastes, due to their organic and nutrient-rich composition, have been utilized as a resource for the production of value-added products. Value added products are of now great interest to researchers and professionals across the world in the last decade and attracted many areas like food, packaging, cosmetic, agriculture, medical, pharmaceutical and therapeutic industries. Therefore, the feasibility and sustainability of the production of various value-added products from industrial and agro wastes will be discussed in the present review. The main focus of this review is to provide a comprehensive knowledge about their enhanced used in different industries.

Keywords: Agro-industrial by-products, Raw materials, value added products

INTRODUCTION:

The change in the form of the product enhancing its value with additional qualities more than the raw material from which it is obtained is called value added products **[1]**. This addition plays an important role in improving the viability, profitability, and sustainability to different industrial and agricultural products minimizing the accumulation of waste and losses. Value addition is a change of one set of

characteristics to other characteristics to make them preferred in the market place for higher returns **[2]**. It helps to increase the shelf-life of the commodity, improve off-farm employment opportunities and increase the trade and economy of the country. As the population is increasing there is a great concern in achieving such products and requires not only increasing the demand for production but also looking at other more effective ways that will maintain standard food production systems and reduce postharvest losses.

The transformed organic matter into value products, treatment methods like physical, chemical, or biochemical methods such as crushing, screening, and filtering and chemical methods such as alkaline hydrolysis, treatment processes such as fermentation (solid state fermentation), pyrolysis, precipitation, hydrolysis, combustion, composting, and filtration were used **[3]**. Many value-added compounds were produced by these treatment methods were used in food ingredients, pharmaceuticals, fuels, and biological materials. The agro industrial wastes were used to convert to biofuels, enzymes, vitamin supplements, antioxidants, livestock feed, antibiotics, biofertilizers and other compounds **[4]**. This conversion may provide cost reduction and lower environmental pollution levels. The difference between the raw product's value, cost, and other inputs and comparing it with the returns of the value-added products will determine the value addition for particular product.

Value added products like breakfast cereals, adhesives, baking mixes, biofuels, bioethanol, biosugar, enzymes, beverages, snack foods etc were obtained by different raw materials as shown in **Table 1** below.

Due to high nutrient presence of polysaccharide/proteins, carbohydrates, polyphenolic constituents, etc. The agricultural products and industrial effluents are being considered as a better-quality control by scientific communities and are integrating waste utilization to produce high value-added products to overcome the current situation.

Table 1: Showing different raw materials and value-added products obtained from them

Rawmaterial	Value product obtained	References
Coffee leaves	ethnomedicine, facial cleansers, tobacco substitutes, animal feed, proliferating agents, packaging materials, absorbance pads, and deodorizers	[5]
Ber	jam, candy, preserve, powder, murabba, beverages, wine, pickle	[6]
Coconutshell	Heavy metal adsorbent	[7]
Rice bran	Dietry fibres	[8]
Agrowaste	energy production, nanofiber production, single cell protein production, nutrient recapturing, phytoextraction, medical purposes, enzyme production, dye removal, microbial pigment production, oil production	[9]
Mango Seeds and pulp	Dietary fiber, Linoleic acid, linolenic acid	[10]
Palm	concretebinder	[11]
Tomato waste	Bioactive phytochemicals	[12]
corn cobs,sawdust and rice husks	Production of antibiotics	[13]
Sugar cane and agro waste	Production of biocolouring pigments, citric acid	[14]

TYPES OF RAW MATERIALS:

Industrial organic by-products of the agro-food industry include coffee, bagasse, degummed fruits legumes, milk serum, sludge from wool, cellulose, etc. **[15]**. Untanned and tanned (trimmings, splits, fleshings, and shavings) wastes from leather industry produce lot of value added collagen peptides which are used in different industries. Agricultural residues include vegetables, cereals, leaves, stalks, seed pods, and stems etc. The recovery of these raw materials of those interesting compounds from by-products depends on the quantities of value-added molecules they have and the treatment that has to be applied to obtain them.

VALUE ADDED PRODUCTS:

BIOPOLYMER AND BIOFUEL PRODUCTION:

The biodegradable nature of biopolymers makes them useful in different applications, such as packaging materials in

food industry, edible films, emulsions, as drug transport materials, medical implants like organ, tissue scaffolds, wound healing and dressing materials in pharmaceutical industries hence these biopolymers are not only derived from natural sources like plants, animals, microorganisms but also as value added products from agricultural and industrial wastes **[16]**. These biopolymers act as alternative to synthetic biopolymers which are causatives of pollution and ecological disturbance. Various residues like vegetable waste, potato peel, carrot peel and onion peel were used in production of bioethanol by the process of fermentation using *Saccharomyces cerevisiae*. This value product could indeed be the best alternative fuel to fossil fuels **[17]**.

ECONOMICALLY IMPORTANT SUBSTANCES:

Biosugars, biooils, bioactive substances with antioxidant, hypolipidemic, hypoglycemic, neuroprotective, and other biological properties were produced from waste from coffee such as husks, pulp, mucilage, silver skins, and spent coffee grounds (SCGs) **[18]**. Nanofibers and nanoparticles obtained from grains of corn, sorghum, and wheat play a vitalroles in the food industry and medicine to shield bioactive compounds, emulsion stabilizing, drug delivery systems, and control release of fertilizers **[19]**. Wheat, sunflower and soymeal, sugarcane bagasse, ricehusk, banana stems give value added enzymes like pectin, methyl esterase, β-1,4-glucanase, xylanase were produced **[20]**. Bio-based pigments from fermentation of agro-industrial waste have numerous advantages such as zero or less toxicity, biodegradability and eco-friendly property **[21]**. Collagen hydrolysates obtained from leather wastes are being utilized as biofertilizer, sportive nutrition and medically in cardiology, dermatology, orthopedy, ophthalmology, urology **[22]** cosmetics and food industry **[23]**. Wood-related waste materials from forestry, wood based industry, and agriculture activities were converted into other value-added products such as bio-energy, construction materials, agricultural compost, and handicraft application **[24]**.

FOOD INDUSTRY:

Jams, jellies, syrups, juices, cider, beverages are some of the value-added products from different fruits **[25]**. Concentrated milk, ice cream, hard and soft cheese, ice-cream mix, butter, cream, yogurt, cheese and whey products are value products from dairy industry **[26]**. UV and gamma irradiated sugarcane bagasse, corn stalks, and rice bran were used to produce the immunosuppressant mycophenolic acid **[27]**. Arabinoxylans extracted from Nejayote have

viscoelastic and nutraceutical properties that can be used as texture enhancer, probiotics and insulin regulator. Food flavors obtained from varied agricultural wastes serve as taste enhancer, with no harmful effects of these flavors and related compounds added to foods.

ORGANIC ACIDS:

Another promising application is the production of organic acids such as citric and gibberellic acid, poly-(3-hydroxybutyrate), adipic acid, itaconic acid were been reported from different industrial effluents and cheap feed stocks **[28]**.

CONCLUSION:

This review discussed the applications of different by-products instead of being discarded as waste, can be used as raw materials for the production of a variety of value-added products. This conversion into value added products represents a promising means to meet the growing demand of different commodities and also minimizes environmental pollution and wastage where growing demand is there due to increase in population. However, cost-effective, practical, and innovative inventions are still necessary for more production to enhance the sustainability of the processing business.

REFERENCES:

[1] Huan Liu, Yuhan Jin, Renwei Zhang, Yuchen Ning, Yue Yu, Peng Xu, Li Deng, Fang Wang, Recent advances and perspectives on production of value-added organic acids through metabolic engineering, Biotechnology Advances, 62, 2023,108076.

[2] Carolina Botella, Ana Diaz, Ignacio de Ory, Colin Webb, Ana Blandino Xylanase and pectinase production by Aspergillus awamori on grape pomace in solid state fermentation, Process Biochemistry, 42, 1, 2007, 98-101.

[3] Qing Jin, Liangcheng Yang, Nicholas Poe, Haibo Huang, Integrated processing of plant-derived waste to produce value-added products based on the biorefinery concept, Trends in Food Science & Technology, 74, 2018,119-131.

[4] Z. Zhu, M. Gavahian, F. J. Barbara et al., Valorization of waste and by-products from food industries through the use of innovative technologies, Agri-food Industry Strategies for Healthy Diets and Sustainability, 2020, 249–266.

[5] Chen, X. A review on coffee leaves: Phytochemicals, bioactivities and applications. Crit. Rev. Food Sci. Nutr. 2019, 59, 1008–1025.

[6] Dalal, Nidhi & raj, Nee & Bisht, Vinita. Value Added Products from

Ber. International Journal of Current Microbiology and Applied Sciences, 8, 2019, 1603-1615.

[7] V. J. Landin-Sandoval, D. I. Mendoza-Castillo, A. Bonilla-Petriciolet, I. A. Aguayo-Villarreal, H. E. Reynel-Avila, and H. A. Gonzalez-Ponce, Valorization of agri-food industry wastes to prepare adsorbents for heavy metal removal from water, Journal of Environmental Chemical Engineering, 2020, 8, 5, 104067.

[8] Tamanna Dey, Tarashree Bhattacharjee, Piyali Nag, Ritika, Amit Ghati, Arindam Kuila, Valorization of agro-waste into value added products for sustainable development, Bioresource Technology Reports,16, 2021, 100834.

[9] B. H. Nagaratnam, M. E. Rahman, A. K. Mirasa, M. A. Mannan, and S. O. Lame, "Workability and heat of hydration of self-compacting concrete incorporating agro-industrial waste," Journal of Cleaner Production, 11 2016, 2, 882–894.

[10] M. A. Silva, T. G. Albuquerque, R. C. Alves, M. B. P. P. Oliveira, and H. S. Costa, Melon (*Cucumis melo* L.) by-products: potential food ingredients for novel functional foods? Trends in Food Science and Technology, 2020, 98, 181.

[11] Z. E. Martins, O. Pinho, and I. M. P. L. V. O. Ferreira, Food industry by-products used as functional ingredients of bakery products, Trends in Food Science and Technology, 2017,67, 106–128.

[12] Ifudu, N.D. Indigenous resources for antibiotic production, Nov/Dec.ed., Expansion Today Nigeria; African University Press Ltd.:1986, 52–53.

[13] Mohamed, Hassan & Shah, Aabid & Song, Yuanda. (2021). Conversion of Agro-industrial Wastes into Value-Added Products, 10, 2021,1021.

[14] Ahmad S, Pathak V V, Kothari R and Singh R P 2018 Prospects for pretreatment methods of lignocellulosic waste biomass for biogas enhancement: Opportunities and challenges. Biofuels, 9, 575-594.

[15] Pirsa S, Sharifi KA. A review of the applications of bioproteins in the preparation of biodegradable films and polymers. J Chem Lett. 2020,1, 47–58.

[16] Zuorro, A.; Lavecchia, R. Spent coffee grounds as a valuable source of phenolic compounds and

bioenergy. J. Clean. Prod. 2012, 34, 49–56.

[17] Arikan, E.B.; Canli, O.; Caro, Y.; Dufossé, L.; Dizge, N. Production of Bio-Based Pigmentsfrom Food Processing Industry By-Products (Apple, Pomegranate, Black Carrot, Red Beet Pulps) Using Aspergillus carbonarius. J. Fungi 2020,6(4),240.100.

[18] R. Castro-muñoz, C. Conidi, and A. Cassano, "Membrane-based technologies for meeting the recovery of biologically active compounds from foods and their by-products," vol. 8398, 2018.

[19] Mitchell, E.S.; Gudka, B.; Whitaker, C.; Shield, I.; Price-Allison, A.; Maxwell, D.; Williams, A. The use of agricultural residues, wood briquees and logs for small-scale domestic heating. Fuel Processing Technol.2020,210,106552.

[20] D. Araújo, M. C. R. Castro, A. Figueiredo, M. Vilarinho, and A. Machado, Green synthesis of cellulose acetate from corncob: physicochemical properties and assessment of environmental impacts, Journal of Cleaner Production, 260, p. 120865, 2020.

[21] C. He, I. Sampers, and K. Raes, Dietary fiber concentrates recovered from agro-industrial by-products: functional properties and application as physical carriers for probiotics, Food Hydrocolloids,111, p. 106175, 2021.

[22] I. M. Ríos-Badrán, I. Luzardo-Ocampo, J. F. García-Trejo, J. Santos-Cruz, and C. Gutiérrez-Antonio, Production and characterization of fuel pellets from rice husk and wheat straw, Renewable Energy, 2020,145, 500–507.

[23] Yorgancioglu, A., Başaran, B., & Sancakli, A, Value Addition to Leather Industry Wastes and By-Products: Hydrolyzed Collagen and Collagen Peptides. Intech Open, 2020, doi: 10.5772/intechopen.92699.

[24] Martin, J.P.; Porto, E.; Correa, C.B.; Alencar, S.M.; Gloria, E.M.; Cabral, I.R.; Aquino, L.M. Antimicrobial potential and chemical composition of agro-industrial wastes.J.Nat.Prod.2012,5,27–36.

[25] Thakur V, Sharma E, Guleria A, Sangar S and Singh K, Modification and management of lignocellulosic

waste as an eco-friendly biosorbent for the application of heavy metal ionsorption, Materials Today: Proceedings, 2020, 32 608-619.

[26] Mella B, Benvenuti J, Oliveira RF, Gutterres M. Preparation and characterization of activated carbon produced from tannery solid waste applied for tannery wastewater treatment. Environmental Science and Pollution Research. 2019, 26, 1-7.

[27] Lestari, W.; Hasballah, K.; Listiawan, M.; Sofia, S. Coffee by-products as the source of antioxidants: A systematic review. F1000. Research 2022, 11, 220.

[28] L. H. Wartelle and W. E. Marshall, "Citric acid modified agricultural by-products as copper ion adsorbents," Advances in Environmental Research, 2000, 4,1, 1–7.