Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 06 (NOV-DEC, 2023)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Natural Pigments: From Fruits and Vegetable Waste and their by Products

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Worldwide, approaches inspired by the Circular Economy model have been increasing steadily, generating new business opportunities such as the recovery of high-added value molecules (e.g., pigments) from vegetable and fruit food waste that may be applied as food additives (e.g., colorants/pigments). Indeed, food waste is a global problem that does not seem to be decreasing, leading to economic, environmental, and social issues. Over the past 100 years, food dyes have been found to be more risky to our health than any other category of food additives.

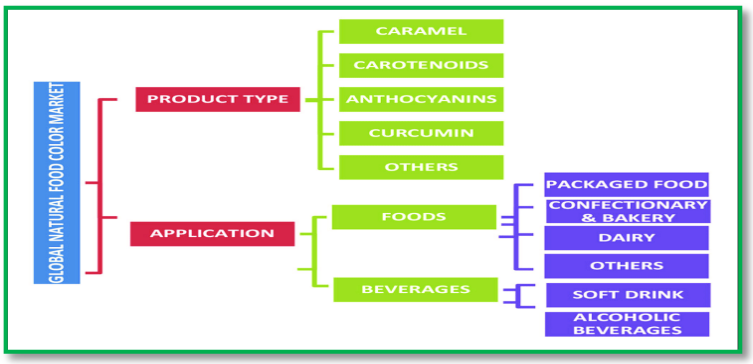
What Harmful effects do Synthetic Colors have on our health?

1. Increases Inflammation and disrupts functioning of the immune system.
2. Contain Cancer causing toxic contaminants.
3. Causes Hypersensitivity especially in children
4. Cause skin irritation, skin rashes, breathing problems and upset stomach.

Synthetic pigments have been associated with adverse effects on human health, thus encouraging research to explore much safer, natural, and eco-friendly pigments. of late, pigments market size is growing rapidly owing to their extensive uses. Hence, there is a need for sustainable production of pigments from renewable bio resources. Valorization of vegetal wastes (fruits and vegetables) and their by-products(e.g. peels, seeds or pomace) can meet the demands of natural pigment production at the industrial levels for potential food, pharmaceuticals, and cosme-ceuticals applications. These wastes/by-productsare a rich source of natural pigments such as: anthocyanins, betalains, carotenoids, Lycopene and chlorophylls. It is envisaged that these natural pigments can contribute significantly to the development of functional foods as well as impart rich biotherapeutic potential.

Global Natural Food Color Market

Methods:-The process of extracting pigments from their source by using a solvent is called extraction. The source can be solid or even liquid. The pigment after extraction is then recovered from the solvent by



the process of separation. For recovery of colorants from food waste, there are different methods of extraction which can be categorized into conventional and emerging methods. Usually, conventional methods such as Soxhlet extraction techniques using organic/inorganic solvents, maceration or hydro-distillation have been widely used for natural pigment extraction. But these conventional methods are time consuming and energy consuming, consume a large amount of solvent required for extraction, represent in loss of nutrients and have many more disadvantages. With these drawbacks, environmentally friendly innovative techniques-Green extraction techniques is now considered to be an emerging, re-discovered and innovative method gaining much importance aimed toward avoiding the adverse effects of synthetic solvents. Greener extraction techniques that assist with various innovative techniques such as: ultra-sound-assisted extraction (UAE), microwave assisted extraction (MAE), enzyme-assisted extraction(EAE), supercritical fluid extraction (SFE), pressurizedliquid extraction (PLE), and pulse-electric field-assistedextraction (PEF) employed for the extraction of natural pigments from vegetal wastes and by-products. These techniques are in demand due to their several advantages like the requirement for minimal solvents, are fast, convenient, can increase the extraction yield, protect pigments from degradation, enhance the quality of natural colorants, and are ecofriendly than conventional extraction techniques.

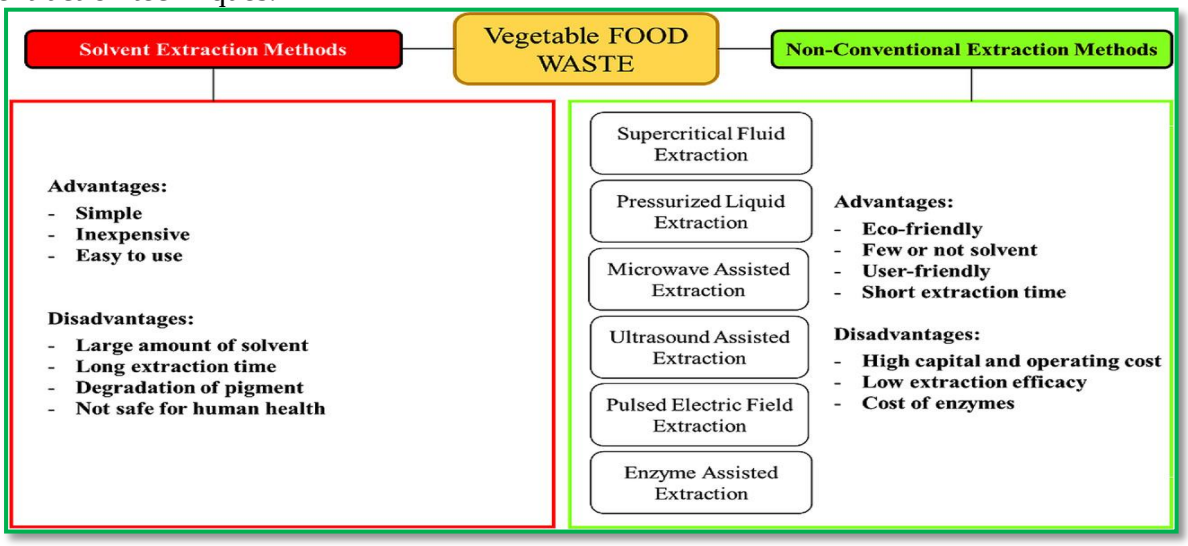


TABLE 1: Natural pigments extracted from vegetable and fruit wastes

Pigment	Sources
Carotenoids	Carrot peels ,Apricot pomace, Pumpkin ,Red pepperbyproducts ,Tomato skin ,Tomato peels ,Pumpkin rind ,Lemon waste ,Carrot juice waste, Pomegranate peels ,Mandarin epicarp ,Carrot waste ,Guava pulp, Gac peel ,Tomato pulp waste
Anthocyanins	Blackberry residues ,Cranberry pomace ,Sweet potato peel ,Sweet cherries skin , Black carrot pomace,Blueberry byproducts ,Blueberry waste, Elderberry pomace Blackcurrant waste, Eggplant peel ,Red grape pomaceGrape byproducts
Betalains	Beetroot pomace ,Pitaya peel , Red beetroots peels, Prickly pear
Chlorophylls	Spinach byproducts, Cucumber Peel, watermelon Peel

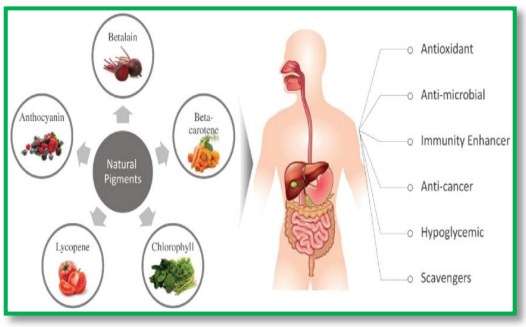
Alignment with Challenges

Stability is one of the vital aspects to be considered for the utilization of natural pigments as colorants and antioxidants in food formulations.The strength and stability of natural pigments

are affected by several factors during processing and storage. Natural pigments extracted from plant resources or agri-food wastes are highly unstable and are susceptible to degradation by external (processing conditions such as temperature and pH) as well as internal factors (e.g. concentration of pigment).The stability of these pigments can be increased by various concentrations in the system; low pH and temperature; presence of stabilizers (e.g. chelating agents, antioxidants); absence of light and the presence of acylation or glycosylation in the structure. In this way, micro or nanoencapsulation represents a promising concept and a best-suited technique for the entrapment of natural pigments in a coating enclosure to enhance their shelf-life. This is a technique which entraps the natural pigments using biopolymers to protect them from various processing and environmental hazards such as: moisture, oxygen, temperature, light, etc. This further improves their stability and ensures easier handling by changing them from liquid to powder forms. Several studies have reported on the use of micro/nanoencapsulation techniques such as spray drying, freeze-drying, electrospinning - nanofibers or complex coacervation- microsphere for the encapsulation of natural pigments. Spray drying is the best technique for the encapsulation of natural colorants because of it is a minimal exertion, rapid, and a reliable modern technique. Microencapsulated powders obtained from natural pigments extracted from wastes or by-products can be utilized in the formulation of several types of functional foods and beverages such as: confectionery, chocolates, jellies, sauces, ice-creams, candies, juices and instant drink powders to color the food commodities and enrich the health-promoting potential.

Potential Impact on our Health

There is a need to explore various vegetal waste resources to obtain food grade pigments with bioactive potentials. This is mainly due to consumers' awareness on health and numerous benefits delivered by these compounds. These pigments possess various biological roles in the protection of human health, like Anti-inflammatory (utilizing cytokines signaling) activity, Antioxidant (utilizing free radical scavenging pathway) activity, Anticancer properties, Antimicrobial activity, Anti-obesity activity.



Possible Area of Improvement

Considerable research works is lacking in the area of green technologies assisted with innovative technologiesfor the extraction of natural pigments on an industrialscale. There is a need to analyze the extraction costs for different phytopigments extracted from various green extraction methods and to identify the mostfeasible technique which can be best suitable for all the applications on an industrial scale.

Conclusion

It is concluded that exploitation of natural and health benefiting pigments from food wastes and by-products not only helps to minimize the environmental stress and supports the circular economy concepts, but can also helps the economic gains to the dependent industry.

References

1. Natural colorants from vegetable food waste: Recovery,regulatory aspects, and stability—A review
2. https://doi.org/10.1111/1541-4337.12951
3. Valorization of fruits and vegetable wastes and byproducts to produce natural pigments
4. https://www.tandfonline.com/doi/pdf/10.1080/07388551.2021.1873240