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Research Article

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Extraction of Beta-Carotene as Natural Dyes from Cucumis Melo Via Soxhlet Extraction Method

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Abstract

Natural dyes are pronounced as an interesting alternative to fabricated dyes. Accordingly, the attractive demand to develop the extraction techniques of the best ingredients of solid and liquid for natural dyes colorants from fruits materials and their application in human life. Extraction is processed using solvents or using modern techniques like ultrasonication and microwave. In this respect, the extraction of natural colorant from Cucumis melo has been investigated as a model. Determination of the structure of active ingredients was performed conducted by UV spectroscopy and gravimetrical analysis. Through the analysis of the results, it will be confirmed that the dye extracted from Cucumis melo of intense color is beta-carotene, which is considered as one of the most colored dyes. Therefore, we recommend using such dyes in the industrial fields especially for coloring and decorating sweets.

Keywords: Cucumis Melo, Extraction, Ultra-Sonication, B-Carotene, Colorants, Sweets

Introduction

Recently, the consumer attracted for essential materials instead of fabricated analogous w h i c h need an extensive role in the food industry. Particularly, due to dietary supplementation and healthy equities associated there from. Such as *Cucumis melo* as a member of *Cucurbitaceae* family, the fruit is recognized locally in Kingdom of Saudi Arabia as "Shamam" and it is widely established as the consequence of its calyces. Usually, they are used in large scale to construct cold beverages in several world's countries, additionally in phytotherapeutic applications [1, 2]. Several pharmacological activities have been effectively cited, such as antihypertensive and cardio protective agents, hepatoprotective, an inhibitor against porcine pancreatic amylase, sedative and antioxidant agents [3-11]. Moreover, *Cucumis melo* has attained an essential position in the soft drinks market; its commercial extract preparations are currently advertised as supplements laying for their attractive health benefits and as a replacement colorant of the fabricated dyes.

The intensive red colorant in the yellow calyces of *Cucumis melo* is beta-carotene and it was usually analyzed and detected using mass spectroscopy [12, 13]. The distinctions for beta- carotene are correlated by how many the -OH and -COOH groups, the nature, location, and the amount of sugars (e.g D-glucose, D-galactose, etc.) incorporated to the molecule as well as aromatic acids coupled to sugars in the molecule [14]. Distinguished glycones are of eighteen naturally existing most plants are pronounced as delphinidin (Dp), pelargonidin (Pg), peonidin (Pn), cyaniding (Cy), malvidin (Mv) and petunidin (Pt) [15-17]. The most prevalent glycosides in nature are the non-methylated three anthocyanidins (Cy, Dp and Pg) and their structures were elucidated using spectroscopic and chemical transformation methods [18-20].

Additionally, organic dyes, whether natural or synthetic are compounds of molecular structure that contain π- electrons 28, 20. It can be affected by light beams that caused the electron oscillation between lower and higher energy levels. The color appearance depends on the following [21-23].

- The chromophoric groups found in the molecular structure. The conjugated double bonds which help the molecule polarization.
- The auxochromophoric groups.

Interestingly, beta-carotene investigation by botanists and plant physiologists was concerned in respect to their importance as pollination attractants and photoprotective agents31. Kong et. al., introduced beta-carotene as a very useful colorant in taxonomic studies, realizing their accessible priority in affecting the color performance of the fresh and treated fruits and vegetables [24]. It was reported that first started studying these compounds to overcome the color degeneration of strawberry preserves fruit juice concentrates. Subsequent works were constructed to define their utility as

natural foodstuff colorants and to authorize fruit juice, which may prevent disease [25, 26].

The main target of the present study is to apply a modern selective extraction method, separation and identification using spectroscopic methods in respect to determining a qualitative estimation of beta-carotene in *Cucumis melo*. The above findings encouraged us to extract the β-carotene as natural dyes from *Cucumis melo*, investigate its chemical composition and exploring its applications for coloring and decorating sweets in Kingdom of Saudi Arabia.

Experimental Methods

Plant Materials

The fresh fruit *Cucumis melo* were collected, the fruit collected was further shelled and dried organs were ground to a reduced fine powder using Thomas-Willey Milling Machine.

Extraction Process

24.0 g of homogenized *Cucumis melo* powder dry parts were immersed in one liter of methanol and stirred at room temperature for 48 hours. The reaction mixture was filtered off and the filtrate was mixed with 40.0 g Amberlite XAD-2 (pore size 9 nm, particles size 0.3-1.2 mm) and stirred for 40 minutes at room temperature. Then packing the particles in a glass column (64cm x 42cm) and the column was washed with deionized water until a colorless solution was obtained. Eluation of the carotenoids remained absorbed on the column sing methanol (1 L) and glacial acetic acid (1%). The intense red solution obtained was subjected to dryness under reduced pressure.

Dyeing process

The method of dying procedure in each case depends on the type of the foodstuff and the dying conditions that were performed by varying: temperature, pH, the addition of other additives and duration of treatments. Each time 20.0 g of samples are used adding ingredients and controlling the required conditions

Procedures

- Start with cool foodstuff e.g. cakes, protect the surface, not to decorate by covering with a sheet of paper.
- Prepare the coloring dye.
- Place the coloring dye on the places to be decorated.
- Keep in liquid for up to 5 minutes; leave it longer for a darker hue.

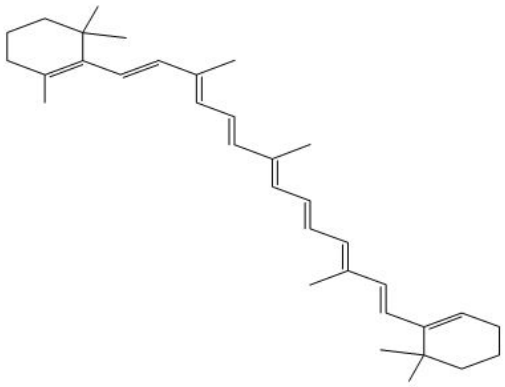
Carefully remove the sheet of paper to get the decoration.

Results and Discussions

UV-VIS spectroscopic analysis of the natural dye derived from *Cucumis melo* was obtained at the wavelength of 480 nm. Regarding the absorbance of natural dye extract derived from both magnetic stirring and ultrasound. Are marked 13% enhancement in percent of yield for the extract accompanying the use of ultrasound in comparable to the control process was recorded.

The color reflectance of dyed silk fabrics using *Cucumis melo* extracts belongs to boiling and solvent extraction techniques. Indeed, the same *Cucumis melo* extracted dye was blended with various mordant to give many colors. Instantly, fabrics dyed using iron as mordant produced the darkest color in comparison with the other mordants for both dyes from *Cucumis melo*.

β-carotene is a red-orange organic compound and is chemically allocated as a distinctive terpenoid, derived from isoprene moiety; it is biosynthesized from geranyl pyrophosphate27.β-carotene is characterized for the general class of carotenes by the β-rings at both terminals of the molecule [21, 22]. β-carotene is considered as a non-polar dye, so it can be isolated via the non-polar solvation [23]. It is characterized by high conjugation, deeply colored, and as a hydrocarbon which lacking functional groups, it is a lipophilic [24, 27].



The dye extracted from *Cucumis melo* of intense color is beta-carotene, which is considered as one of the most colored dyes.

Our results were revealed that, an attractive modification in the yield percent for colorant isolated has been observed in case of using ultrasound. It can be interpreted owing to the extent degree of binding of coloring matter related to plant cell membranes. On the other hand, the chemical constituents of plant species are another important factor which responsible for the chromophoric moiety and its solubility origin. Regarding the model selection of the plant, the basic chromophore group is carotenoid possess the OH group. According to Almahy, "the hydroxyl group is expected to be extracted better applying aqueous solvation using organic solvents" [25]. Conversely, in the case of Green wattle, the main chromophore investigated is poly phenolic (kaempferol), which is preferred to be performed better using water. Hence, better yields are observed for some plants as compared to Green wattle using water as solvent [26, 28-34].

Conclusion

β-carotene is providing an eco-friendly and safe facility for the coloring of food stuff and other materials. Application of ultrasound was proved to perform the extraction process for a larger extent owing to the better leaching of natural dyes of the plant cell membranes, consequently a mass transfer to solvent was assisted by acoustic cavitation's assisted by ultrasound. Additional process parameters such as solvent system, temperature, ultrasound power, amount of dye material etc., are attracting parameters for our future investigation work.

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