

## **Utilizing Diverse Coating Materials for Storage Stability of Encapsulated Anthocyanin Extract from Black Carrot**

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### **Abstract**

The enzymatic helped cum hydraulic powered crusher extract of black carrot which has high anthocyanin content were encapsulated through spray drier utilizing a blend of JSS (Jack fruit seed starch), SPI (Soy protein isolate) and NBRE-15 (SET - 1) what's more, in the second arrangement of investigation utilizing JSS, Whey protein and NBRE-15 (SET-2) as coating materials. The quality traits of the powders which were delivered at an ideal blend of SET - 1 and SET-2 were described by anthocyanin content, antioxidant agent limit and 'L', 'a', 'b', 'C' and 'H' value. It was accounted for that SET-1 was discovered better typifying material when contrasted with SET-2. SET-1 had higher retention of anthocyanin content, shading, antioxidant agent action during storage at 25 0C. For spray drying black carrot anthocyanin, SET-1 containing soy protein with JSS what's more, NBRE-15 gave most important anthocyanin content moreover, cell support limit powder in the wake of drying. In solicitation to restrict the concealing disaster, anthocyanin content additionally, cell fortification development these things should be taken care of in brilliant concealed containers with least head space. SET-1 had higher viability to foresee the loss of concealing, anthocyanin and cell reinforcement specialist activity during storage.

**Key words:** BlackCarrot, JSS, Encapsulation, Spray Drying, SPI.

### **Introduction**

Anthocyanin's are the normal color present in numerous blooms, products of the soil and are essentially liable for their red, blue or purple color[1]. Research on the utilization of anthocyanins, due to their potential medical advantages in battling a few illnesses; have pulled in incredible enthusiasm for the utilitarian nourishment, nutraceutical and pharmaceutical enterprises as of late[2]. Cell reinforcement action of anthocyanin's act as an anti-carcinogenic operator and are useful in treating illnesses, for example, neural and cardiovascular sicknesses and diabetes[3]. The majority of the enterprises are utilizing the engineered nourishment shading have a substance source that causes unfavorable wellbeing impact[4]. Blackcarrot anthocyanin's can be utilized as a characteristic nourishment colorant having antioxidant agent properties to advance medical advantages[5]. The black carrot was begun from center Asia and is viewed as the model of all cutting edge orange carrots[6]. Carrot, as far as their healthy benefit among different foods grown from the ground vegetables has been positioned tenth[7]. Five significant anthocyanin's color present in Black carrot are, two nonacylated, Cya3XylGlcGal and Cya3XylGal and three subordinates of

cyanidinacylated with sinapic corrosive, ferulic corrosive and p-coumaric corrosive[8]. Birds has been examined the utilization of black carrot anthocyanin's as the regular colorant in the creation of ice cream parlor, jams, sticks and solidified treats[9]. The elements that influence the shading and security of anthocyanin's are structure and fixation, pH, temperature, light, nearness of shades, self-affiliation, metallic particles, catalysts, oxygen, ascorbic corrosive, sugar and their corruption items, proteins and sulfur dioxide[10].

Expanding the requests of nutraceutical nourishment due to expanded buyer mindfulness, specialists are presently focusing to created nourishment with additional utilitarian and nutraceutical properties Among them epitome innovation is a significant territory to create utilitarian elements for the fortress in to various nourishment frameworks Exemplification is a system to forestall the delicate materials for example, anthocyanin's from dampness, warmth, light or oxidation. It is a bundling system of materials as miniaturized scale and nano particles. In view of high transient nature of black carrot, it is hard to protect it as a crude item. Spray drying is another system to protect a large portion of the anthocyanin's present operating at a profit carrot in blend with transporter operators for quite a while. There are a few techniques for exemplification of anthocyanins has been depicted. Spray drying has been utilized as a basic system in epitomizing water-solvent encapsulation regular fragrance and shading. Spray dried black carrot anthocyanin have better warmth, light what's more, pH solidness, along these lines, have upgraded rack life and solidness. The present examination was led to think about the storage soundness of spray dried anthocyanin-rich extract from black carrot exemplified utilizing.

The utilization of extracts from regular sources as nourishment shading is a continuous pattern on the grounds that, as a rule, they are Commonly Perceived as Sheltered substances and bring medical advantages for buyers. An assortment of normal colorants are utilized in the nourishment business, yet there is as yet a worry about their generation expenses and stability and their exhibition had been read for as far back as decade. Substances like carotenoid, chlorophyll, turmeric, anthocyanin, and betalain extricates from normal sources give an assortment of hues. Our theory depends on the probability of utilizing microencapsulation to expand stability of anthocyanins. Beforehand, we contemplated betalain extricates from Beta vulgaris and Myrtillocactusgeometrizers and got dried materials that were microencapsulated, getting an improvement in the materials' stability against UV light, pH and temperature. Anthocyanin's are a gathering of phenolic aggravates that are liable for the shades of blooms, natural products, and vegetables. It has been accounted for that this gathering of mixes has antioxidant agent, antimutagenic, anticancer and antiobesity properties, and they lessen the danger of coronary illness. The hues conferred by anthocyanin's are brilliant and could be utilized in the nourishment business as a trade for colorants like FD&C Red. The hues got are ordinarily red, orange, blue and purple, contingent upon the synthetic structure of anthocyanin's; however, basic changes are prompted by changes in the pH of the medium, that influence both shading quality and intensity.

Common wellsprings of anthocyanins are purple corn, red cabbage, purple sweet potato, apples, grapes, kiwi, red onions and a few berries. A few investigations have utilized nearby plants like black carrot. Black or purple carrot was initially from Turkey and the Center and Far East, yet as of late, new assortments with high anthocyanin content had been developed in different pieces of the world. Therefore, this source was chosen for our examination. The soundness of anthocyanins in plant separates relies upon the temperature and solids content; and by expanding these conditions, the corruption paces of anthocyanin's increment as well. To limit this debasement, it is prescribed to cool the extracts when created. Different components that influence shading and strength of anthocyanins are focus, light, co-colors, metallic particles, catalysts, sugars, proteins, and antiradical action. Thinking about those components, numerous endeavors have been made to upgrade anthocyanin's stability. Acylation of anthocyanins is the most normally utilized strategy, as it has been accounted for that acylatedcyanidin subsidiaries are progressively steady during delayed stockpiling contrasted with the comparing non-acylated ones additionally affirmed that there is an expansion in shading quality through acylation. Then again, microencapsulation has been utilized to build soundness of common colorants. At that point, thinking about these conditions, a few endeavors have been made to safeguard common extracts and colorants utilizing various systems, for example, expelling mixes through tar sections and microencapsulation. Here, we study the strength of black carrot extricates while adjusting the test conditions, including extraction solvents, and we study the possibility of microencapsulation and the repercussion of this technique on the soundness of the extracts.

## **Materials & methods**

Black carrot tests for anthocyanin extraction were developed in the Division of Vegetable Science, Indian Horticulture Exploration Foundation, New Delhi furthermore, moved to the Division of Nourishment Science and Post-Collect Innovation, IARI, New Delhi in about 20 kg plastic packs and kept at 20 °C until extraction.

### **1. Juice Extraction:**

Carrots were physically stripped utilizing a hardened steel blade and squashed coarsely by utilizing a blender. For the inactivation of polyphenol oxidase action, the squashed mass was warmed to 60 °C in a water spray and cooled quickly to 45 °C with ice water. The pectinase chemical was added to the mass at 0.2 ml/kg blended altogether and hatched at 60 °C for 60 minutes. The mass promptly squeezed in a hydraulic powered press. The separated juice was warmed to 90 °C for 1 minute then cool to 5 °C and stuffed in pre-disinfected golden hued glass bottles.

### **2. Arrangement of Feed Blend:**

A blend of various bearer operators viz., JSS, SPI and NBRE-15 (SET - 1) and JSS, whey protein and NBRE-15 (SET-2) were utilized to embody the anthocyanin extricate. Recently enhanced proportion of JSS: SPI: NBRE-15 and JSS: SPI: NBRE-15 were independently

used to set up the anthocyanin feed blend at the upgraded convergence of 27.3 o Brix (SET-1) and 27.8 o Brix (SET-2).Brix was estimated after homogenization of the blend utilizing computerized ultraturrax homogenizer for the mixing time of 30 minutes.

### 3. Spray Drying:

The feed blend was spray dried in a Sono Dry 1000 advance research center spray drier with complete unit 650mm L×550 mm W×1625 mm H and drying chamber width size 230 mm.

### 4. Exemplified Anthocyanin Powder Stockpiling:

Exemplified black carrot anthocyanin's powder were put away in golden shaded jugs and in straightforward hued bottles with screw tops and set at 25 °C to decide the quality property of embodied anthocyanin powder. Corruption study was pursued for 9 weeks of storage and the substance was broke down week after week agreeing.

### 5. Moisture Substance of Exemplified Anthocyanin Powder:

The dampness substance of the spray dried powder was dictated by utilizing a vacuum stove strategy. 2 g powder tests were estimated and kept in the stove at 70 °C and 100 mm Hg vacuum for 7-8 h. Subsequent to cooling in desiccators, the dampness content in rate was determined by utilizing the accompanying condition.

$$\text{Moisture content (\% w.b.)} = \frac{\text{Initial weight (g)} - \text{Final weight (g)}}{\text{Initial weight}}$$

### 6. Color Measurement:

The shading changes in the epitomized tests were estimated with Tracker Lab colorimeter. The instrument was adjusted with high contrast reference tiles taking as a standard. The shading value were communicated as 'L' (delicacy/murkiness), 'a' (red/green), 'b' (yellow/blue), 'C' (Chroma) and 'H' (tone point).

$$C = (\alpha^2 + b^2)^{1/2}$$

$$H^\circ = \tan^{-1} (b^*/a^*)$$

### 7. Total Anthocyanin's Content:

The complete monomeric anthocyanin was controlled by pH differential method. Two support frameworks were readied potassium chloride cushion, pH 1 and sodium acetic acid derivation cradle, pH 4.5. The pH was balanced with HCl. Tests were weakened in pH 1 and pH 5 cradles and the absorbance estimation were made at 510 and 700 nm separately. Anthocyanin's in epitomized powder communicated as cyanidin-3-glucoside reciprocals, as pursues:

$$\text{Cyanidin - 3 -glucoside equivalents (mg/L)} = A \times MW \times DF \times 1000 / (\epsilon \times l)$$

Where,  $A$  (Absorbance) =  $pH\ 1.0 (A510-A700) - pH\ 4.5$ ,  $MW$  = Molecular weight,  $DF$  = Dilution Factor,  $\epsilon$  = Molar.

The exemplification proficiency of the anthocyanin was determined utilizing recently distributed strategy.

## 8. Antioxidant Activity:

Antioxidant activity in encapsulated black carrot powder was controlled by CUPRAC strategy to measures the copper diminishing storage of polyphenols, Nutrient C and E. For assurance of cell reinforcement movement 100 $\mu$ l supernatant examples were blended in with 1 ml 10-2 M copper chloride, 1 ml 7.5 $\times$ 10<sup>-3</sup> M Neocuproine, 1 ml ammonium acetic acid derivation cradle and 1 ml refined water in the test tubes. The last volume arrived at 4.1 ml. The absorbance of the examples was taken at 450 nm following 30 minutes against a reagent clear in the UV-Vis spectrophotometer. The computation was finished utilizing the accompanying condition:

$$\text{Antioxidant storage } (\mu\text{ mol Trolox/g}) = (A / \epsilon TR) (V_f / V_s) DF (V_t/m)$$

## Results

The underlying dampness substance of spray dried black carrot powder was 4.36 % and 5.02 % for the SET-1 also, the SET-2 separately. It was discovered that expansion in feed stream rate from 2 to 2.5 ml/min, the dampness content in the encapsulated powder were additionally expanded and arrived at 4.85 % for SET-1 and 5.42% for the SET-2. It was moreover revealed that expanding in feed stream rate, increment the dampness content. During the storage time frame the 'L' values increment essentially for SET-1 and for SET-2, be that as it may, values of an and b declined regarding days interim. New epitomized black carrot indicated 'L', 'a' & 'b' estimations of 32.20, 28.21 and - 1.60 for the SET-1. Be that as it may, for the SET-2 these qualities were accounted for to be 34.32, 24.21 and - 1.66 separately. On the other hand, the 'C' values were 30.77 for STE-1 and 29.96 for SET-2 individually. Our examples had a negative H value which went - 17.61 (for SET-1) to - 14.56 (for SET-2) relating to a pale blue tint for the crisp encapsulates. It was seen that L values expanded as the 'a' & 'b' values declined each week during storage. The decrease in a qualities was a sign of the decrease of anthocyanin content what's more, moved towards somewhat blue tone with a negative 'H' value for both the sets. SET-1 had higher retention of a qualities when contrasted with SET-2, indicating it had a higher ability to avert anthocyanin decrease during storage. Golden hued bottles were seen as progressively viable to forestall shading corruption over straightforward hued bottles. The examples needed to fall 'b' value and achieved a higher negative an incentive during week interims, demonstrated expanded in blueness. It was accounted for 'a' diminishing in the 'b' factor of black carrot syrups during storage.

The anthocyanin content was profoundly affected by diverse coating operators. If there should be an occurrence of SET-1 anthocyanin content was seen as most extreme 2969.66

mg/100 g of dry issue with encapsulation productivity 87.72%. Then again, SET-2 had low encapsulation effectiveness for example 75.36% with anthocyanin content 2752.91 mg/100 g of dry issue. It was accounted for anthocyanin content in black carrot  $2721.61 \pm 5.92$  mg/100 g of dry issue. Golden shaded jugs were accounted for to be increasingly compelling in holding anthocyanin content over straightforward shaded jugs during storage. Toward the finish of the storage time frame, anthocyanin retention in SET-1 and SET-2 put away in Golden hued bottles were discovered 49.98 % and 38.04 %. Be that as it may, those put away in straightforward hued bottles had retention of 35.15 % for SET-1 and 34.56 % for SET-2. It is appearing the decrease design in anthocyanin content during storage in straightforward hued jugs and Golden hued bottles. The decrease in the anthocyanin substance might be because of the nearness of warmth stable type of polyphenol oxidase or peroxidase. It might likewise a consequence of the transformation of anthocyanin glycosides to chalcones, bringing about phenolic acids and aldehydes due to hydrolytic responses. Black carrots contain cyanidine based anthocyanin and have vicinal hydroxyl gatherings. Anthocyanin of this gathering is required to additional inclined to degradation.

During stockpiling at 25 °C, the soy protein (SET-1) was accounted for to be better epitomizing specialist than whey (SET-2) containing the epitomizing specialist. Structure assumes a key job in the assurance of the cell reinforcement action of anthocyanin's and exceptionally connected with anthocyanin content and totalphenolic compound of nourishment products. The cell reinforcement movement of embodied black carrot was answered to be 344.3  $\mu\text{mol}$ trolox/100g dry issue (SET-1) and 282.3  $\mu\text{mol}$ trolox/100g dry issue (SET-2) by utilizing the CUPRAC strategy. It was accounted for cell reinforcement movement in black carrot by utilizing DPPH and FRAP techniques in their examination, were low when contrasted with our examples. It was accounted for cell reinforcement action. The distinctions in the cell reinforcement action rely upon different elements like climatic conditions, cultivar, development conditions and phase of reaping. The storage temperature plays a significant job in deciding the solidness of the antioxidant agent. The exemplified black carrots powders were put away at 25 °C, in this manner a fast decrease in the antioxidant agent movement during storage. It was additionally in the understanding that the more misfortune in cell reinforcement movement happened in black carrot jam and preserves put away at 25 °C as contrasted with those put away at 4 °C. The decrease in the cell reinforcement movement could be because of the nearness of oxygen in the head space of the jugs. At the end of storage, SET-1 demonstrated higher retention for example half in the antioxidant agent action as analyzed to SET-2 with most extreme retention 38.04 put away in golden shaded containers. Then again, tests put away in straightforward shaded containers had retention of 40.14% and 30.93% for SET-1 and SET-2 separately. The decrease in the cell reinforcement could likewise be because of presentation of the examples in the light.

## **Conclusion**

For spray drying black carrot anthocyanin, SET-1 containing soy protein with jack natural product seed starch what's more, NBRE-15 gave most noteworthy anthocyanin content

furthermore, cell reinforcement limit powder in the wake of drying. In request to limit the shading misfortune, anthocyanin content also, cell reinforcement movement these items ought to be put away in golden shaded jugs with least head space. SET-1 had higher effectiveness to anticipate the loss of shading, anthocyanin and antioxidant agent action during storage. The enzymatic helped cum hydraulic powered crushed extract of black carrot which has high anthocyanin content were epitomized through spray drier using a mix of JSS, SPI and NBRE-15 (SET - 1) in addition, in the second course of action of examination using JSS, Whey protein and NBRE-15 (SET-2) as coating materials. The quality attributes of the powders which were conveyed at a perfect mix of SET - 1 and SET-2 were portrayed by anthocyanin content, antioxidant agent operator breaking point and L, a, b, C and H value. It was represented that SET-1 was found better exemplifying material when stood out from SET-2. SET-1 had higher maintenance of anthocyanin content, concealing, antioxidant agent activity during storage at 25 °C.

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