Anti-aging harmless food additives containing anthocyanins produced by genetic modified plant chassis cells

Worldshaper-Shanghai

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Introduction

Anthocyanin are natural, water-soluble pigments which belong to the flavonoids.

The main global anthocyanin consumption is driven by the food and beverage industry, used as a **harmless colorant**. The fact that Anthocyanin can **eliminate free radicals gives its antioxidant property.**

Chronic diseases associated with aging can present challenges for the middle-aged and elderly population, meaning the demand for anti-aging drugs will keep increasing. Anthocyanin's high potential **as antioxidant is hampered by its low bioavailability and the vast requirement of space for planting plants with natural anthocyanin.** Therefore, our team decided to transplant anthocyanin's production pathway to **carrot chassis cell** and present as food coloring additives**.** We will also be searching for the best condition for anthocyanin and try to improve the poor bioavailability of anthocyanin by adding auxiliary materials.

Our goal is to produce stable anthocyanin with **high yield by genetic engineering to assist people against aging.**

Background

Ageing, an inevitable issue, describes the decreased physiological and psychological resilience.

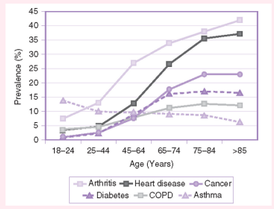


Figure 1. Prevalence of Selected Chronic Conditions Expressed as Percentages, as a Function of Age for the U.S. Population (2002–2003 Dataset). Created by Randall. E. Harris. Data from National Center for Health Statistic.

According to World Health Organization, by 2050, the percentage of individuals over the age of 60 is projected to increase from **12% to 22%.** As our bodies age, many would experience **geriatric diseases**, including arthritis, cancer, and diabetes.

Neurodegenerative disorders are also commonly caused by aging, such as Alzheimer's and Parkinson's. People suffer from cognitive disorder, difficulties in concentrating, memorizing, communicating and loss of visual ability.

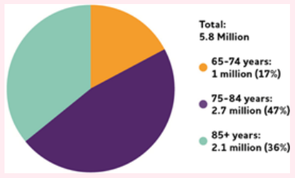


Figure 2. Number and ages of people 65 or older with Alzheimer's dementia, 2020. From 2020 Alzheimer's disease facts and figures Alzheimer's Association report

According the New Insight Industry Research Center, with the continuous progress of technology and the gradually recognized effect of anthocyanin**, the market demand for anthocyanin** has gradually increased.

Using plants to produce anthocyanin requires **a lot of arable land, and seasonal and climatic limitations exists.** However, biosynthesize anthocyanin could help solve the problem of insufficient space, and production by biosynthesis method is free from seasonal and climatic constrains. As a result, large scale production could be carried out regardless to season or climate.

Idea/Future work

In our design, an inducible anthocyanin biosynthesis system is constructed by **regulating the transcription level of SbMYB and SbDEL, two anthocyanin regulators.**

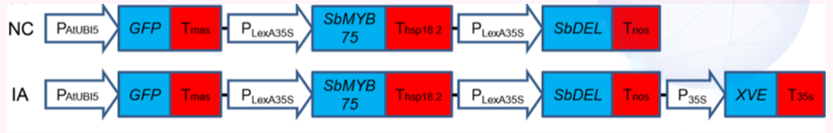


Figure 3. Construction of the carrier

Our goal is to construct such an inducible anthocyanin biosynthesis system in an **edible plant chassis cell.** In our construction, constitutively expressed XVE transcription factor could be activated in the presence of β-estrogen, then activates the expression of SbMYB75 and SbDEL, which further enhance the expression of anthocyanin production-related genes. **Agrobacterium rhizogenes** is transformed with constructions by electroporation, then used to **infect the carrot to produce positive infected hairy root.** The hairy root can then be induced by β-estrogen to produce anthocyanin.

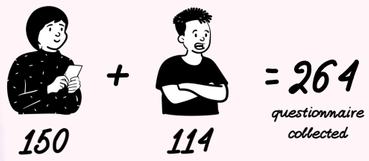
We are also aiming to produce a **safe food pigment that can also have anti-aging effects.** Addressing such health issues, we also want to help improve some habits of our users.

Hence, we design **a jar that can both quantify the ingestion of flavoring** and satisfies the storage of our anthocyanin food pigment. The jar is designed to have several chambers that can hold different flavorings. One of them can be used to store salt, which is often consumed excessively. Through the notification of the amount of seasoning already used in a day, our user can manage their consumption and their health condition better. Also, the sealed, sun-blocked jar can guarantee that the anthocyanin is not spoiled before usage.

Human Practice

Our HP is mainly based on three parts: 1) public research 2) corporate organizations and experts 3) public science

1. Public research: We investigated the public's understanding and acceptance of aging, anthocyanin and food additives by means of questionnaires and offline interviews, which laid the foundation for our subsequent product design and other aspects.



2. Companies and institutions: We conducted offline and online interviews with experts in the fields of aesthetic medicine, food safety and nutrition. Understanding the current market of the anti-aging industry, the main ingredients involved, the mainstream product types and popular production techniques. We are also getting familiar with assessment of the anti-aging capacity of anthocyanin as well as biosafety and control measures.

3. We collaborated with the Yunnan education project **"Mountain Education for the Future"** to design an online course for children in the mountainous regions to learn about plants and colors, and to introduce our project in a fun and educational way.

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