4 - 39 Identification of Flavonoids and Expression of Anthocyanin Biosynthetic Genes in Leaf Color Mutant Induced by Carbon Ion Beam in Wandering Jew(*Tradescantia fluminensis*)

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Leaf color mutants are ideal materials for studying physiological processes in plants. Here, a thermos-sensitive leaf-color mutant of Green wandering jew was isolated after carbon ions irradiation, which was designated as mt. The color of young mutant leaves was more sensitive to variations of temperature, however, the young leaves of wild type remained green under low - temperature conditions (6 ℃-20 ℃). To elucidate the characteristics of pigmentation in mutant leaves under room temperature conditions (25 ℃) and low - temperature conditions (7 ℃), the ultra-structural, pigment composition, molecular mechanisms and anthocyanin accumulation involved in this phenomenon have been investigated in four independent experiments. The results showed that chloroplasts of mutants exhibited abnormal morphology and distribution at 25 ℃, and under low - temperature conditions(7 ℃), the chloroplasts converted into leucoplast in leaves on mutants. Temperature change affected the rate of color transition, chlorophyll and anthocyanin concentrations in leaves on mutants. Molecular analysis indicated that all the anthocyanin biosynthetic genes and regulatory genes were constitutively up-regulated in mutant leaves at 7 ℃. The other anthocyanin biosynthesis and regulatory genes showed similar expression levels between mutant and wild type except PAL, CHS, ANS were up-regulated at 25 ℃. HPLC analysis of anthocyanins in mutant and wild type leaves revealed that the contents of cyanidin, petunidin and delphinidin were significantly lower than those of under low-temperature conditions (7 ℃) except pelargonidin was not detected in mutant leaves under room - temperature conditions(25 ℃). The HPLC profile also indicated the highest levels of flavonols in mutant leaves at 7 ℃ significantly. Overall, above results indicated a close similarity among ultra-structures, pigment compositions, transcript amount and anthocyanin accumulation were tightly associated with temperature variation in leaves of leaf color mutant. These findings would provide better understanding of the mechanism of pigmentation changes in mutant leaves under different temperature conditions in Wandering jew.

4 - 40 Effect of Carbon Sources on the Biomass Accumulation of *Saccharomyces cerevisiae*

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β−glucan is one of the most important sources of cell wall in yeast strains (*Saccharomyces cerevisiae*). It is now known that β-glucan not only exhibits a broad spectrum of biological activities including immune-modulating, anti-inflammatory, anti-cancer, and anti-aging properties, but also can be used in food production as moisturizer, dietary fibers(DF)[1]. Therefore, it is imperative to breed yeast strains with higher biomass production and optimize the fermentation process. *Saccharomyces cerevisiae* needs carbon sources in biomass accumulation,but glucose is expensive in industrial fermentation[2]. The aim of this study is to evaluate the different carbon sources on the growth of *Saccharomyces cerevisiae.*

S. cerevisiae 100G-9 used in this research was screened out from the $^{12}C^{6+}$- ion beam irradiation. The strain was incubated in the culture medium with three different carbon sources-glucose, saccharose and sweet sorghum stem juice(reducing sugar content is 1.0 mg/mL) respectively, and fermented for 24 h under the conditions of 30 ℃ and 200 r/min, and then the biomass accumulation was measured.

Fig. 1 showed that the biomass accumulation of *S. cerevisiae* 100G-9 increseased up to 7.9 g/L under the 2% gulcose content, and Fig. 2 showed that the optimal biomass accumulation increased to 7.02 g/L from 4.017 g/L under the condition of 2% saccharose. When using sweet sorghum stem juice as replaced carbon source, the optimized biomass accumulation is 7.33 g/L with the juicecontent of 4% (Fig. 3), which is 0.31 g/L higher than using saccharose, and then decreased to 6.84 g/L at the content of 6%. According to the report[3], the reason of biomass decline was that the high content of carbon source may inhbit the regular growth of *S. Cerevisiae.* Although the biomass accumulation is 0.57 g/L lower than using gulcose, considering the industrial production costs, sweet sorghum stem juice is much cheaper than glucose, indicating that sweet sorghum stem juice can be used as the ideal carbon resource in industrial yeast fermentation.

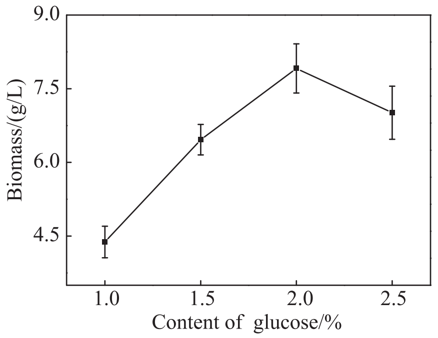

Fig. 1 Effect of glucose on biomass accumulation.

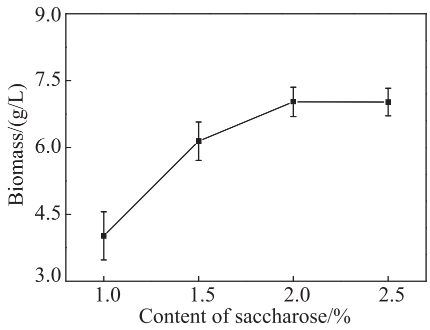

Fig. 2 Effect of saccharose on biomass accumulation.

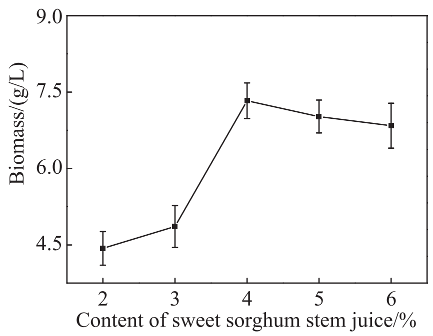

Fig. 3 Effect of sweet sorghum stem juice on biomass accumulation.

The results demonstrated that the content of carbon sources had an important effect on the growth of *S. cerevisiae* 100G-9, and *S. cerevisiae* 100G-9 could grow well using sweet sorghum stem juice as carbon resource. It shows that sweet sorghum stem juice is an economical carbon resource in fermentation of mutant strain *S. cerevisiae* 100G-9.

References

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4 - 41 Effect of Carbon Ion Beam Irradiation on Arsenic Tolerance in *Acidithiobacillus ferrooxidans*

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Biooxidation has been successfully applied in the field of refractory gold ore pretreatment. It refers to a process that uses acidophilic microorganisms to oxidize and deteriorate the minerals, thus making gold available for cyanidation. *Acidithiobacillus ferrooxidans*(*At.f*), a chemolithoautotrophic, acidophilic, moderately thermophilic bacterium, is the most crucial microorganism involved in biooxidation. *At.f* can obtain energy by oxidizing ferrous irons and reduced sulfur compounds in the minerals[1]. As a toxic metalloid carcinogen, arsenic is always associated with hydrothermal gold deposits. Arsenic is frequently found as arsenopyrite (FeAsS), realgar (As_4S_4), orpiment (As_2S_3) and in refractory gold ores[2]. The high toxicity of dissolved arsenic can seriously inhibit the activity of *At.f* or even completely stop the biooxidation process. Therefore, strong resistance against soluble arsenic is necessary for *At.f* to increase leaching efficiency and recovery of gold from the leachates. The aim of this study is to screening strain *At.f* with strong arsenic-tolerance by carbon ion beam irradiation and domestication.

At.f YS-1 used in this study was isolated from acid mine drainage at Yangshan gold mine. The cells were irradiated with different doses of carbon ion beam, including 5, 10, 20, 40, 80, 120, 160 and 200 Gy. After irradiation, all samples were inoculated into 9K medium and incubated at 35 ℃ and 150 rpm, and sodium arsenite of 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 mmol/L were added in the medium. To improve the arsenic resistances, samples were inoculated into fresh medium containing a low arsenite concentration of 10 mmol/L, and then transferred into media containing higher concentration of arsenite until samples cannot survive in the higher concentrations of arsenite. The ferrous iron oxidation rate was calculated to select the high arsenic-tolerant ability strain.

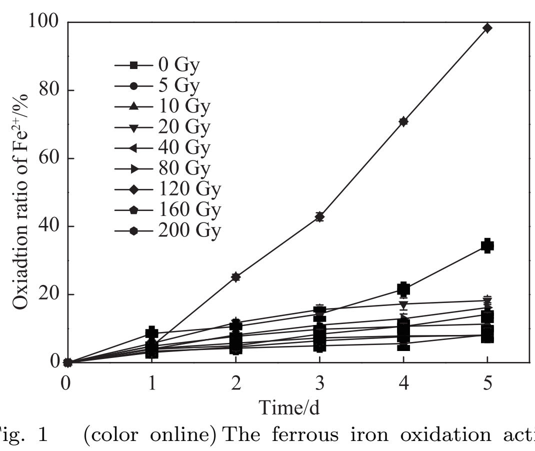

Fig. 1 (color online) The ferrous iron oxidation activity of irradiated strains adapted in the presence of 90 mmol/L arsenate.

The results showed that strains irradiated with different doses of carbon ion beam had different tolerance to soluble inorganic arsenic (Fig. 1). When strains were