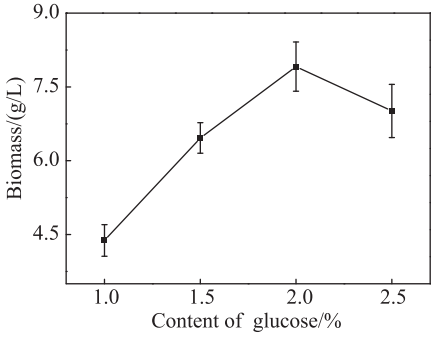


Fig. 1 Effect of glucose on biomass accumulation.

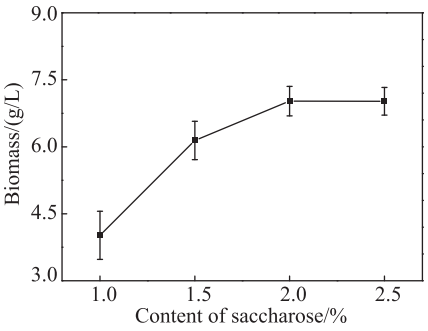


Fig. 2 Effect of saccharose on biomass accumulation.

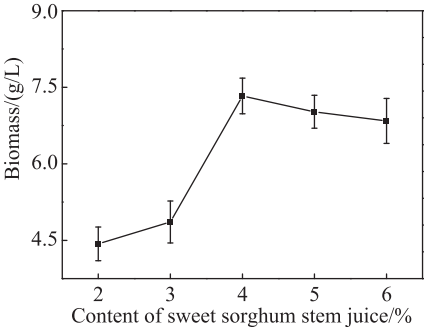


Fig. 3 Effect of sweet sorghum stem juice on biomass accumulation.

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.

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

Yan Qian, Zhang Miaomiao, Guo Xiaopeng, Lu Dong and Li Wenjian

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.

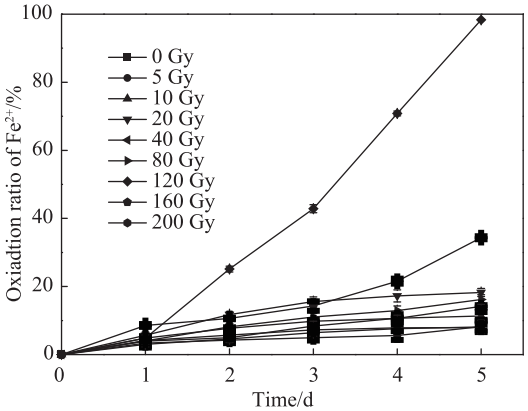


Fig. 1 (color online) The ferrous iron oxidation activity of irradiated strains adapted in the presence of 90 mmol/L arsenate.

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

incubated in the presence of 90 mmol/L arsenate, the highest arsenic-tolerant ability was observed in the 120 Gytreated group in which ferrous irons were completely oxidized within 5 d. While the oxidation capacities of other strains were inhibited severely, including original strain. The arsenite resistance of sample treated by 120 Gy carbon ion beam was higher than those reported previously. For example, Barrett[3] suggested that arsenite with a concentration of 30 mmol/L was a major toxin to *At.ferrooxidans*, and it can hardly grow anymore. The result showed that the carbon ion beam irradiation and domestication can improve the arsenic-tolerant ability of strain YS-1.

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## 4 - 42 Study on the Mechanism of Flower Pigment Mutation Induced by Carbon Ions in Geranium (Pelargonium × hortorum)

Yu Lixia, Zhou Libin, Du Yan, Luo Shanwei, Feng Hui, Mu Jinhu, Chen Yuze and Li Wenjian

Flower color as the important economic indicator for ornamental plants has become the primary target for ornamental improving and breeding. Heavy ion mutation technology as a unique and efficient mutagen has been widely used in germplasm innovation and plant breeding. In our study, 150 young shoots of Pelargonium were exposed to 80 MeV/u carbon ions and finally one stable genetic flower color mutant was obtained at dosage of 30 Gy. Comparing with wild type, the physiological indexes of mutant displayed significant differences. The color of petal in mutant was changed from red to light pink, and the color of peduncle and torus was changed from green to red, as well as the pistils and stamens' color were changed from yellow green to purplish red. In order to elucidate underlying mutation mechanism of coloration change in mutant induced by carbon ions, the anatomical structures, pigment components and quantities and expression profiles of key genes involved in anthocyanin biosynthesis were investigated.

Anatomical structure observations suggested that the morphology of epidermal cells and the distribution of anthocyanins had no significantly differ between the mutants and the wild type, but the quantities and types of anthocyanidins were not same. As shown in Fig. 1, abundant purple-red and salmon pigments fully filled with the upper and lower epidermal cells of wild type, while only a small number of pale pink pigments in mutant. HPLC(High performance liquid chromatography) analyses were performed to identify the pigments in petal of wild type and mutant. The results indicated that the main pigments determined the flower color of wild type were abundant pelargonidin(61.2%) and bits of cyaniding(21.0%) and delphinidin(17.8%). On the contrary, the unique pigment can be detected in mutant was cyanidin. The core reason of depigmentation in mutant was the absence of pelargonidin and delphinidin (Fig. 2).

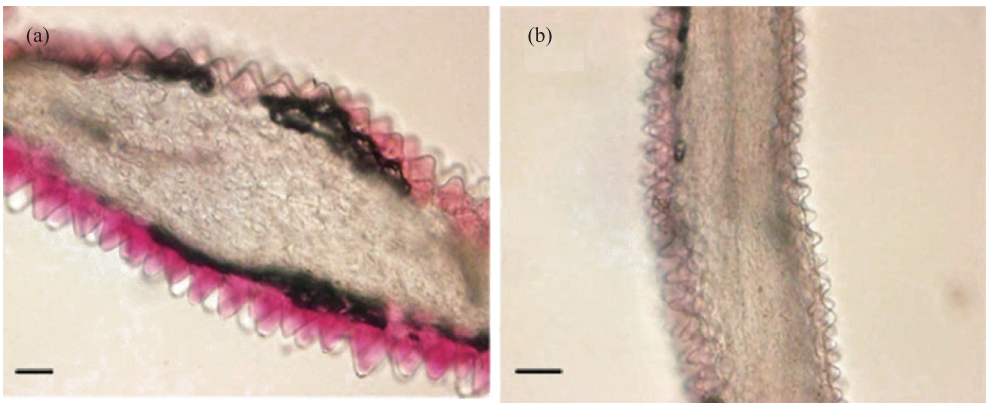


Fig. 1 Microscopic assessment of epidermal cells. (a) wild type, (b)mutant.

Quantitative real-time PCR were executed to analyze the expression profiles of the key structural genes involved in the anthocyanin biosynthetic pathway. The results suggested that most of genes were down-regulated in mutant,