

The Different Changes of Endogenous Polyamines in Tomato Plants with Different Heat-tolerance under High Temperatures

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Abstract: The changes of endogenous polyamine levels induced by high temperatures were investigated in tomato plants with different heat-tolerance. Plants were treated at temperatures of 25/20°C (day and night), 33/25°C and 38/28°C at seedling or blooming stage. The results showed that the levels of spermidine and spermine in heat-tolerant varieties significantly increased with increase of growing temperature, and the maximum was observed at 38/28°C. In contrast, in heat-sensitive varieties, the highest levels of spermine and spermidine occurred at 33/25°C. The temperature treatment of 38/28°C remarkably decreased spermine and spermidine contents both in leaves and flowers compared with 33/25°C in heat-sensitive varieties. The putrescine content showed no regular changes both in temperature treatments and varieties. The involvement of polyamines in tomato heat tolerance is discussed.

Key words: Tomato; Heat-tolerance; Polyamines

冷藏和气调处理对青花菜 Glucoraphanin 含量的影响

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Effects of Cold Storage and Controlled Atmospheres on the Content of Glucoraphanin in Broccoli Florets

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关键词: 青花菜; Glucoraphanin (4-甲基亚磺酰丁基芥子油苷); 冷藏; 气调

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Glucoraphanin (4-甲基亚磺酰丁基芥子油苷) 在青花菜中含量丰富, 其降解产物 Sulforaphane 具很强的抗癌活性。本试验以 'Marathon' 青花菜为试材, 将新鲜花球切成小花球后用 100 mg/L 的 NaClO 表面消毒 1 min, 清水洗净。分别取 650 g 花球置于 0°C、5°C 和 10°C 冷藏, 并在 5°C 下进行 5 种气调处理: 1) Air, 2) Air + 10% CO₂, 3) Air + 20% CO₂, 4) 1% O₂, 5) 1% O₂ + 10% CO₂。每一处理分别在处理当天、处理后 3、6、9、12 d 取样 50 g, 真空冷冻干燥, 并研磨成粉末状贮藏于 4°C 待用。将 0.2 g 冷冻干燥样品在沸水中煮 10 min, 3 500 g 离心 5 min 后, 取上清液, 再用 2 mL 重蒸水溶解沉淀后同法离心, 合并上清液。提取液经 DEAE-Sephadex A-25 柱层析后, 加入 100 μL 0.1% 的芳香基硫酸酯酶 (aryl sulphatase) 过夜, 最后用 1 mL 重蒸水过柱得到洗脱液供 HPLC 分析。HPLC 分析的色谱条件为: 150 mm × 4.6 mm Spherisorb C-18 柱, 以乙腈和水作为流动相, 1.5% ~ 20% 的乙腈线性洗脱 30 min, 流速为 1.0 mL/min, 采用 226 nm 和 280 nm 双波长检测, 以烯丙基芥子油苷 (sinigrin) 和硝基苯基半乳糖吡喃糖苷 (NPG) 作为内标。

试验结果表明, 在 0°C 和 5°C 冷藏期间, 青花菜花球中的 Glucoraphanin 含量无明显下降; 而在 10°C 下贮藏 9 d, 其含量开始明显下降, 且此时的花蕾黄化, 外观品质差。因此 10°C 条件下贮藏时间不宜超过 9 d。在 5°C 的气调贮藏中, 较高的 CO₂ (Air + 10% CO₂, Air + 20% CO₂) 对 Glucoraphanin 含量无显著影响, 而较低的 O₂ (1% O₂, 1% O₂ + 10% CO₂) 则使其含量在 0~9 d 持续下降。从贮藏的效果来看, 处理 3 可引起细胞汁液的渗出和酸味的产生, 使产品的外观品质明显下降, 而处理 2、4、5 均有较好的效果, 货架寿命在 30 d 以上。但较低的 O₂ 使 Glucoraphanin 含量明显降低。从产品的外观品质和 Glucoraphanin 含量综合考虑, 处理 2 较好。有报道表明, 低 O₂ 条件下, 青花菜产品更易腐烂和发酵, 而低 O₂ 逆境可能引起 Glucoraphanin 的代谢或降解, 从而引起其含量的变化, 具体机理尚待进一步研究。

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