

四种山蓝加工方法的比较

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摘要: 用高效液相色谱法和分光光度法测定了四种加工方法所得山蓝加工提取物中有效成分含量, 结果表明, 经阴干, 晒干, 乙醇浸泡几种传统加工方法加工的山蓝中紫蓝素含量分别为 311、456、472 mg/100 g(干重), 而采用避氧热处理加工的山蓝中, 紫蓝素含量达 1.73 g/100 g。用传统加工方法对山蓝进行加工, 有效成分含量低, 制约了山蓝的利用价值, 而避氧热处理能大大提高有效成分含量, 提升山蓝的品质。研究结果对山蓝的加工、炮制和开发利用有重大意义。

关键词: 山蓝; 加工; 有效成分; 紫蓝素

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The comparison of four methods for processing *Peristrophe baphica*

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Abstract: The content of the effective component, Zilanine, in *Peristrophe baphica* processed by four methods was measured by HPLC and photometric techniques. In samples processed by drying in the shade, by drying in the sun, and by steeping in 50% alcohol, its content is 311 mg/100 g, 456 mg/100 g and 472 mg/100 g related to the dry weight. It reaches 1.73 mg/100 g in that processing by heating with deoxygenation, a novel method. The value of *P. baphica* is limited if traditional methods are used. The novel method can increase the content of the effective component and thus improve the quality drastically. It is possible to make the best use of *P. baphica* by the novel method.

Key words: *Peristrophe baphica*; processing; effective component; zilanine

山蓝 (*Peristrophe baphica* (Spreng.) Bremk.), 又名红丝线、观音草, 为爵床科植物, 药材有清热止咳、凉血解毒、消炎止血、散瘀消肿等功效(国家中医药管理局中华本草编委会, 1999), 用于肺燥热咳、咯血、肺结核、糖尿病、跌打损伤、毒蛇咬伤等的治疗(罗献瑞, 1993)。药理研究表明该植物有显著的降压(王宇等, 1995)、降血脂、清除氧自由基、改善心功能(周良等, 2000)的作用。印度民间用于席子、布料的染色并用于治疗皮肤病(Council of Sci-

entific and Industrial Research, 1969)。广东中部和广西民间常于端午节用本品鲜叶裹粽吃; 广西、云南少数民族以之制作民族食品“五色米饭”, 其紫、蓝、红色者系采用山蓝为原料以不同温度提取的提取液染制并调节不同 pH 而成。广西宜山用山蓝作为酿酒原料制作红兰酒已有 600 多年历史, 1958 年建成德胜红兰酒厂工业化生产红兰酒作为广西宜山特产投放市场(中国商业出版社, 1992)。以山蓝提取食用色素, 具有原料易得, 得率高, 色素稳定性较好, 安

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全无毒等优点,有较好的市场前景(谢运昌等,1997)。除鲜用外,其采收加工方法为晒干,还有50%乙醇浸提(覃洁萍等,1994)。为提高山蓝加工品的品质,保证山蓝的药效,指导山蓝的加工、炮制和正确利用(王琦等,2000),本文根据紫蓝素含量对4种山蓝加工方法进行比较。

1 材料和仪器

1.1 仪器

高效液相色谱仪(Waters,486紫外检测器,510泵,U6K进样器),721型分光光度计(上海第三分析仪器厂),台式离心机(TL-5.0,上海市离心机械研究所),旋转蒸发器(R-3000,BUCHI),冰柜(海尔)。

1.2 试剂

紫蓝素对照品(自制),乙腈(色谱纯),C18色谱填料(北京金欧亚公司),氮气。

1.3 植物材料

山蓝(*Peristrophe baphica* (Spreng.) Bremek.) 栽培于广西植物研究所栽培试验地(桂林市雁山),2002年8月摘取其枝叶部分,随机分为12份,每份100g。

2 方法

2.1 山蓝加工

2.1.1 阴干 取经称量的100g山蓝鲜料3份,置于室内通风处阴干5d,再置于内装变色硅胶干燥器中存放。

2.1.2 晒干 取经称量的100g山蓝鲜料3份,置于烈日下曝晒1d,再置于内装变色硅胶干燥器中存放。

2.1.3 50%乙醇冷浸 取经称量的100g山蓝鲜料3份,每份加800mL50%乙醇浸泡30d。

2.1.4 避氧热处理 取经称量的100g山蓝鲜料3份,每份置于1000mL圆底烧瓶中,以氮气驱除瓶内氧气,加入经沸腾脱氧的98℃热水400mL(混合物平衡温度84℃),置于旋转蒸发器上,于84℃保温90min,倾出,放冷(谢运昌等,2003a)。

2.2 紫蓝素含量测定(洪筱坤等,2000)

2.2.1 供试品制备 对前述四种加工方法所得山蓝加工品,阴干及晒干品加20倍水提取3次;避氧热

处理样料渣再加水4倍提取2次;酒精冷浸样倾出酒精浸提液,残渣用200mL水洗除酒精,真空蒸发除去酒精,料渣再加4倍水提取2次。各样分别合并提取液,定容至2000mL,取样,离心,取上清液,得供试品,置冰柜保存。

2.2.2 分光光度法 取供试品,以pH8.0,0.05mol/L Tris-缓冲液稀释,使吸光度在0.2~0.7之间,测吸光度,以 $E_{1\%}^{1\text{cm}}=1.026$ 计算紫蓝素含量。

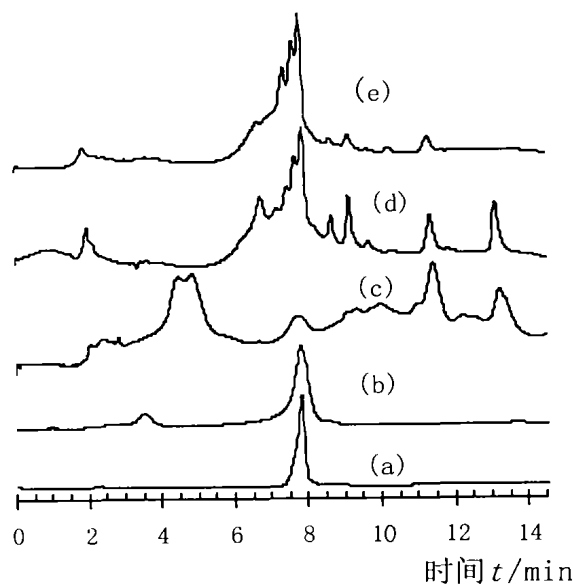


图1 山蓝加工品的高效液相色谱图

Fig. 1 HPLC profiles of samples of processed *Peristrophe baphica*

(a)紫蓝素对照品;(b)避氧热处理;(c)50%乙醇浸泡;(d)阴干;(e)晒干。
(a)Standard of zilanine; (b)Heating with deoxygenation; (c)Steeping in 50% alcohol; (d)Drying in the shade; (e)Drying in the sun.

2.2.3 高效液相色谱(HPLC)法 (1)色谱条件:色谱柱为Spherisob C18(4.6mm×2.5mm,10μm),柱温为室温30℃,流动相B为乙腈,A为重蒸水,梯度洗脱(Krstulovic等,1982),梯度条件:B从10%开始,以线性3min达25%,6min达35%,10min达42%,12min达60%,12~14min保持60%,16min降至10%。流速1.0mL/min。检测波长590nm,进样量10μL。以紫蓝素为外标(以水溶解),制作标准曲线,得线性回归方程 $C=0.7892+2.27\times 10^{-5}A$,相关系数 $r=0.9990$ 。线性范围4~20mg/L。(2)含量测定:取供试液,用蒸馏水稀释,使溶液中紫蓝素浓度在4~20mg/L范围内,进样10μL,测定峰面积积分值,代入回归方程,计算

紫蓝素含量。

3 结果与讨论

避氧热处理, 阴干, 晒干, 50%乙醇冷浸 4 种山蓝加工方法对山蓝鲜品进行加工, 加工品的高效液相色谱(HPLC)图见图 1, 其紫蓝素的含量见表 1。

从图 1 可见, 4 种山蓝加工方法所得加工品的高效液相色谱(HPLC)图有较大差异。避氧热处理加工品的谱图以紫蓝素峰为主; 阴干, 晒干, 50%乙醇冷浸 3 种加工品的 HPLC 谱图色谱峰较杂, 紫蓝

素峰不是主峰。阴干、晒干品的色谱图相似。从表 1 可见, 经阴干, 晒干, 乙醇浸泡几种传统加工方法加工的山蓝中紫蓝素含量分别为 311、456、472 mg/100 g(干重), 其加工品的紫蓝素含量均不高; 采用避氧热处理加工的山蓝中, 紫蓝素含量达 1.73 g/100 g, 紫蓝素含量与传统方法相比, 可提高 30 倍左右。分光光度法与 HPLC 法相比, 测定结果偏高, 这是由于 HPLC 法能分离纯化紫蓝素组分, 而分光光度法受到其它色素成分及杂质的干扰。HPLC 法测定结果更为可靠。避氧热处理法中, HPLC 法结果接近分光光度法, 表明紫蓝素为紫蓝中色素主要成分。

表 1 四种加工方法所得山蓝加工品中紫蓝素的含量

Table 1 The content of zilanine in *Peristrophe baphica* processed by four methods

| 加工方法 Processing methods | 编号 No. | 高效液相色谱法 Content measured by HPLC | | | | 分光光度法 Content measured by photometry | | | |
|-------------------------------|-----------|---|------------------|---|--------------------|---|------------------|---|--------------------|
| | | 以鲜料计(mg/100g) Content related to fresh weight | | 以干料计(mg/100g) ¹⁾ Content related to dry weight | | 以鲜料计(mg/100g) Content related to fresh weight | | 以干料计(mg/100g) ¹⁾ Content related to dry weight | |
| | | 测定值 Value | 平均 In average | 测定值 Value | 平均 In average | 测定值 Value | 平均 In average | 测定值 Value | 平均 In average |
| 避氧热处理 | 1 | 309 | — | 1.72×10^3 | — | 350 | — | 1.95 | — |
| Heating with deoxygenation | 2 | 316 | 310 | 1.76×10^3 | 1.73×10^3 | 347 | 347 | 1.93 | 1.93×10^3 |
| | 3 | 304 | — | 1.69×10^3 | — | 344 | — | 1.92 | — |
| 阴干 | 1 | 5.68 | — | 31.6 | — | 27.0 | — | 150 | — |
| Drying in the shade | 2 | 5.27 | 5.59 | 29.4 | 31.1 | 25.9 | 26.5 | 144 | 147 |
| | 3 | 5.83 | — | 32.5 | — | 26.7 | — | 149 | — |
| 晒干 | 1 | 8.36 | — | 46.6 | — | 30.1 | — | 168 | — |
| Drying in the sun | 2 | 8.20 | 8.18 | 45.7 | 45.6 | 28.2 | 28.1 | 157 | 157 |
| | 3 | 8.09 | — | 45.1 | — | 26.1 | — | 145 | — |
| 50%乙醇浸泡 | 1 | 8.51 | — | 47.4 | — | 31.1 | — | 173 | — |
| Steeping in 50% alcohol | 2 | 8.42 | 8.47 | 46.9 | 47.2 | 29.1 | 31.2 | 162 | 174 |
| | 3 | 8.47 | — | 47.2 | — | 33.3 | — | 186 | — |

¹⁾ 避氧热处理和 50%乙醇浸泡样根据阴干及晒干样的干重平均值(17.95 g 干重/100 g 鲜重)计算干重。

The dry weight of the samples processed by heating with deoxygenation and by steeping in 50% alcohol was calculated with the average data of the sundried and the air-dry samples.

紫蓝素为山蓝的主要有效成分和山蓝色素主成分。它有较强的抗乙型肝炎病毒、很强的抗脂质过氧化、抑制蛋白酪氨酸酯酶、抗糖尿病作用(谢运昌等, 2003a)。传统方法对山蓝进行加工, 山蓝中的紫蓝素前体物质紫蓝胺酚(谢运昌等, 2003b)会发生分解、聚合、与其他成分缩合等反应, 紫蓝素含量低, 品质不佳, 是当前山蓝的药用价值及作为食用色素的价值不高的原因。用避氧热处理法对山蓝进行加工是山蓝加工方法的一个创新, 可大大提高山蓝有效成分及山蓝色素的含量, 提升山蓝的品质, 使山蓝的价值得到充分的体现。研究结果对广西特色植物山蓝的加工、炮制和开发利用有重大意义。

参考文献:

- 中国商业出版社. 1992. 中国商品大辞典(烟酒分册)[M]. 北京: 中国商业出版社, 274.
- 国家中医药管理局中华本草编委会. 1999. 中华本草(第 7 卷)[M]. 上海: 上海科学技术出版社, 466—467.
- 罗献瑞. 1993. 中草药彩色图集(第二册)[M]. 广州: 广东科技出版社, 80—81.
- 周良, 谢世彬. 2000. 红丝线草的研究进展. 长春中医药大学学报[J]. 16(3): 63.
- 覃洁萍, 卢红美. 1994. 红蓝中色素的提取及其稳定性研究[J]. 食品科学, 15(4): 33—36.
- 谢运昌, 蒋小华, 文永新, 等. 2003a. 紫蓝素化合物、其

- 制备方法及其用途[P]. 中国专利(CN1431200A), Council of Scientific and Industrial Research. 1969. The Wealth of India[M]. New Delhi: Publications and Information Directorate, 313-314.
- Hong XQ(洪筱坤), Wang ZH(王智华), Li QY(李琴韵), et al. 2000. Analysis and Testing of Chemical Composition on Chinese Traditional Patent Medicine (中成药化学成分的分析)[J]. *Traditional Patent Medicine*(中成药), **22**(1): 80-100.
- Krstulovic AM, Brown BR. 1982. Reversed-phase High-performance Liquid Chromatography[M]. New York: John Wiley & Sons Inc.
- Wang Q(王琦), Sun LL(孙立立), Jia TZ(贾天柱). 2000. The Review of Development of Chinese Herbal Processing(中药饮片炮制发展回眸)[J]. *Traditional Patent Medicine*(中成药), **22**(1): 33-58.
- Wang Y(王宇), Yang ML(杨美玲). 1995. The anti-hypertensive mechanism of OL-W 红丝线醇提水转溶物的降压作用[J]. *Journal of Jinan University(Medicine Edition)*(暨南大学学报(医学版)), **16**(4): 22-25.
- Xie YC(谢运昌), Cheng JY(程菊英). 1997. Advance on the research of Zilanhong Color from *Peristrophe roxburghiana*(紫蓝红色素的研究进展)[J]. *Chinese Wild Plant Resources*(中国野生植物资源), **16**(4): 9-13.
- Xie YC(谢运昌), Wen YX(文永新), Jiang XH(蒋小华), et al. 2003b. The molecular constitution and chemical change of the precursor of the pigment from *Peristrophe baphica*(山蓝色素前体的分子组成和化学变化)[J]. *Guihaia*(广西植物), **23**(4): 367-369.

(上接第 444 页 Continue from page 444)

during the initial stage of the germination. Showing the cell group before the vascular bundle formed $\times 182$; 3. The secondary leaf during the initial stage of the germination. Showing the vascular bundle of the differentiation $\times 262$; 4. The semi-amphivasal bundle in the coleoptile $\times 250$; 5. The secondary leaf with limited protein. Showing the protein $\times 325$; 6. The secondary leaf before the vascular bundle formed. Showing the starch grain $\times 200$; 7. The first (white arrow) and the second (black arrow) secondary leaf during the initial stage of the germination. Showing the starch grain $\times 91$; 8. The secondary leaf during the plumule showing. Showing the starch grain in the parenchyma cells of the main vein $\times 138$; 9. The primary leaf blade during the plumule showing. Showing the starch grain in the parenchyma cells of the main vein $\times 126$; 10. The primary leaf blade during the initial germination period of the seed. Showing the starch grain in the parenchyma cells of the main vein $\times 113$; 11. The secondary leaf during the initial germination period of the seed. Showing the starch grain in the parenchyma cells of the vascular bundle and the cells around it $\times 175$; 12. The secondary leaf during the initial germination period of the seed. Showing the starch grain in the parenchyma cells of the edge by the leaf blade $\times 337$.

Plate II 1. The cells of the secondary leaf in initial stage of the germination. Showing the unformed organelle $\times 60\ 000$; 2. The cells of the secondary leaf in initial stage of the germination. Showing the heterochromatin in the nucleus $\times 8\ 000$; 3. The cells of the secondary leaf in initial stage of the germination. Showing the granal thylakoid $\times 40\ 000$; 4. The cells of the secondary leaf. Showing the mitochondrion(black arrow), and the amyloplast(white arrow) $\times 20\ 000$; 5. The cells of the secondary leaf, showing the microbody with crystalloid $\times 50\ 000$; 6. The cells of the secondary leaf, showing the chloroplast $\times 25\ 000$.