

鱼体胆汁中壬基酚和双酚A的分析方法

吴明红, 潘辰苑, 杨明, 钱冬英

钱冬英(1965—), 女, 博士, 研究方向为污染控制与环境毒理学. E-mail: dyqian@shu.edn.cn

Analytical Methods for Monitoring Nonylphenol and Bisphenol A in Fish Bile

WU Ming-hong, PAN Chen-yuan, YANG Ming, QIAN Dong-ying

- [摘要](#)
- [参考文献](#)
- [相关文章](#)

Download: [PDF \(628KB\)](#) [HTML \(1KB\)](#) [Export: BibTeX or EndNote \(RIS\)](#) [Supporting Info](#)

摘要 环境雌激素(environmental estrogens, EEs)已成为环境领域的热点问题,其中壬基酚(nonylphenol, NP)和双酚A(bisphenol A, BPA)因广泛存在于水生环境中,对水生生物特别是鱼类造成了潜在的危害而备受关注。但是, NP 和BPA 在水体中的浓度不高,难以对它们进行准确的测定。鱼体胆汁具有较高的生物蓄积性,可以通过鱼类胆汁来对污染物质进行测定,从而反映水体的污染状况。本工作主要从预处理(水解和固相萃取)和检测分析(色谱和质谱联用技术)两方面展开,介绍了鱼体胆汁中NP 和BPA 的分析方法,并比较了不同处理、分析方法的灵敏度和优缺点,为建立NP 和BPA 等EEs 类物质在水生生物样品中的检测方法提供参考。

关键词: [鱼](#) [胆汁](#) [双酚A](#) [壬基酚](#) [环境检测](#)

Abstract: The research on environmental estrogens (EEs) has become a hot issue in the field of environmental science. Nonylphenol (NP) and bisphenol A (BPA) attract much attention due to their wide existence in the aquatic environment, causing a potential hazard to aquatic organisms, especially to fish. However, chemical monitoring and analysis of NP and BPA is not easy to perform since their presence is always at relative low levels in various environmental media. Fish bile is of high bioaccumulation potential, and is a convenient material for chemical analysis of environmental pollutants. This review focuses on the analytical methods for monitoring NP and BPA in fish bile. Corresponding pretreatment (hydrolysis and solid-phase extraction) and detection methods including combined technology of chromatography and mass spectrometry are reviewed. In addition, sensitivity, advantages and disadvantages of different pretreatment and detection methods are compared to provide a reference for establishing methods for detecting NP, BPA and other EEs in aquatic organisms.

Keywords: [fish](#), [bile](#), [bisphenol A \(BPA\)](#), [nonylphenol \(NP\)](#), [environmental monitoring](#)**基金资助:**

国家自然科学基金资助项目(11025526; 31100376; 41173120)

通讯作者 钱冬英(1965—), 女, 博士, 研究方向为污染控制与环境毒理学. E-mail: dyqian@shu.edn.cn**作者简介:** 钱冬英(1965—), 女, 博士, 研究方向为污染控制与环境毒理学. E-mail: dyqian@shu.edn.cn**引用本文:**

.鱼体胆汁中壬基酚和双酚A的分析方法[J] 上海大学学报(自然科学版), 2013,V19(4): 423-428

.Analytical Methods for Monitoring Nonylphenol and Bisphenol A in Fish Bile[J] J.Shanghai University (Natural Science Edition), 2013,V19(4): 423-428

链接本文:<http://www.journal.shu.edu.cn//CN/DOI: 10.3969/j.issn.1007-2861.2013.04.017> 或 <http://www.journal.shu.edu.cn//CN/Y2013/V19/I4/423>

- [1] Gladzala-kopciuch R, Filipiak A, Buszewski B. Isolation, purification and determination of 4-nonylphenol and 4-tert-octylphenol in aqueous and biological samples [J]. Talanta, 2008, 74(4): 655-660.

Service

- ▶ [把本文推荐给朋友](#)
- ▶ [加入我的书架](#)
- ▶ [加入引用管理器](#)
- ▶ [Email Alert](#)
- ▶ [RSS](#)

作者相关文章

[5] Chen T C, Shue M F, Yeh Y L, et al. Bisphenol A
[6] occurred in Kao-Pin River and its tributaries in Taiwan
[7] Environmental Monitoring and Assessment, 2010, 161: 135-145.

[8] Azevedo D A, Lacorte S, Viana P, et al. Occurrence
[9] of nonylphenol and bisphenol-A in surface waters
[10] from Portugal [J]. Journal of the Brazilian Chemical
[11] Society, 2001, 49(1): 97-103.

[12] Bolz U, Hagenmaier H, Korner W. Phenolic xenoestrogens
[13] in surface water, sediments, and sewage
[14] sludge from Baden-Wurttemberg, south-west Germany
[15] Environmental Pollution, 2001, 115(2):
[16] 1-301.

[17] Belfroid A, van Velzen M, van der Horst B, et
[18] al. Occurrence of bisphenol A in surface water and
[19] uptake in fish: evaluation of field measurements [J].
[20] Chemosphere, 2002, 49(1): 97-103.

[21] Wu M H, Wang L, Xu G, et al. Seasonal and spatial
[22] distribution of 4-tert-octylphenol, 4-nonylphenol and
[23] bisphenol A in the Huangpu River and its tributaries,
[24] Shanghai, China [J]. Environmental Monitoring and
[25] Assessment, 2013, 185(4): 3149-3161.

[26] Lindholm C, Pedersen S N, Bjerregaard P. Uptake,
[27] metabolism and excretion of bisphenol A in the
[28] rainbow trout (*Oncorhynchus mykiss*) [J]. Aquatic
[29] Toxicology, 2001, 55(1/2): 75-84.

[30] Markey C M, Michaelson C L, Sonnenschein C,
[31] et al. Alkylphenols and bisphenol A as environmental
[32] estrogens [M]. Boston: Springer, 2001: 129-153.

[33] Kinnberg K, Toft G. Effects of estrogenic and antiandrogenic
[34] compounds on the testis structure of the
[35] adult guppy (*Poecilia reticulata*) [J]. Ecotoxicology
[36] and Environmental Safety, 2003, 54(1): 16-24.

[37] Jobling S, Sheahan D, Osborne J A, et al. Inhibition
[38] of testicular growth in rainbow trout (*Oncorhynchus*
[39] *mykiss*) exposed to estrogenic alkylphenolic
[40] chemicals [J]. Environmental Toxicology and
[41] Chemistry, 1996, 15(2): 194-202.

[42] Sohoni P, Tyler C R, Hurd K, et al. Reproductive
[43] effects of long-term exposure to bisphenol A in
[44] the fathead minnow (*Pimephales promelas*) [J]. Environmental
[45] Science and Technology, 2001, 35(14):
[46] 17-2925.

[47] Hibberd A, Maskaoui K, Zhang Z, et al. An improved
[48] method for the simultaneous analysis of phenolic
[49] and steroidal estrogens in water and sediment [J].
[50] Talanta, 2009, 77(4): 1315-1321.

[51] Arukwe A, Thibaut R, Lungebrigt K, et al. In

[52] vivo and in vitro metabolism and organ distribution

[53] of nonylphenol in Atlantic salmon (*Salmo salar*) [J].

[54] *Aquatic Toxicology*, 2000, 49(4): 289-304.

[55] Liu J L, Pan X J, Huang B, et al. An improved

[56] method for simultaneous analysis of steroid and phenolic

[57] endocrine disrupting chemicals in biological

[58] samples [J]. *International Journal of Environmental*

[59] *Analytical Chemistry*, 2012, 92(10): 1135-1149.

[60] Hauser-davis R A, Bastos F F, de Oliveira F,

[61] et al. Fish bile as a biomarker for metal exposure [J].

[62] *Marine Pollution Bulletin*, 2012, 64(8): 1589-1595.

[63] 龚诚, 刁悦, 沈卫阳, 等. 环境内分泌干扰物的检测分析

[64] Ferreira A M R, Hill E M. Bioconcentration and

[65] distribution of 4-tert- octylphenol residues in tissues

[66] of the rainbow trout (*Oncorhynchus mykiss*) [J]. *Marine*

[67] *Environmental Research*, 2001, 51(1): 75-89.

[68] Larsson D G J, Adolfsson-erici M, Parkkonen

[69] J. Ethinyloestradiol—an undesired fish contraceptive?

[70] *Aquatic Toxicology*, 1999, 45(2/3): 91-97.

[71] Pedersen R T, Hill E M. Tissue distribution

[72] and depuration of 4-tert-Octylphenol residues in the Cyprinid Fish, *Scardinius erythrophthalmus* [J]. *Environmental*

[73] *Science and Technology*, 2002, 36(15):

[74] 75-3283.

[75] Gibson R, Tyler C R, Hill E M. Analytical

[76] methodology for the identification of estrogenic contaminants

[77] in fish bile [J]. *Journal of Chromatography*

[78] *A*, 2005, 1066(1/2): 33-40.

[79] Budzinski H, Devier M H, Labadie P, et al. Analysis

[80] of hormonal steroids in fish plasma and bile by

[81] coupling solid-phase extraction to GC/MS [J]. *Analytical*

[82] *and Bioanalytical Chemistry*, 2006, 386(5):

[83] 29-1439.

[84] Vallejo A, Usobiaga A, Ortiz-zarragoitia M,

[85] et al. Focused ultrasound-assisted acceleration of enzymatic

[86] hydrolysis of alkylphenols and 17 -oestradiol

[87] glucuronide in fish bile [J]. *Analytical and Bioanalytical*

[88] *Chemistry*, 2010, 398(5): 2307-2314.

[89] Fenlon K A, Johnson A C, Tyler C R, et al.

[90] Gas-liquid chromatography-tandem mass spectrometry

[91] methodology for the quantitation of estrogenic

[92] contaminants in bile of fish exposed to wastewater

[93] treatmentworkseffluentsandfromwildpopulations [J].

[94] *Journal of Chromatography A*, 2010, 1217(1): 112-

[95] 118.

[96] 任仁, 陈明, 武少华, 等. 环境样品中烷基酚和双酚A的

[97] 353.

[98] Liedtke A, Schonenberger R, Eggen R I L, et al.

- [99] Internal exposure of whitefish (*Coregonus lavaretus*)
- [100] to estrogens [J]. *Aquatic Toxicology*, 2009, 93(2/3):
- [101] 8-165.
- [102] Labadie P, Budzinski H. Alteration of steroid
- [103] hormone balance in juvenile turbot (*Psetta maxima*)
- [104] exposed to nonylphenol, bisphenol A, tetrabromodiphenyl
- [105] ether 47, diallylphthalate, oil, and oil
- [106] spiked with alkylphenols [J]. *Archives of Environmental*
- [107] *Contamination and Toxicology*, 2006, 50(4): 552-
- [108] 561.
- [109] Rostkowski P, Horwood J, Shears J A, et al.
- [110] Bioassay-directed identification of novel antiandrogenic
- [111] compounds in bile of fish exposed to wastewater
- [112] effluents [J]. *Environmental Science and Technology*,
- [113] 11, 45(24): 10660-10667.
- [114] Vigano L, Mandich A, Benfenati E, et al. Investigating
- [115] the estrogenic risk along the river Po and its
- [116] intermediate section [J]. *Archives of Environmental*
- [117] *Contamination and Toxicology*, 2006, 51(4): 641-651.
- [1] 郑柯文, 李寒, 王昭, 汪洋, 鹿建霞, 马盛韬, 于志强, 任国发, 傅家谟. 气相色谱/质谱法同时检测鱼肉样品中三氯生及其甲基代谢产物[J]. *上海大学学报(自然科学版)*, 2013,19(4): 354-357
- [2] 许海1,2, 杨明1, 吴明红1. 水环境中双酚A污染及其对鱼类的毒性研究进展[J]. *上海大学学报(自然科学版)*, 2013,19(4): 429-436
- [3] 陈侃 王长谦. 模式生物斑马鱼在心血管疾病研究中的应用[J]. *上海大学学报(自然科学版)*, 2013,35(1): 64-072
- [4] 蔡灵1, 吴曼丽1, 范丹青1, 杨明2. 大黄鱼Hepcidin基因转录物的相对定量分析[J]. *上海大学学报(自然科学版)*, 2012,18(4): 413-418
- [5] 尚玉昌. 动物行为研究的新进展(一): 蜜蜂的觅食行为[J]. *上海大学学报(自然科学版)*, 2011,33(4): 208-210
- [6] 潘吉星. 金鱼在中国的家养史及其在东西方的传播[J]. *上海大学学报(自然科学版)*, 2008,30(5): 287-290
- [7] 孙志禹; 董方勇. “赶鱼”——三峡三期上游围堰爆破拆除中的生态保护[J]. *上海大学学报(自然科学版)*, 2007,29(2): 83-86
- [8] 赵光俊; 张文俊; 张目; 林爱华. 鱼群动画的行为规划[J]. *上海大学学报(自然科学版)*, 2007,13(2): 142-147
- [9] 严燕来. 我国古代“透光镜”和鱼洗神奇效应的物理分析[J]. *上海大学学报(自然科学版)*, 2006,28(5): 283-287
- [10] 肖明; 杨建邺. 德国第一位获诺贝尔奖的女性——克莉斯蒂安·努斯莱因美尔哈德[J]. *上海大学学报(自然科学版)*, 2006,28(4): 243-247