

论文

轻稀土镧、铈急性生物效应的血清¹H NMR谱代谢组学研究

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摘要:

采用现代核磁共振和模式识别技术,通过分析腹腔注射给药La(NO₃)₃(2, 10和50 mg/kg体重)和Ce(NO₃)₃(2, 10和50 mg/kg体重) 48 h后大鼠血清的核磁共振氢谱,由内源性代谢物浓度的变化研究了两种稀土化合物在大鼠体内的急性生物效应,利用主成分分析法对两者进行了分类比较. 在低剂量(2 mg/kg体重)组La(NO₃)₃和Ce(NO₃)₃血清中, 乳酸和肌酸酐等内源性代谢物浓度发生了微小变化; 在高剂量组(10和50 mg/kg体重)中, 含量变化较大的重要内源性代谢物包括3-羟丁酸、丙氨酸、肌酸酐、丙酮、乙酸、琥珀酸和葡萄糖等,其中3-羟丁酸和丙氨酸等在La的剂量组中变化较大,Ce的剂量组血清中丙酮、琥珀酸和葡萄糖含量变化明显. 实验结果表明, 低剂量La和Ce的毒性较低,并对机体影响较小,高剂量则对大鼠肝脏造成损伤,且Ce的毒性大于La.

关键词: 轻稀土; 血清; 核磁共振; 模式识别; 生化效应

Investigation on the Acute Biochemical Effects of Light Rare Earths(Lanthanum and Cerium) by NMR-Based Metabonomic Approaches

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Abstract:

¹H NMR spectroscopy and pattern recognition method were used to assess acute biochemical effects of light rare earths. Male Wistar rats were treated with both La(NO₃)₃ and Ce(NO₃)₃ at doses of 2,10 and 50 mg/kg body weight. Serum samples from the rats dosed with the two kinds of light rare earths were gained after 48 h and analyzed by 600 MHz ¹H NMR spectra. Each NMR spectra was data-processed to provide 238 intensity-related descriptors as input coordinates in a multidimensional space and analyzed by pattern recognition method. Many low-molecular weight metabolites were identified by ¹H NMR spectra of rat serum. An increase in ketone bodies,creatinine,lactate,succinate and various amino acids (valine,leucine and glutamine) were found from the higher doses(10 and 50 mg/kg body weigh) of rare earths-treated groups,together with a decrease of glucose in the serum from Ce(NO₃)₃-dosed groups. Those results may mean that high-dosage of La and Ce impair the specific region of liver. The similar toxicities with various mechanisms for La and Ce were implicated by NMR-based metabonomic approach. Ce(NO₃)₃ exhibited a higher toxicity than La(NO₃)₃ at the same doses.

Keywords: Light rare earth; Serum; Nuclear magnetic resonance(NMR); Pattern recognition; Biochemical effects

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