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土壤中苯并[a]芘对白符跳(*Folsomia candida*)的生态毒性研究

Ecotoxicity of Benzo(a)pyrene to *Folsomia candida* in soil

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中文摘要:

苯并(a)芘(B[a]P)是一种典型的多环芳烃(PAHs),在油田周边和污灌区土壤中有较高的检出率。在污染土壤生态风险评估和制定土壤生态基准时,常用土壤跳虫作为敏感生态受体,但已有研究表明,目前常用的成虫生长率、死亡率和繁殖率等指标特征往往仅对土壤中高剂量B[a]P产生毒性响应。采用白符跳(*Folsomia candida*)的生态毒理试验筛选可用于较低剂量B[a]P下新的敏感指标特征,并比较其在两种典型地带性土壤天津潮土和鹰潭红壤之间的敏感性差异。结果表明,幼虫的生长指标最敏感,能对土壤较低浓度B[a]P产生毒性响应,可作为指示土壤B[a]P毒性的指标。四个指标的敏感度依次为:幼虫体长>成虫体长>繁殖数>存活数。B[a]P对白符跳的毒性效应在两种土壤类型间存在显著差异(红壤和潮土中幼虫体长的最低效应浓度(LOEC)值分别为1和500 mg kg⁻¹),可能受土壤理化性质,特别是有机质含量和pH的影响,在制定土壤生态基准时需对不同土壤的毒性数据进行归一化校正。

Abstract:

Benzo(a)pyrene (B[a]P) is a typical kind of polycyclic aromatic hydrocarbons (PAHs) often found in soils adjacent to the oil field or in soils irrigated with sewage. Collembolans are often used as sensitive receptors in ecological risk assessment of contaminated soils and in development of soil ecological benchmarks. However, the characteristic indices, such as growth rate, fatality and reproduction rate of their adults, were only responsive to high concentrations of B[a]P in the soil. In the present study, *Folsomia candida* was used as subject for ecotoxicity test to screen out new characteristic indices sensitive to low concentrations of the substances. Besides, comparison was made between two typical zonal soils, i.e. udic-ferrosols and aquic-cambosols in sensitivity of the subject insects. Results show that the index of growth rate of their larva was the most sensitive and even responsive to a low concentration of B[a]P. It is, therefore, suggested that the index be cited as an indicator of the soil B[a]P toxicity. The four indices followed an order of juvenile length > adult length > reproduction rate > survival rate in sensitivity. Significant difference in ecotoxicity of B[a]P to *F. candida* existed between the two soils with LOEC value being 1 mg kg⁻¹ in udic-ferrosols and 100 mg kg⁻¹ in aquic-cambosols, which is likely attributed to the difference in soil physico-chemical property, especially content of organic matter and pH. It is, therefore, necessary to normalize ecotoxicity data of various soils in developing soil ecological benchmarks.

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