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氧化/磺化腐殖酸对潮土中 Cu、Zn、Fe、Mn 有效性的影响

孙静悦，袁 亮，林治安，张水勤，赵秉强，李燕婷*
（中国农业科学院农业资源与农业区划研究所/农业部植物营养与肥料重点实验室，北京 100081）

摘要:【目的】研究比较改性腐殖酸对潮土微量元素有效性的影响及其作用机理，以期为开发提高微量元素有效性的专用腐殖酸功能材料提供科学依据。**【方法】**采用土壤培养法，将腐殖酸 (HA)、氧化腐殖酸 (YHA) 和磺化腐殖酸 (SHA) 分别按 30、100、300 mg/kg 用量与干土混匀装入培养瓶中，调节含水量至田间持水量的 60%，置于 25℃ 人工气候箱中进行恒温培养，并保持土壤湿度恒定。分别在培养第 3、7、15、30、60 天取样，测定土壤有效铜、锌、铁、锰含量。**【结果】**三种腐殖酸对土壤 Cu、Zn、Fe、Mn 有效性的影响大小依次为 HA>YHA>SHA。施用 30～300 mg/kg 腐殖酸 (HA) 可显著提高土壤有效铜含量，特别是在 15～30 天内，土壤有效铜含量提升幅度可达 51.3%，明显优于氧化腐殖酸和磺化腐殖酸；施用三种腐殖酸 30～300 mg/kg 可在 15 天内增加土壤有效锌含量，其中以腐殖酸 (HA) 效果最好，土壤有效锌含量增幅可达 11.8%～20.3%，优于氧化腐殖酸、磺化腐殖酸；30～100 mg/kg 用量下，施用腐殖酸 (HA) 可在 15 天内使土壤有效锰含量提升 5.6%，效果优于氧化腐殖酸和磺化腐殖酸，300 mg/kg 用量下，磺化腐殖酸可使土壤有效锰含量提升 13.6%；施用 30～300 mg/kg 的腐殖酸 (HA) 一周后，土壤有效铁含量提高 4.3%～7.2%，磺化腐殖酸或氧化腐殖酸用量分别在 30 mg/kg 和 300 mg/kg 时可提高土壤铁有效性。**【结论】**施用腐殖酸可显著提升潮土铜的有效性，但对潮土锌、锰、铁有效性的影响呈现出阶段性变化，不同结构腐殖酸对潮土微量元素有效性的影响差异较大，以 HA 对元素有效性的影响最大。因此，腐殖酸应用于提升微量元素有效性时，需考虑腐殖酸本身性质及施用时期等因素。

关键词: 腐殖酸；氧化腐殖酸；磺化腐殖酸；微量元素有效性

Effects of oxidized/sulphonated humic acid on the availability of Cu, Zn, Fe and Mn in fluvo-aquic soil

SUN Jing-yue, YUAN Liang, LIN Zhi-an, ZHANG Shui-qin, ZHAO Bing-qiang, LI Yan-ting*
(*Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences /Key Laboratory of Plant Nutrition and Fertilizer, Ministry of Agriculture, Beijing 100081, China*)

Abstract:【Objectives】The paper studied the effects and acting mechanism of humic acids with different structures on the availability of micronutrient elements, which will help choosing proper humic acids to make functional specific fertilizers containing micronutrient elements.**【Methods】**Indoor thermostatic incubation method was adopted using fluvo-aquic soil as tested material. The tested humic acids included the original humic acid (HA), oxidized humic acid (YHA) and sulfonated humic acid (SHA), each of them was mixed with dry soil in ratio of 30, 100 and 300 mg/kg, respectively. The soil water content was adjusted to 60% of the field water holding capacity before loaded into a culture bottle. The treated soils were cultured at 25℃ inside an artificial growth chamber. Samples were taken at the 3rd, 7th, 15th, 30th and 60th day of culture to determine the available copper, zinc, iron and manganese contents.**【Results】**The effects of three humic acids on the availability of Cu, Zn, Fe and Mn in soil were in order of HA>YHA>SHA. 1) HA of 30–300 mg/kg significantly increased the available Cu content in the soil, especially within 15–30 days it was increased by 51.3%, significantly higher

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联系方式：孙静悦 E-mail：jingyuesun2017@163.com；* 通信作者 李燕婷 Tel：010-82108664，E-mail：liyanting@caas.cn