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第19卷第5期 生 态 学 报 Vol. 19, No. 5
1999年9月 ACTA ECOLOGICA SINICA Sept., 1999

环境因子对挪威云杉林土壤有机质分解过程中重量和碳的气态损失影响及模型

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S791.180.2

摘要: 用严重酸化的挪威云杉林的枯落物和矿质土壤, 研究了温度和含水量对有机质分解过程中重量和碳的气态损失的影响。在为期1a的室内试验期间, 没有元素的输入、淋失和植物根系吸收。实验分3个温度处理(年均温度分别为11.6、12.3和14.5℃)和4个水分处理(从几乎风干到各种被分解物的饱和含水量)。在有利条件下, 枯落物未分解层 O_L 的重量损失速率是半分解层 O_F 的2倍和已分解层 O_H 的5～6倍。矿质土壤的重量损失速率小于枯落物层。分解速率在很大程度上受控于环境条件, 其中含水量起着决定性作用, 极端干旱会使分解速率非常低, 水分过多时也会限制土壤微生物活动, 最适宜的含水量为各种被分解物饱和含水量的70%～90%。在应用的温度范围内, 温度差别只起着次要作用。被分解物在土壤剖面中所处的位置越深, 含水量越低, 温度的影响越小, 建立了符合土壤有机质分解机制的重量损失和碳损失的数学模型。

关键词: 有机质分解; 重量损失; 碳损失; 气候变化

The influences of environmental factors on the gaseous mass-loss and carbon-loss from organic matter of a Norway spruce forest soil

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Abstract: The influences of temperature and water content on the gaseous mass-loss and carbon-loss from organic matters of a strongly acidified Norway spruce forest soil were investigated for one year in the laboratory under the conditions without element input, leaching and uptake by plants. There were 3 temperature-treatments and 4 moisture-treatments. Under the favourable conditions the mass-loss rate of O_L-material was doubled as high as that of O_F-material and 5～6 times as high as that of O_H-material. The mass-loss rate of mineral soils was smaller than those of the litter materials. The rate of mineralization was essentially controlled by the environmental factors. Among them the water content played a decisive role. Under the extreme dry conditions the mineralization rate was very small. The microbial activities were restricted under very wet conditions. The most favourable water contents amounted to 70%～90% of the saturation capacity of each material. Within the applied temperature range, the temperature difference played only a subordinate role. the deeper the litter materials lay in the profile and the drier it was, the smaller the temperature effect was. Mathematical models based on the mineralization mechanism were built for the mass-loss and carbon-loss.

Key words: mineralization of organic matter; mass-loss; carbon-loss; climate change

文章编号: 1000-0933(1999)05-0641-06 **中图分类号**: $S718.51^{+6}$ **文献标识码**: A

气候变化是一个全球性的环境问题。除水蒸汽外, CO_2 是最重要的温室气体。全球约有 1.5×10^{15}kg 碳

收稿日期: 1997-07-18; **修订日期**: 1997-11-29