岩石力学与工程学报 2006 25 (03): 601-608 ISSN: 1000-6915 CN: 42-1397/O3

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考虑气固耦合填埋场沉降数学模型

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收稿日期 2004-10-17 修回日期 2005-5-21 网络版发布日期 2006-12-15 接受日期

摘要 为研究城市生活垃圾填埋场孔隙气压对沉降的影响程度，把填埋场简化为非稳定单向气体渗流场，采用Gibson和Lo一维压缩模型及U.S. EPA Landgem产气方程，结合达西定律、气体状态方程、有效应力原理和多孔介质流体动力学理论，建立了考虑气固耦合的填埋场沉降计算模型。填埋场的沉降按封场前和封场后2个阶段分别计算，封场前填埋场接受垃圾，堆填压力增加，而封场后的堆填压力保持不变。运用差分法求解的结果表明，填埋场垃圾体内孔隙气压与深度、时间和透气率等因素有关。封场前，气压随深度和时间的增加而增加；封场后，气压随时间逐渐消散。高透气率的填埋场有较高的气体消散速率。封场前气压的增加减小了填埋场沉降速率，从而导致填埋场的容量减少。提出在填埋场沉降计算和边坡稳定分析时考虑气压影响的必要性。

关键词 数值分析 沉降 气固耦合 数学模型 填埋场

分类号

MATHEMATICAL MODEL FOR LANDFILL SETTLEMENT CONSIDERING GAS-SOLID COUPLING EFFECT

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Abstract

To study the influence of refuse pore gas pressure on the landfill settlement，a mathematical model was developed，which simplified the landfill as a one-dimensional unsteady gas seepage field. The model incorporated Gibson and Lo model，U.S. EPA Landgem model，Darcy¢s law，ideal gas law，principle of effective stress and theory of dynamics of fluids in porous media. According to the model，the landfill settlement was calculated by the active stage and closed stage，respectively. During the active stage，the landfill continually received refuse，which led to the increase of loads. During the closed stage，the loads kept constant. The result of the finite difference solution represented that the pore gas pressure in the landfill was influenced by the depth，time and permeability. The pore gas pressure increased with the depth and time in the active stage，and dispersed gradually in the closed stage. The landfill with a high permeability has a high rate of pore gas pressure dispersing. The decrease of settlement rate，caused by the increase of gas pore pressure，will decrease the capacity of the landfill. The gas pore pressure should be considered to calculate the settlement and to evaluate the stability of landfills.

Key words numerical analysis settlement gas-solid coupling mathematical model landfill

DOI:

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