An Investigation of the Potential for the Bio-degredation of Motor Oil Within a Model Permeable Pavement Structure

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Abstract

A review of the existing literature confirmed the need for further rese the potential impact of porous and permeable pavements on hydrocarbo contamination of urban storm water. The examination of the extent of hydroc contamination in the environment highlighted the scope of the problem and it's potential hazards. An examination of the retention characteristics of porous and permeable pavement structures, and the review of the environment necessary for in-situ bio-degradation, suggests the potential for the development of a significant pollutant control mechanism.

The primary aim of the research programme was the initial investigation of the potential for the bio-degradation of motor oil within a permeable pavement structure (PPS). The goal of the experimental design was to set up a system which would allow for the evaluation of the internal environment of the PPS in terms of the factors which influence bio-degradation. The bio-degradation process is influenced by a number of variables, including temperature, pH, the amount of available oxygen, moisture content of the environment and the availability of sufficient levels of inorganic nutrient. A laboratory based approach was adopted, employing a series of model permeable pavement structures. Each phase of the investigation endeavoured to control particular variables, and examine others.

Similated rainfall of distilled water was applied to the laboratory structures at a consistant intensity of 30 mm/h for individual events of a duration of 30 minutes. For the majority of the research programme, the structures experienced rainfall events once evey 7 days. High volumes of clean motor oil, 3 -4 liters of oil per meter square of surface area, was applied to the structures as the target contaminant. Varying amounts of commercially available microbial mix and liquid nutrient were applied to the laboratory structures.

A monitoring and analytical approach, employing temperature measurements, CO_2 and O_2 levels was adopted which allowed for an ongoing indication of the level of microbial activity within the various laboratory structures. The calculation of a total mass balance at the completion of an experimental run, combined with the gas and temperature readings allowed for an initial calculation of a degradation rate for the laboratory PPS.

The laboratory equipment and procedures developed for the investigation proved capable of providing the necessary dependable data for the purpose of the study. The laboratory analytical procedures developed, though arduous, allowed for the generation of competent results. Within the criteria set for the laboratory investigation, the PPS was shown to be capable of supporting microbial growth. CO_2 levels within the laboratory structures were measured at levels exceeding 1 % by volume. This allowed for a level of target pollutant synthesis at a rate calculated at between 6 and 38 mg/kgd. Further research is required in order to extend these initial findings and to define the structures potential further.

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