WASTES: Solutions, Treatments and Opportunities
2nd International Conference
September 11th – 13th 2013

POROUS MEDIUM BURNERS FOR THE COMBUSTION OF GASES FROM LANDFILLS. THE DIRECT SIMULATION APPROACH

I. Malico[1,2]
1 University of Évora. Escola de Ciências e Tecnologia. R. Romão Ramalho 59, 7000-671 Évora, Portugal. imbm@uevora.pt
2 IdMEC. Instituto Superior Técnico. Universidade Técnica de Lisboa. Av. Rovisco Pais, 1049-001 Lisboa, Portugal.

ABSTRACT

Landfill methane recovery associated to its conversion to carbon dioxide through combustion is a common greenhouse gas mitigation strategy in developed countries. The typically low and fluctuating energy content of landfill gas makes combustion challenging. Among the several possible energy conversion technologies, innovative porous burners are a potential option. These burners offer a set of advantages when compared to free flame burners, but are still under investigation.

The development of reliable models specific for landfill gas combustion in porous burners can help understanding burner performance and the stability of the combustion process to fluctuations in methane concentration and flow rate. When considering porous burners, almost all the numerical studies apply the volume-average technique to the conservation equations and replace the complex structure of the surfaces that bound the phases by a fictitious model, in which each phase occupies the entire domain. This approach has produced valuable results but offers little detail as far as pore level characteristics are concerned. In the alternative direct numerical simulation approach, the transport phenomena are simulated through the real porous matrix structure. Due to its high computational costs, direct numerical simulations of porous medium combustion are rare. However, their potential is high.

Keywords: Landfill gas. Energy valorization. Porous burners. CFD. Immersed boundary method.