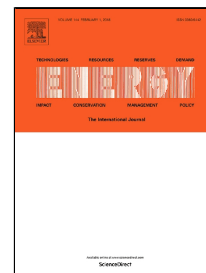


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The combustion characteristics and performance evaluation of DME (dimethyl ether) as an alternative fuel in a two-section porous burner for domestic cooking application



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1 **The combustion characteristics and performance evaluation of DME (dimethyl ether) as**  
2 **an alternative fuel in a two-section porous burner for domestic cooking application**

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6 **ABSTRACT**

7 Towards enhancing the thermal performance and fuel flexibility of existing domestic cooking  
8 stoves, the present work employs the heat recirculation mechanism of the porous medium  
9 (PM) combustion to these burners offering greater fuel compatibility for both liquefied  
10 petroleum gas (LPG) and renewable fuel dimethyl ether (DME). To establish the advantages  
11 of DME combustion than that of LPG within the stove, experimental measurements and  
12 numerical modeling are performed in a two-layer PM burner. The numerical model is used to  
13 investigate the dynamics of DME flame in the PM through reaction path analyses. Both  
14 experiment measurements and numerical predictions show lower CO emissions for DME  
15 flame than that of LPG flame inside the PM stove. With the use of DME instead of LPG,  
16 following the guideline of World Health Organization, the maximum allowable equivalence  
17 ratio can be extended from 0.4 to 0.5 and the thermal load from 4.0 kW to 5.0 kW. Moreover,  
18 the total heat generation rate, the gas- and solid-phase temperatures and radiant efficiencies of  
19 the burner with DME flame are higher than that with LPG flame at the same input conditions.  
20 However, the stability ranges of DME flame are found to be less than that of LPG flame.

21 **Keywords:** Combustion, Porous medium burner, DME/LPG cooking stove; Lattice  
22 Boltzmann method, Finite difference method

23 **Nomenclature**

$A_c$  cross-sectional area (m<sup>2</sup>)

$C$  specific heat (J/kg·K)

$d_p$  pore diameter (m)

24

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