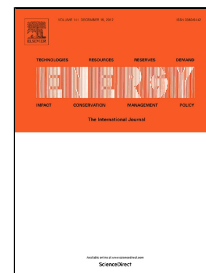


# Accepted Manuscript

Experimental study on combustion and emissions of dual fuel RCCI mode fueled with biodiesel/n-butanol, biodiesel/2,5-dimethylfuran and biodiesel/ethanol

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1           **Experimental study on combustion and emissions of dual fuel RCCI mode fueled with**  
2           **biodiesel/n-butanol, biodiesel/2,5-dimethylfuran and biodiesel/ethanol**

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7           **Abstract:** To investigate the effect of biofuel properties on RCCI combustion and emissions, the  
8           experimental study was conducted on a single-cylinder diesel engine. Three low reactivity oxygenated  
9           biofuels, i.e. n-butanol, 2,5-dimethylfuran (DMF) and ethanol were injected in the intake port and  
10          biodiesel was directly injected into the cylinder to realize RCCI operation. Results show that the heat  
11          releases are changed from two-stage to single-peak with the increase of EGR rates. Biodiesel/ethanol  
12          presents 1 °CA longer ignition delay than the others, which indicates latent heat has significant effect on  
13          ignition delay. Under different injection timings, the trends of combustion and emissions are similar for  
14          three RCCI modes, meantime, biodiesel/ethanol shows greater potential on reducing NO<sub>x</sub> and soot  
15          emissions simultaneously (soot<0.3 FSN and NO<sub>x</sub><1.5 g/kWh at SOI of -8 °CA ATDC) and biodiesel/n-  
16          butanol presents the highest ITE of 47.5%, and shows remarkable advantages on improving indicated  
17          thermal efficiency of RCCI combustion. Employing 80% fraction of biofuels by port injection results in  
18          lower soot emissions (below 0.3 FSN) and higher CO and HC emissions than neat biodiesel, but  
19          relatively high cetane number of n-butanol limits the maximum applying fraction. The increase of load  
20          highlights the differences on combustion and emissions among three RCCI modes.

21          **Key words:** RCCI; dual fuel; oxygenated biofuels; combustion; emissions

22          **1. Introduction**

23          Internal combustion engines have been dominant in power device application for more than 100  
24          years due to the high power output, efficiency and stability. However, in recent two decades,  
25          environmental pollution and energy crisis have become two key challenges that must be addressed for  
26          the development of internal combustion engines. Enormous efforts have been made to increase the  
27          efficiency and decrease the emissions of engines. New combustion modes represented by homogeneous  
28          charge compression ignition (HCCI), low temperature combustion (LTC), partially premixed  
29          combustion (PPC) and reactivity controlled compression ignition (RCCI), etc., which can be generally  
30          called low temperature combustion, have shown great potential to achieve clean and efficient combustion.

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