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A Study of Alternative Fuels Potential Effects on the Combustion Engines using acoustic emission

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**Introduction**

The limit of mineral fuel motivates researchers into finding alternative energy sources for diesel engines. However, the impacts of long-term use of the alternative fuels on the reliability and service life of CI engine have not yet been fully understood.

Some of alternative fuels have different properties from the normal diesel, which may influence the performance of engine, mainly in processes of piston lubrication, valve seal and combustion.

The recent studies shows that processes of piston lubrication, valve seal and combustion will generate acoustic emission (AE) signals, offering the potential to monitor operating conditions.

In this study, using four types of fuels (Fischer-Tropsch fuel, methanol-diesel blended fuel, emulsified diesel and standard diesel), the condition changes of CI engine have been investigated by AE techniques.

**Testing Facilities and Methods**

<table>
<thead>
<tr>
<th>Tab 1 The parameters of the 4100BZL engine</th>
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</thead>
<tbody>
<tr>
<td><strong>Manufacture/model</strong></td>
</tr>
<tr>
<td><strong>Engine type</strong></td>
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<tr>
<td><strong>Number of cylinders</strong></td>
</tr>
<tr>
<td><strong>Combustion system</strong></td>
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<tr>
<td><strong>Bore/stroke</strong></td>
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<tr>
<td><strong>Displacement volume</strong></td>
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<tr>
<td><strong>Compression ratio</strong></td>
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<tr>
<td><strong>Cylinder liners</strong></td>
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<td><strong>Start of fuel injection</strong></td>
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<tr>
<td><strong>Rated power</strong></td>
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<tr>
<td><strong>Max torque</strong></td>
</tr>
</tbody>
</table>

**Fig. 4 RMS of acoustic emission signals under different operating conditions**

Figure 4 shows the behaviour of AE RMS values for a engine cycle under different speed and loads for the baseline diesel. The AE RMS values in the middle of piston stroke is enhanced while the high burst around TDC is suppressed significantly. A clear increase of AE energy can be seen as the speed increases. As shown in the Fig. 5, methanol fuel produces a clearly higher average AE energy for nearly all operating conditions.

**CONCLUSION**

- The methanol diesel has the worst impact on the engine running state.
- It has little difference between diesel and other two fuel in AE signals.