

**CORROSION OF CARBON STEEL IN DIFFERENT
BIODIESEL BLENDS**

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FACULTY OF ENGINEERING

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KUALA LUMPUR

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ABSTRACT

Biodiesel is currently in regular use as an alternative fuel over conventional petroleum diesel. However, corrosion of automotive materials is one of the concerns related to biodiesel compatibility issues. The present study aims to investigate the effects of Tert-butylamine and Benzotriazole additive addition on the corrosion behavior of low carbon steel S45C material in different biodiesel blends. Static immersion tests in biodiesel conducted for 1440 hours on solution B0, B20, B50 and B100 without the presence of corrosion inhibitors. Similar testing was carried out with the addition of additive Tert-butylamine and Benzotriazole on solution B20 and B100. At the end of the test, corrosion characteristic was investigated by weight loss measurements, corrosion rate and changes on the exposed metal surface (EDX). Fuels were analyzed by using TAN (total acid number) analyzer and Density measurement in order to investigate the acid concentration and compositional characteristics respectively. Surface morphology was examined by digital photography and scanning electron microscope (SEM). The test result indicates that biodiesel is more corrosive to low carbon steel S45C sample when compared to diesel. The presence of additive Tert-butylamine and Benzotriazole, acts as corrosion inhibitor that retards the corrosion attack and protects the sample from further deteriorating. Both additives improve the corrosion behavior of the low carbon steel S45C sample. However the results indicate that Tert-butylamine acts as the more efficient and effective corrosion inhibitor for low carbon steel S45C operating in biodiesel environment.

ABSTRAK

Biodiesel kini sering digunakan sebagai bahan api alternatif berbanding konvensional diesel petroleum . Walau bagaimanapun, kakisan bahan automotif adalah salah satu kebimbangan yang berkaitan dengan isu-isu keserasian biodiesel. Kajian ini bertujuan untuk menyiasat kesan tert-butylamine dan Benzotriazole pada kelakuan kakisan bahan S45C keluli karbon rendah dalam campuran biodiesel yang berbeza. Ujian rendaman statik dalam biodiesel B0, B20, B50 dan B100 dijalankan selama 1440 jam tanpa kehadiran perencat kakisan. Ujian yang sama telah dilakukan dengan tambahan tert-butylamine dan Benzotriazole pada biodiesel B20 dan B100. Pada akhir ujian, ciri kakisan telah disiasat oleh ukuran berat keluli karbon rendah, kadar hakisan dan perubahan pada permukaan logam yang terdedah (EDX). Minyak telah dianalisis dengan menggunakan alat TAN (jumlah nombor asid) dan alat pengukuran ketumpatan untuk menyiasat kepekatan asid dan ciri-ciri kerencaman masing-masing. Morfologi permukaan diperiksa oleh digital fotografi dan imbasan mikroskop elektron (SEM). Keputusan ujian menunjukkan bahawa biodiesel lebih mengakis karbon rendah sampel keluli S45C berbanding diesel. Kehadiran tambahan tert-butylamine dan Benzotriazole, bertindak sebagai perencat kakisan yang melambatkan serangan kakisan dan melindungi sampel daripada terus merosot. Kedua-dua bahan tambahan memperbaiki kelakuan kakisan keluli karbon S45C sampel yang rendah. Walau bagaimanapun, keputusan menunjukkan bahawa tert-butylamine bertindak sebagai perencat kakisan yang lebih cekap dan berkesan untuk keluli karbon rendah S45C beroperasi dalam persekitaran biodiesel.

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LISTS OF ABBREVIATION

°C	Degree Celsius
kg	Kilogram
mg	Milligram
g	Gram
s	Second
mL	Milliliter
TBA	Tert-Butylamine
BTA	Benzotriazole
ppm	Part per million
SEM	Scanning Electron Microscope
EDX	Energy Dispersive X-Ray
KOH	potassium hydroxide
%	percent
µm	Micrometer
in	Inch
TAN	Total Acid Number
LCS	Low Carbon Steel