UNIVERSITI TEKNOLOGI MARA
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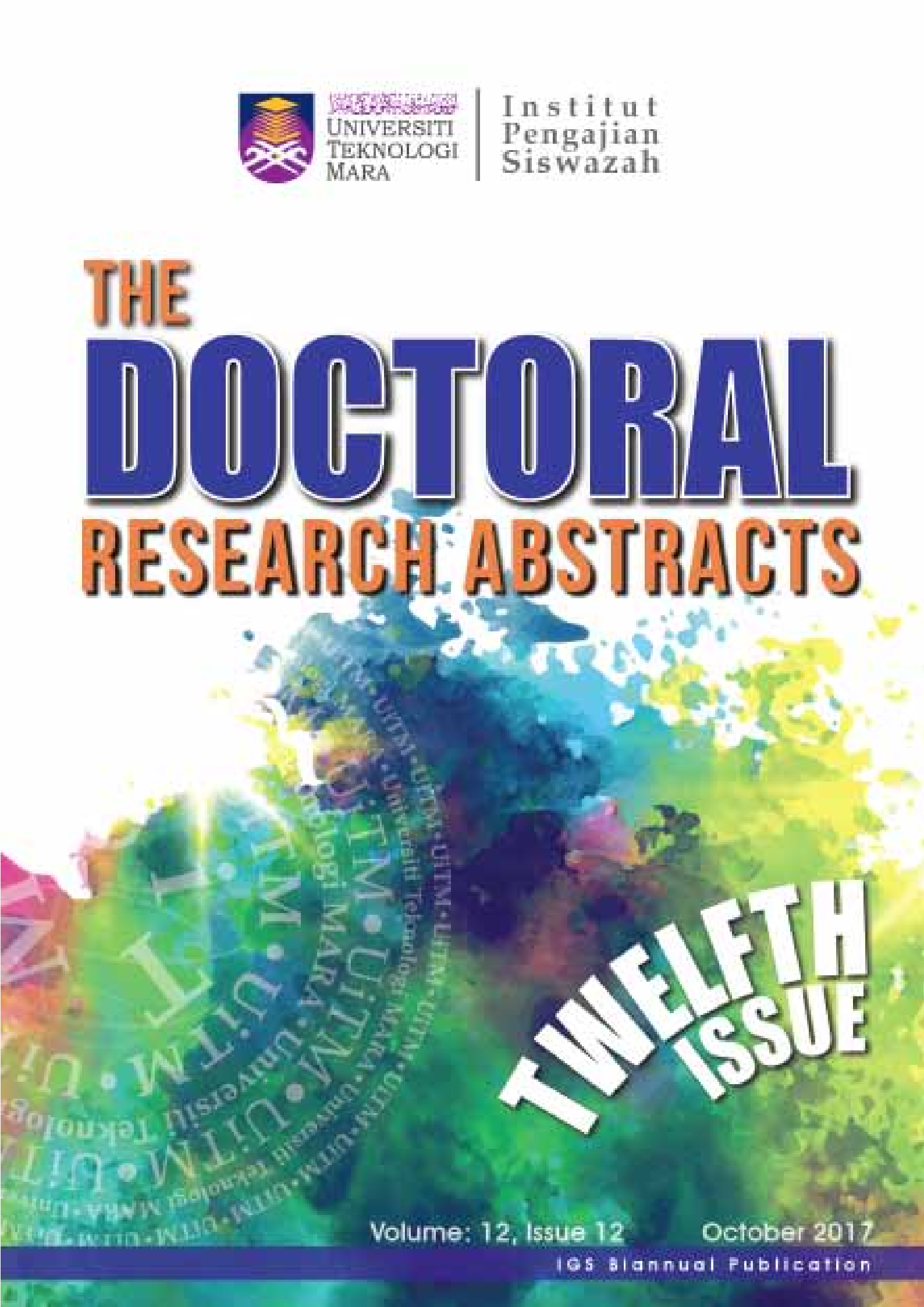
THE DOCTORAL RESEARCH ABSTRACTS



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Title : FAST PYROLYSIS OF EMPTY FRUIT BUNCH AND PALM KERNEL SHELL FOR PRODUCTION OF BIO-OIL USING AUGER REACTOR

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Pyrolysis has received a lot of interest as it can convert biomass into gas, liquid (bio-oil) and solid products. Bio-oil can be utilized as a feedstock for various chemicals as well as fuels production, and heat and power generations. The purpose of this research is to optimize the process conditions for bio-oil production from oil palm empty fruit bunch (EFB) and palm kernel shell (PKS) in an auger reactor and to elucidate the detailed characteristics of bio-oil. The maximum bio-oil yield for EFB was 64.54 wt% at temperature of 500 ^{o}C, nitrogen flow rate of 2 L/min and mass feeding of 8 kg/hr, while the maximum of 64.38 wt% of bio-oil yield was obtained at temperature of 550 ^{o}C, nitrogen flow rate of 3 L/min and 8 kg/hr for PKS. The highest higher heating value obtained for both EFB and PKS bio-oil was 27.28 kJ/mol and 26.68 kJ/mol, respectively, for bio-oil produced at 550 ^{o}C. The moisture content observed to be reduced with increasing pyrolysis temperature. Both of the GC-MS and FT-IR spectra indicated that phenol is a major component and the oxygenated species is the major component in both EFB and PKS bio-oil and most of compound infused to the organic phase at high temperature. The UV-Fluorescence absorption, which indicates the aromatic content, was also the highest for 550^{o}C bio-oil for both EFB and PKS. The result also shows that the PKS has higher aromatic content compared to EFB. The activation energy obtained for EFB at isothermal condition was 99.78 kJ/mol, while 112.43 kJ/mol for PKS. Besides that, the frequency factor for EFB is found to be 1.02 $\times 10^{6}$ s^{-1}, while 1.44 $\times 10^{6}$ s^{-1} for PKS. The activation energy obtained at third lump are 140.63 kJ/mol for EFB, while 246.07 kJ/mol for PKS. For isothermal condition it was lower than non-isothermal condition since the amount of energy needed for pyrolysis reaction to occur at high temperature and high heating rate are lower than slower heating rates due to the transport effect.

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