Extractive Desulphurization on Model Oil using 1-Butyl-3-Methylimidazolium Tricyanomethane

Syamsul B. Abdullah[1*] and Z. Man[2]

[1]Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Pahang. MALAYSIA
[2]PETRONAS Ionic Liquid Centre, Chemical Engineering Department, Universiti Teknologi PETRONAS, Bandar Seri Iskandar, 31750 Tronoh, Perak. MALAYSIA
E-mail: syamsul@ump.edu.my

Abstract
In this study, experiments were conducted for the removal of sulfur compound (present as benzothiophene or BT) with concentration of 2000 ppm in the model oil (present as *n*-dodecane or *n*-C_{12}) using 1-butyl-3-methylimidazolium tricyanomethane ([bmim][TCM]) as the extractant. The effects of stirring speed, extraction time and water content on the extraction efficiency were investigated. In the end, the loading factor of the [bmim][TCM] is also discussed.
Keywords: Extractive desulphurization, sulfur removal, ionic liquids, model oil, 1-butyl-3-methylimidazolium tricyanomethane

Introduction

In every oil refinery, the central separation step is distillation process where petroleum is separated into various fractions according to their volatility. Unfortunately, the sulfur compounds present in the crude oil will also be collected in the fractionated distillation products. In order to meet market regulation, the sulfur content in each product obtained from different fractionation temperatures is required to be removed. For commercial diesel especially, due to the tightening of air quality act all over the world, the maximum allowable limit of sulfur content has been reduced drastically (*Zhao et al. 2007; Dai et al. 2008; Liu et al. 2008).*

For instance, European Union (EU) imposed a restriction on sulfur content in fuels at 350 ppm in 2004, followed by a drastic reduction to 50 ppm in 2006, when later reduced it further to 10 ppm in 2010. In general, after 2010, the limit for sulfur content in fuel has been reduced to within the range of 15 to 10 ppm in Japan, United States of America (USA), Canada, Australia, New Zealand, Singapore and Hong Kong. Currently, many of the other countries in the world, especially those with high fuel consumption such as China, India, Russia, Brazil and Iran, are taking steps to follow the standard fuel product specification that is presently in place in the USA and Europe. Some countries in Asia, Middle East and South America such as Thailand, Bahrain, Oman, Kuwait, Argentina, Chile and Peru are currently contemplating a more drastic action in ratcheting down the standards which would bring them at par with the USA Environmental Protection Agency (EPA) and Euro IV standard, where the limit for sulfur content is 50 ppm (*Lo et al. 2003; Lu et al. 2007; Rheinberg et al. 2008; Zhao et al. 2008; Li et al. 2009; Adzamic et al. 2009; Kulkani and Afonso, 2010; Taib and Murugesan, 2011; Wang et al. 2011*).

In Malaysia, since 2006 petroleum companies have adopted Euro II standard where the sulfur content is kept at 500 ppm. However, due to stringent environmental requirement imposed by the government recently, petroleum refineries are forced to comply with a new requirement to further