HIGH PURITY PALM POLYOL ESTER FOR LUBRICANTS

ZULINA ABD MAURAD; YEONG SHOOT KIAN and ZAINAB IDRIS

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Palm based oleochemicals are suitable to be used as feedstock to produce a base oil lubricant (Yeong *et al.*, 2010). Palm oil possesses good inherent properties, which are desirable for lubricants, but it is limited by its poor low temperature fluidity. Palm oil properties can be improved in the areas of processing technology. The ideal oil for lubricant must have a high level of monounsaturated but low levels of saturated and polyunsaturated fatty acids (Harold, 1997). In view of that, the development of specialty esters using palm-based material was further investigated. Palm-based esters are molecules similar to natural oils, but exhibit a much better thermal, oxidative and hydrolytic stability as well as cold temperature fluidity without sacrificing much of its good properties as lubricant.

Technology of esterification using catalyst to produce lubricant ester involve washing and drying to remove residual catalyst. Traces of acid and moisture will remain as impurities in the final esters. Catalyst ester are generally known as genotoxic contaminant in the product if acid catalyst is being used at high reaction temperature. Therefore, this new technology will resolve these problems.

THE TECHNOLOGY NOVELTY

The process for producing polyol ester with low acidity has been filed for patent (PI 2016704810). The product fulfilled the industrial standard quality requirement. The pentaerythritol esters contain at least 96% w/w % tetra-ester. The process is using a non-catalytic and solventless method within an economical reaction duration.

METHODOLOGY

Pentaerythritol (PE) and C_8-C_{10} palm-based fatty acids are synthesize according to in *Figure 1*.

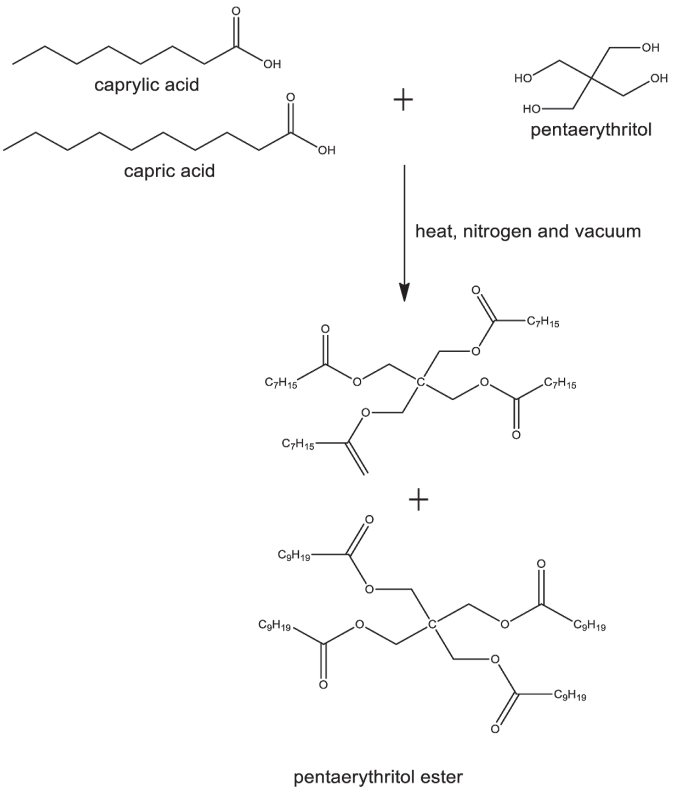

Figure 1. Synthesis of polyol ester.

Since the equilibrium constant controls the amount of ester produced, an excess of C_8-C_{10} fatty acid or pentaerythritol increases the yield of the ester. For lubricant base stock, the hydroxyl and acid values of the resulting polyol esters must be lower than 1 mg KOH g^{-1} sample. The proposed schematic diagram is illustrated in *Figure 2*.

ADVANTAGES

- Uses renewable resources as feedstock.
- Fully biodegradable. The esters are readily biodegradable with maximum of 9 days to pass 60% level and achieved 100% biodegradability in less than 15 days.
- Non-toxic.

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Head of Corporate Implementation and Consultancy Unit, Malaysian Palm Oil Board. 6, Persiaran Institusi, Bandar Baru Bangi, 43000 Kajang, Selangor, Malaysia.
Tel: 03-8769 4574 Fax: 03-8926 1337 E-mail: tot@mpob.gov.my Website: www.mpob.gov.my

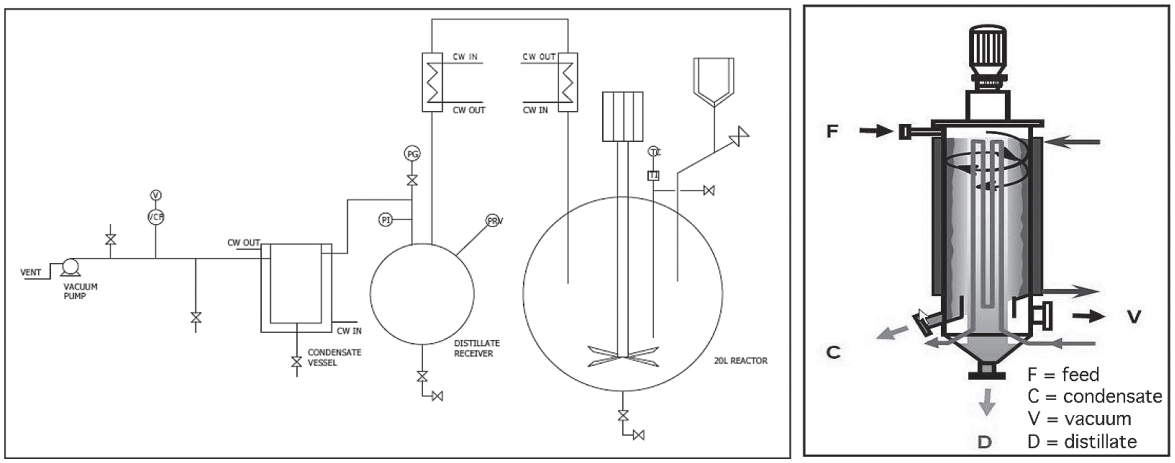

Figure 2. Esterification pilot plant (left) and short path distillation (right).

MARKET ANALYSIS

The world lubricant consumption was 38.7 million tonnes in 2012 (Kline and Company, 2013) and 39.2 million tonnes in 2013, a growth of 1% in one year (Kline and Company, 2014). The growth rate is expected to increase at 2.3% per year with 43.9 million tonnes in 2017. The fastest growth will be in Asia supported by rising vehicle ownership rates and ongoing industrialisation such as China.

ECONOMIC ANALYSIS

The estimated investment cost for the high purity of palm polyol ester for lubricants is given below:

Economic analysis	Value
Estimated cost of esterification and distillation plant	RM 4 Mill
Production capacity	360 t yr^{-1}
Internal rate of return (IRR)	28%
Net present value (NPV)	RM 3 180 937
Payback period	2 years

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For more information, kindly contact:

Head of Corporate Implementation
and Consultancy Unit, MPOB
6, Persiaran Institusi,
Bandar Baru Bangi,
43000 Kajang, Selangor, Malaysia
Tel: 03-8769 4574
Fax: 03-8926 1337
E-mail: tot@mpob.gov.my
www.mpob.gov.my