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LETTER TO THE EDITOR

Production of High Oleic Palm Oils on a Pilot Scale

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Dear Editor in Chief,

Ref: Letter to the JAOCS Editor-in-Chief from Albert Dijkstra

This letter is in response to the comments of Albert Dijkstra concerning our paper entitled "Production of High Oleic Palm Oils on a Pilot Scale" which was published in the Journal of the American Oil Chemists Society [1]. The objective of our study and the publication was to provide information on characteristics and composition of a high oleic oil obtained through the process of interesterifying palm oil with methyl oleate. Because of the newly developed biodiesel industry, palm-based methyl ester is readily available. For our work, methyl oleate was purchased; we did not conduct fractional distillation of palm methyl ester. The full process of starting from basic oil to methyl ester, followed by distillation was therefore not included, nor mentioned, but we expected interested parties would likely look into the full process if the industry has palm biodiesel product, or one may just start from appropriate raw materials. The reacted ester recovered from the process has many potential applications in biodiesel and oleochemical industries. It can also be recycled. All of these aspects were considered in our work in order to enhance the economic viability of the process, although not mentioned, because the paper was not written as a result of a graduate student thesis.

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Concerning Table 1. Dijkstra has rightly pointed out that columns 4 and 5, showing values for FAME before and after mixing, do not accurately show the composition of the 50:50 blend of palm olein and methyl oleate and that this is due to incompleteness of the reaction in the analysis of FAME, especially when methyl oleate was present in the mixture. These two columns were inadvertently placed into the table by mistake and we did not discuss the values in the two columns. The discussion was based on comparing the feed oil and the high-oleic oil obtained. From the table, the high-oleic palm oil (HOPO) composition did not deviate too far from the calculated average mixture.

When discussing the results of the fatty acid compositions before and after randomization, we actually referred to the comparison of the feed oil and the HOPO, and not to the data from the two columns representing before and after reaction.

For FAME preparation, the sample size was about 0.05 g. The reagent used was 0.5 M sodium methoxide and is therefore a liquid. We did not mention the details for preparing sodium methoxide because it is a commonly known reagent prepared from sodium metal and methanol. The mixture separated into two layers when water was added.

The standard deviations of Tables 1 and 5 were generally higher than those of Tables 3 and 6. This is because data from Tables 1 and 5 were from pilot plant experiments, while Tables 3 and 6 were from laboratory experiments. The variability in the pilot-plant experiments was higher than in the laboratory experiments where better control can be achieved. The laboratory experiments were included at a later stage when requested by the reviewers for data on palm oil. It was no longer possible to run pilot-plant trials because methyl oleate in large quantities was no longer available. Perhaps, the authors should have

mentioned this, although it was not the intention to mislead readers. In fact, Table 3 actually show more consistent results, where HOPO reflects the calculated average composition and that of the mixture after interesterifications.

The data on iodine values (IV) in Table 1 reflected the FAME data, as they were calculated based on the unsaturated fatty acids. As for the standard deviations, they reflect the standard deviations of the particular fatty acids used in the calculations. The values given for HOPO were from the three pilot-plant trials, and thus the variation was larger than for RBD palm olein and methyl ester, where it would be indicative of the consistency in the two raw materials being used for the trials.

The triacylglycerol (TAG) compositions were presented only for the major TAG found in the oils. Those familiar with the HPLC method used, which was reverse-phase HPLC using 75:25 v/v ratio acetone acrylonitrile as mobile phase, would know that the TAG mentioned as POP, POO, etc., do not mean the absolute POP isomer. It is well known to those familiar with the method that the method does not separate the isomers.

It is true that the TAG shown in the mixture columns are actually of the sample (which includes the methyl oleate, diacylglycerols, etc.). The HOPO data are reflective of the oil, without the methyl oleate present.

Dijkstra rightfully pointed out the typographical errors in the axes in Fig. 1. Upon further reflection, the slight FFA increase could be due to the formation of a small amount of soaps in the reaction, and some of which could be hydrolyzed in the presence of citric acid to form FFA. The data are reported as obtained from pilot-plant experiments which cannot be as easily controlled as in laboratory trials. We cannot explain why the oleic increased and then appeared to decrease.

The paper attempts to present a case study of the possibility of preparing a high-oleic oil from palm oil and to further enhance the oleic content through fractionation. While Dijkstra has put up a full process, as he envisions it, the authors felt that such a process may be possible for companies having fully integrated processes including a methyl ester plant, etc. In other cases, one may be only interested in purchasing the methyl oleate and starting from that as raw material. In the latter case, the methyl oleate and palmitate mixture at the end of the reaction could be sold as methyl ester for biodiesel. The high-oleic palm stearin (HOPS) as Dijkstra saw it was to be recycled back to be mixed with RBD palm oil. In fact, the authors felt that there could be a better use for HOPS oil, because it is also a high-oleic oil having sufficient solids to be utilized in margarine or shortenings. The authors have evaluated HOPS for applications as margarines and shortenings. The authors thank Dijkstra for his keen interest in the work and for calling attention to the areas which the authors had overlooked.

The objectives of the paper were to provide information for a process to produce a high oleic palm-based oil through chemical interesterification with an oleate source, which may become increasingly available due to growth in biodiesel manufacture, and to provide compositional data about possible fractions. Two distillations are indeed needed for the complete process, but may not need to be taken up by one operator, as the process can be split up. The authors provided the process for the reaction between the refined palm oil products and methyl oleate. Although it had been critically projected that the HOPO obtained has not reached equilibrium, the data obtained reflects what was achieved, which was not far from equilibrium. There are certain aspects of the pilot-plant design which could have given the results as shown in Fig. 1, and of which we are not able to explain fully without divulging designs of the plant.

Reference

1. Ramli MR, Siew WL, Cheah KY (2009) Production of High Oleic Palm Oils on a Pilot Scale. J Am Oil Chem Soc 86:587–594