MPOB STATEMENT ON 3-MCPD ESTERS

BACKGROUND

The Malaysian Palm Oil Board (MPOB) continually promotes a high regard for issues of food quality and safety by providing information, guidance and updates on matters of concern to the palm oil industry. The following information on 3-MCPD esters and glycidyl esters in food and refined edible oils is provided to address the concern on food safety issues related to these compounds.

![3-MCPD](image1)

![3-MCPD diester](image2)

![Glycidol](image3)

![Glycidyl ester](image4)

Recent studies have reported the presence of 3-MCPD esters in all refined vegetable oils and fats. However, there is no agreed standard analytical method which has been validated separately for free and bound 3-MCPD monoesters and diesters. MPOB has been actively developing methods using different derivatizing agents. An evaluation carried out by a reputable European laboratory on behalf of MPOB has found that palm
oil does not contain the highest level of 3-MCPD esters in comparison with other oils as reported by some researchers. The reasons for the differences could be manifold, however, the difference in the method of analysis and the sampling of the oils analysed are the main issues.

The health risk posed by MCPD esters is also ambiguous. It should also be noted that currently, no toxicological data on 3-MCPD esters are available and the assessment by Federal German Institute for Risk Assessment (BfR) has assumed that toxicologically relevant 3-MCPD is released from 3-MCPD esters during digestion. Tolerable daily intake (TDI) for 3-MCPD has been established at 2 µg/kg body weight and the same value was used for the assessment of 3-MCPD esters. Another assumption is that the metabolism of 3-MCPD ester is similar to that of dietary triacylglycerols (TAGs), forwarding the hypothesis that ingestion of (sn1)-monoester would result in the release of free 3-MCPD, while (sn2)-monoesters would be absorbed as such. MPOB will be collaborating with reputable research institutes in determining the metabolism and toxicology of 3-MCPD ester in an animal model.

MPOB conscientiously monitors the latest news on 3-MCPD and glycidyl esters in food products and has initiated its own research to clarify, resolve and reduce the potential health risk from these compounds.

To this end, MPOB has formulated the following research strategies:

- Participate in collaborative trials organized by BfR and Joint Research Centre (JRC) or other Scientific Institutes to validate the method;
- Monitor the content of these contaminants at the various stages of the refining process;
- Understand the mechanisms of the formation of 3-MCPD esters and glycidyl ester at different refining conditions with different CPO quality;
- Modify the refining process in order to reduce or eliminate the precursors of these contaminants;
- Conduct toxicological studies in collaboration with other research organisations.
MPOB is committed to safeguard the interest and well-being of the consumer, not only by addressing issues on 3-MCPD and glycidyl esters but also other related food safety issues.

**CURRENT FINDINGS**

Factors which have been reported to cause the formation of 3-MCPD esters are deodorising temperature in refining process, pH and chloride content (nature of the chloride ion).

MPOB has verified ‘Method BfR 008’ which was developed by the Federal German Institute for Risk Assessment (BfR) for analysis of 3-MCPD esters. This method is based on the acidic transesterification method and detection is by Gas Chromatography with Mass Selective Detector (GC-MSD). The limit of detection (LOD) is 0.25 mg/kg, whilst limit of quantification (LOQ) is 0.5 mg/kg.

Surveys of 3-MCPD ester levels in Malaysian palm oil were conducted in 2009-2010 and 2012 on crude palm oil, bleached palm oil, RBD palm oil, RBD palm olein and RBD palm stearin samples. Results are summarised in **Table 1**. The first survey in 2009-2010 was conducted to determine the range of 3-MCPD esters in the collected samples, while the second survey in 2012 was conducted with the specific aim of monitoring reduction of 3-MCPD esters in refined palm oil.

**Table 1.** 3-MCPD ester levels in Malaysian palm oil products

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of sample</th>
<th>3-MCPD esters range, mg/kg (Year of survey)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>2009-2010</td>
</tr>
<tr>
<td>1</td>
<td>Crude Palm Oil</td>
<td>N.D – 0.965 <em>(n = 106)</em></td>
</tr>
<tr>
<td>2</td>
<td>Bleached Palm Oil</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>RBD Palm Oil</td>
<td>&lt; LOD – 5.77 <em>(n = 80)</em></td>
</tr>
<tr>
<td>4</td>
<td>RBD Palm Olein</td>
<td>&lt; LOD – 4.13 <em>(n = 50)</em></td>
</tr>
<tr>
<td>5</td>
<td>RBD Palm Stearin</td>
<td>0.354 – 1.787 <em>(n = 15)</em></td>
</tr>
</tbody>
</table>

- *N.D = Not Detected*
- *LOD = 0.25 mg/kg, LOQ = 0.5 mg/kg*
Based on results from refining studies (32 pilot plant trials, 200 kg batch) conducted at MPOB, the possible factors that contribute to the formation of 3-MCPD esters besides the deodorisation temperature are as follows:

- acidity (dosage of phosphoric acid);
- type of bleaching earth (natural versus acid activated); and
- chloride levels.

The level of 3-MCPD esters in the processed palm oil can be reduced if the following measures are taken:

1. The FFB should be harvested and sterilized immediately to reduce the phospholipids and free fatty acid, as this would enable ease of degumming and deodorisation.
2. Natural clay and acid-activated clay with neutral or close to neutral pH are recommended during refining.
3. Optimisation of phosphoric acid dosage during degumming to levels just sufficient for effective degumming, and the reduction of acidity prior to bleaching is recommended.
4. Chemical refining is a possible way to reduce the formation of 3-MCPD esters.
5. Ensuring good quality CPO for refining will help towards reducing 3-MCPD esters and other contaminants.

The palm oil industry in Malaysia will continue with efforts to reduce the amount of 3-MCPD esters in the palm products. MPOB is committed to working together with the palm oil industry to ensure that palm oil complies with the maximum level (ML) of 3-MCPD esters, if this ML is officially established.