Mitigation of 3-MCPD- and Glycidyl-esters in Food Matrices
Where do 3-MCPD- and GE originate?

- 3-MCPD and GE mainly occur in refined vegetable fats during the high temperature processing.
- Palm Oil tends to have the highest levels of 3-MCPD and GE.
- Reducing fat content to lower 3-MCPD/GE-levels will significantly influence the taste and structure of the food.
- Reformulation of the applied fat/oil blend could mitigate the problem.
PALM OIL AND ITS FRACTIONS
In fractionation 3-MCPD and GE tend to go into the softer fractions. Soft fractions therefore include higher levels of these compounds.
Average 3-MCPD- and GE-values in Palmoil and -fractions

Source: ADM Research
3-MCPD- and GE reduction in Palm oil

3-MCPD and GE-reduction in Palm oil and its fractions is possible, but:

- To achieve significantly lowered 3-MCPD- and GE levels requires additional processing steps
- 3-MCPD can be significantly lowered, but it is very difficult to reach zero.
- GE can be minimised after refining
- The removal of 3-MCPD is very difficult. Therefore the formation of 3-MCPD has to be prevented in the sourcing and refining process already
Average 3-MCPD- and GE values in various oil types

Source: ADM Research
REPLACING PALM OIL BY LIQUID OILS
Simple Replacements for Palm Oil

In frying applications Palm oil and Olein can be replaced by liquid oils.

Due to stability reasons the choice of the correct liquid oil is important.

Source: AOCS; Physical and Chemical Characteristics of Oils, Fats and Waxes 2006
Rancimat stability of liquid oils and palm oil

Source: ADM Research
Example: Soft Filling Fat

[Graph showing the comparison of 3-MCPD and GE levels in different fats.]

Source: ADM Research
Replacement of Palm in Harder Fats

In soft fats palm fractions can be replaced relatively easy by liquid oils.

If structure or higher solid fat contents are needed, the possible addition of liquid oils is limited.
Potential Problems of low-3-MCPD Modifications

<table>
<thead>
<tr>
<th>Hard Palmfractions</th>
<th>Hydrogenated fats</th>
<th>Exotic Fats</th>
<th>Coconut/PK Fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must be low 3-MCPD/GE</td>
<td>Must be low TFA</td>
<td>Price</td>
<td>Lauric / taste issues</td>
</tr>
</tbody>
</table>

ALTERNATIVES BASED ON HYDROGENATED OILS
Example: Baking Fat with fully hydrogenated liquid oil

Source: ADM Research
- Partially hydrogenated fats contain significant amounts of *trans*-fatty acids
- Fully hydrogenated fats contain no *trans*-fatty acids, but also no unsaturated fatty acids
- Going back to hydrogenation does not necessarily mean going back to *trans* fatty acids
- Still hydrogenation must be labelled

Source: ADM Research
ALTERNATIVES BASED ON EXOTIC FATS
What are exotic fats

- Fat mentioned in the cocoa directive
  - Kokum
  - Shea
  - Sal
  - Mangokernel
  - Illipé
  - (Palm Oil and -fractions)
- Cocoa Butter
Comparison Palmoil : non-palm Filling Fat

„Hydrogenation“ labelling not required.

Source: ADM Research
Comparison Palm Oil: non-palm Filling Fat

Source: ADM Research
Drawbacks

• Major drawback of palm alternatives based on exotic fats might be the cost impact

• Due to expensive crude materials these products can be significantly more expensive

• Availability is limited (for example: Shea not grown in plantations, Illipé only flowering every 3 – 7 years)

• For some solutions tempering is necessary as per cocoa butter
Summary

3-MCPD/GE in refined oils and fats could be reduced by:

- low-3-MCPD/GE palm products
- Liquid oils which have naturally a lower potential towards 3-MCPD/GE
- Fats based on fully-hydro oils
- Fats based on exotic fats if “non-hydro” label is necessary
- Combinations of all above

Some solutions might influence the performance, texture or structure
Thank you!

Please also visit us online www.olenex.com