

The Effect of Refining Process Conditions on Contaminant Removal and Side Reaction Products Formation.

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The vegetable oil refining process has been developed between 1820 and 1900 and was further improved during the following century. Originally, vegetable oils were mainly refined to improve their quality for new applications like margarine, bakery fats and deep fried products. The refining process has been optimized to reduce the natural taste and colour and to remove most of the free fatty acids. Later it was discovered that this optimized process also reduces many of the contaminants present in the crude oil. The levels of the following contaminants can be minimized in this way:

- Poly Aromatic Hydrocarbons
- Pesticide residues
- Oil extraction solvents
- Heavy metals
- Mycotoxins (e.g. Aflatoxin in coconut oil and Zearalenone in maize oil)

However, the refining process may also introduce side reaction products. The best known side reaction products are trans fatty acids, formed at high deodorization temperature, and 3-MCPD esters. The refiner will optimize the parameters of the refining process to maximize the reduction of crude oil contaminants on one hand while limiting the formation of unwanted side reaction products on the other. This requires an understanding of the effect of the refining process parameters on the formation of trans and 3-MCPD esters.

In 2008 FEDIOL has launched a research project to investigate the possible ways to mitigate the formation of 3-MCPD esters during the refining process, while maintaining the quality and food safety of the refined product. This project was based on the different processes applied by the FEDIOL members and included an evaluation of the results of previous industrial trials done by members and other industrial partners. The FEDIOL trials were carried out in the pilot plant of one of its members using crude and bleached oils from industrial origin.

The main conclusions of the FEDIOL pilot plant trials are:

- The formation of 3-MCPD esters mainly occurs at deodorization temperature although some formation during bleaching was observed.
- The level is more determined by crude oil characteristics and less by refining conditions.
- There is a strong influence of the analytical method on the results at high levels.
- There is no simple relationship between 3-MCPD ester levels in refined product and the free fatty acids or diacylglycerol levels in the crude or bleached oil.

However, the information obtained from this research project is insufficient to optimize the refining process for 3-MCPD ester mitigation while maintaining the quality and food safety of the refined product. A better understanding of the formation mechanism is required to give direction to further refining trials.