



Möglichkeiten der Minimierung von 3-MCPD- und Glycidyl-Fettsäureestern in Pflanzenölen – Ergebnisse aus dem ersten FEI-Projekt

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Inhalt des Vortrages

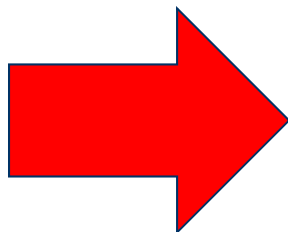
- Hintergründe zum 1. FEI-Projekt
- Raffination von Fetten und Ölen
- Einfluss der Rohware
- Einfluss des Raffinationsprozesses
- Zusammenfassung

3-MCPD-FE und verwandte Verbindungen in

Stellungnahme Nr. 047/2007 des Bundesinstitutes für Risikobewertung vom 11. Dezember 2007

Aus Sicht der **Risikobewertung besteht unmittelbarer Handlungsbedarf** für die weitere **Untersuchung der Ursachen** und eine **Suche nach alternativen Techniken** bei der Herstellung von raffinierten Fetten mit dem Ziel, die Ge-halte an 3-MCPD-Estern in Säuglingsmilch zu reduzieren,

Da von der Problematik der 3-MCPD-Fettsäureester nicht nur einzelne Produkte oder Produkte einzelner Hersteller betroffen sind, müssen **grundsätzlich alternative Techniken für die Herstellung raffinierter Fette und Öle entwickelt** werden.



FEI-Forschungsprojekt
(AiF 16004 BG; 2009 – 2011)

geht
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hes

20.11.2008: Erklärung von Überbefunden vor allem in Palmöl mit der Bildung von Glycidylestern (Weisshaar, CVUA Stuttgart/Kuhlmann, SGS)

Untersuchungen zur Bildung von 3-Monochlorpropan-1,2-diol-Fettsäureestern (3-MCPD-FE) in Pflanzenölen und Entwicklung von Strategien zu deren Minimierung

Projektziele

- **Aufklärung** der Zusammenhänge zwischen Bildung von 3-MCPD-FE, Prozessbedingungen und Zusammensetzung der beteiligten Komponenten (PPM/MRI)
- **Empfehlungen** für die Definition von Prozessbedingungen zur **Minimierung** von 3-MCPD-FE, **ohne die Qualität der Produkte negativ zu beeinflussen** (PPM/MRI)
- **Entfernung** von 3-MCPD-FE aus dem **raffinierten Produkt (DIL)**
- **Entwicklung einer direkten Quantifizierungsmethode** basierend auf der SIVA mittels LC-MS (DFA)



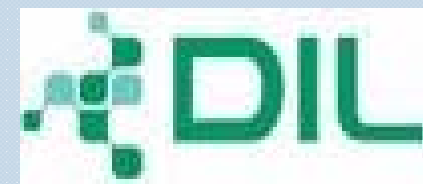
Max Rubner-Institut,
Münster (MRI)



Pilot Pflanzenöl
Magdeburg e.V.
(PPM)



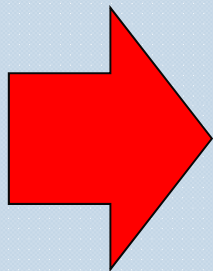
Deutsche
Forschungsanstalt für
Lebensmittelchemie
(DFA)



Deutsches Institut für
Lebensmitteltechnik e.V.

Wirtschaftliche Bedeutung

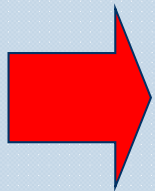
- 3 Mio. t Pflanzenöle für die Ernährung, 95 % müssen raffiniert werden
- 19 Saatverarbeitungs- und Raffinationsbetriebe (5 Mrd. Euro Jahresumsatz, 2000 Mitarbeiter)
- Raffinierte Fette u. Öle werden als Rezepturbestandteil in 80 % aller Lebensmittel eingesetzt (Kindernahrung, Süßwaren, Margarine, Feinkost, etc.)



Nicht nur die Öl produzierende Industrie ist betroffen, sondern auch ein Großteil der nachgelagerten Branchen

Innovativer Beitrag des Projektes

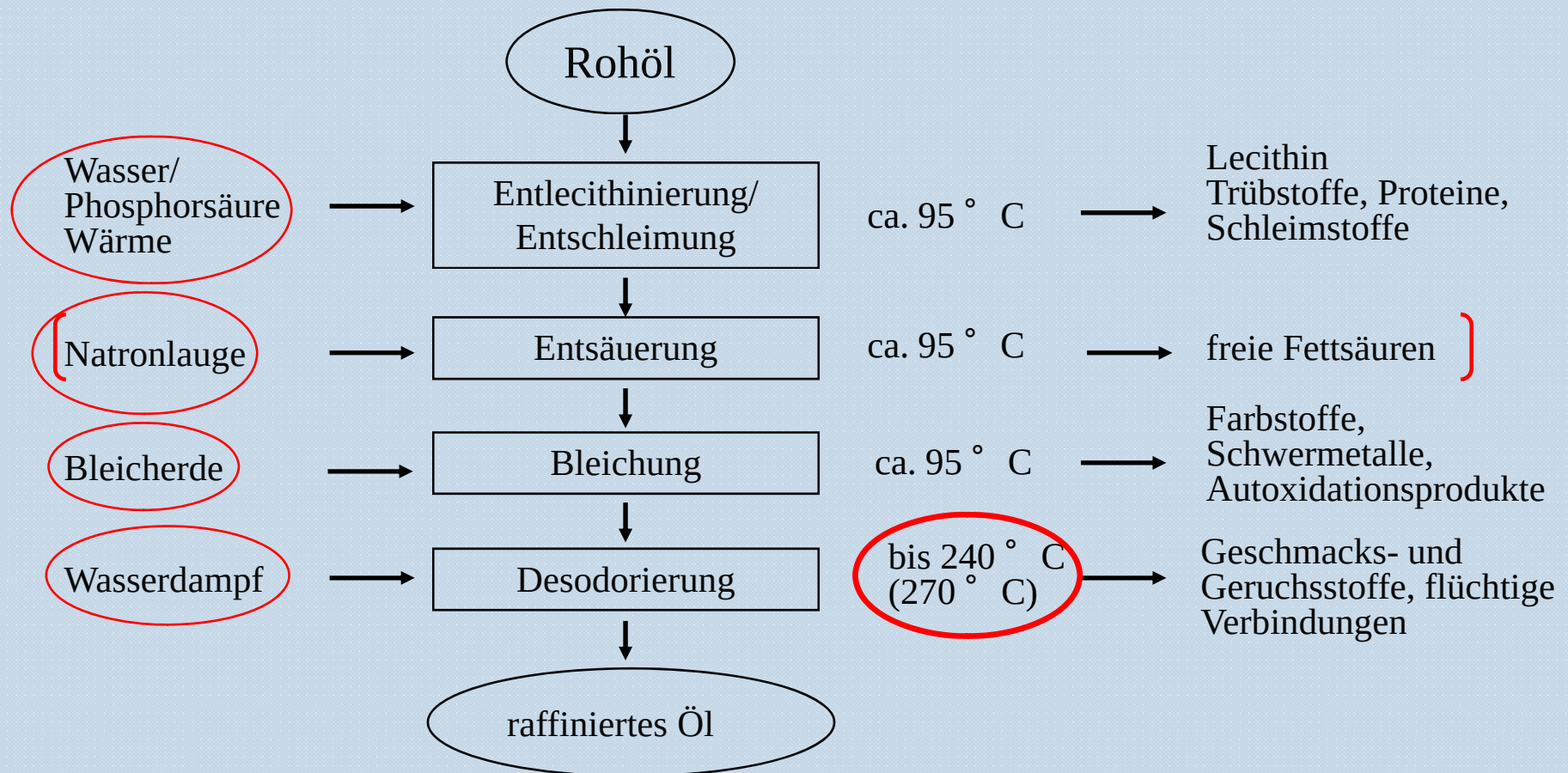
Klare Empfehlungen für die Herstellung von Fetten und Ölen mit niedrigen Gehalten an 3-MCPD-Fettsäureestern und verwandten Verbindungen



Sichert die Wettbewerbsfähigkeit der kmUs nicht nur im Bereich der Ölverarbeitung, sondern auch im Bereich der Weiterverarbeitung von Fetten und Ölen

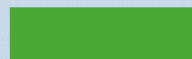
Raffination

Extraktion der Ölsaart durch Pressung und Lösungsmittel

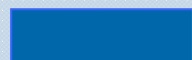


Einfluss der Raffination auf verschiedene Kontaminanten

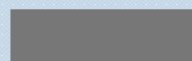
	Kohlen- wasser- stoffe < 20	Polyzyklische aromatische Kohlenwasser stoffe (PAKs)	Pestizide	Aflatoxin B1	Zeara- lenone
Rohöl					
Entschleimen					
Neutralisation					93 %
Bleichung					77 %
Desodorierung					



Chemische Raffination



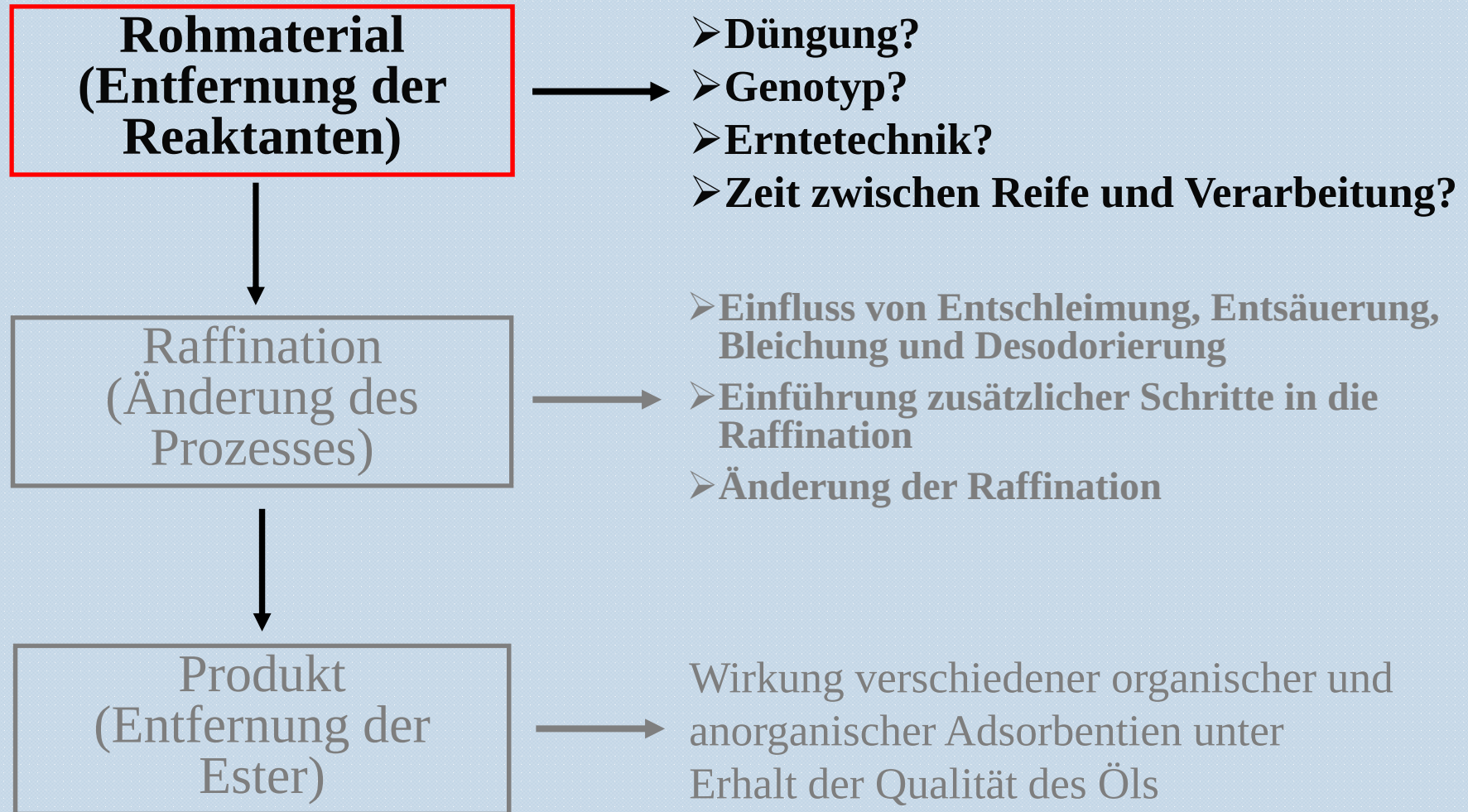
Physikalische Raffination



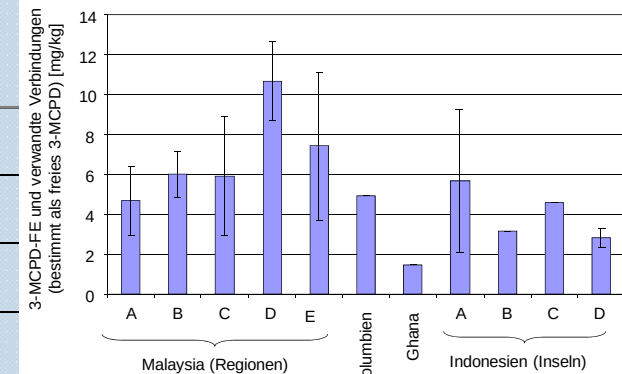
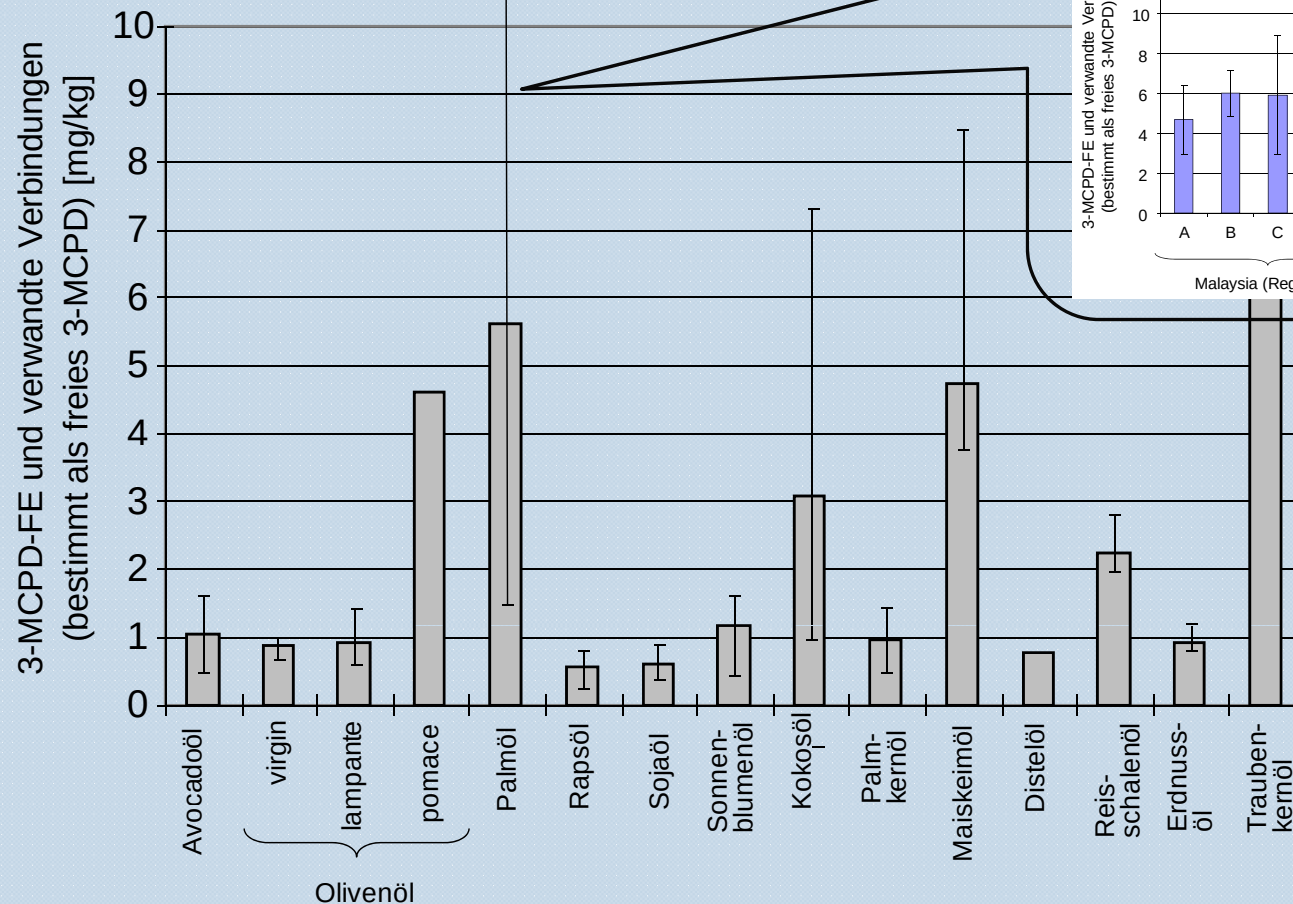
Physikalische und chemische Raffination

Quelle: Dr. van Duijn, Fediol

Untersuchung der relevanten Stellschrauben



Potential verschiedener Pflanzenöle zur Bildung von 3-MCPD-Estern und verwandten Verbindungen



Einfluss des Rohmaterials auf die Bildung von 3-MCPD-FE und verwandten Verbindungen



Früchte sind

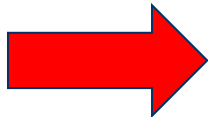
- nicht lagerfähig



Endocarp
Mesocarp
Exocarp

Optimaler Erntezeitpunkt, schneller Transport zur Ölmühle und schnelle Inaktivierung der Enzyme führen zu

- niedrigem Gehalt an freien Fettsäuren
- niedrigem Gehalt an Diglyceriden



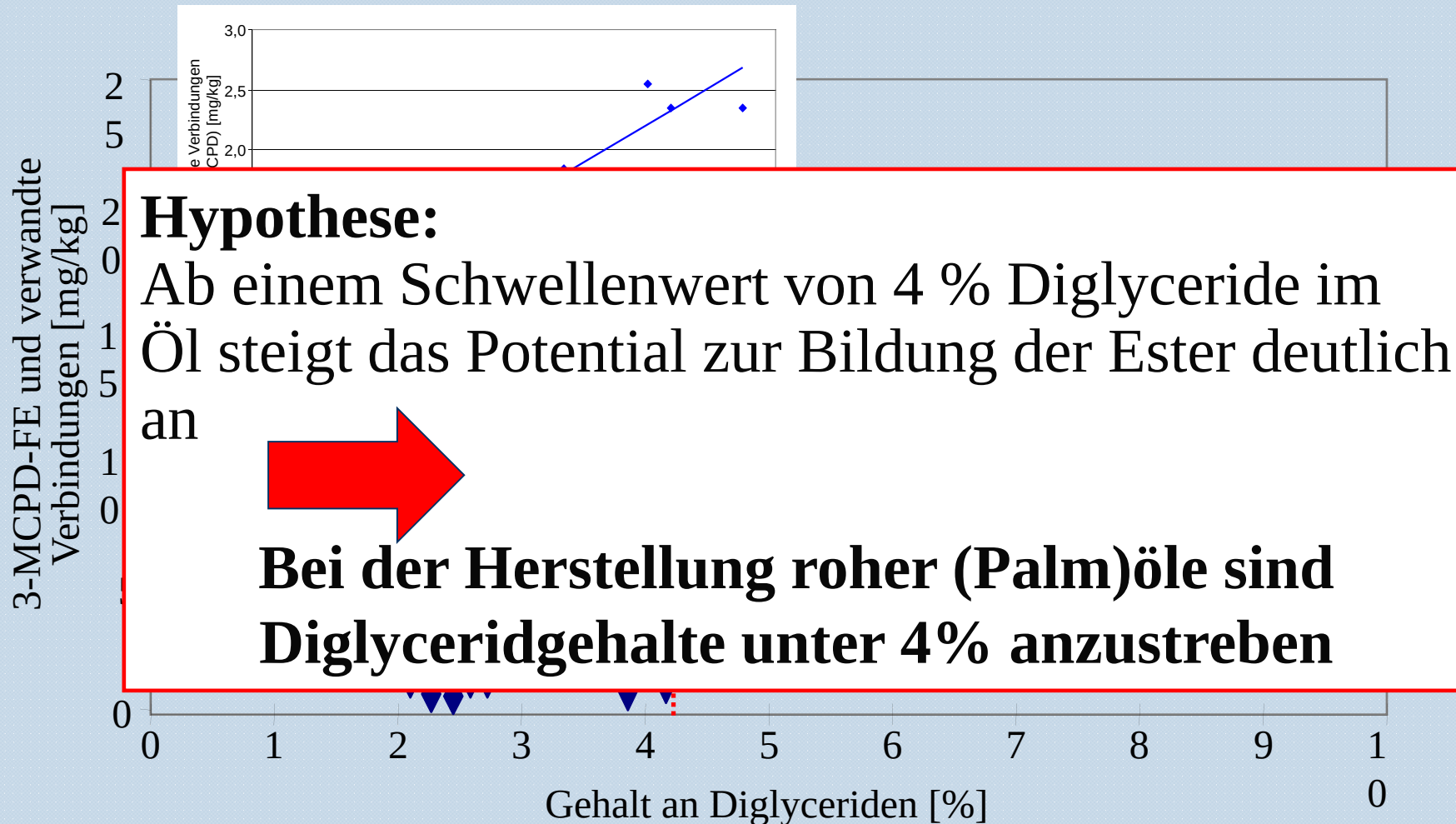
- niedrigere Temperatur während der Raffination ist möglich
- geringere Bildung von 3-MCPD-FE und verwandten Verbindungen während der Raffination



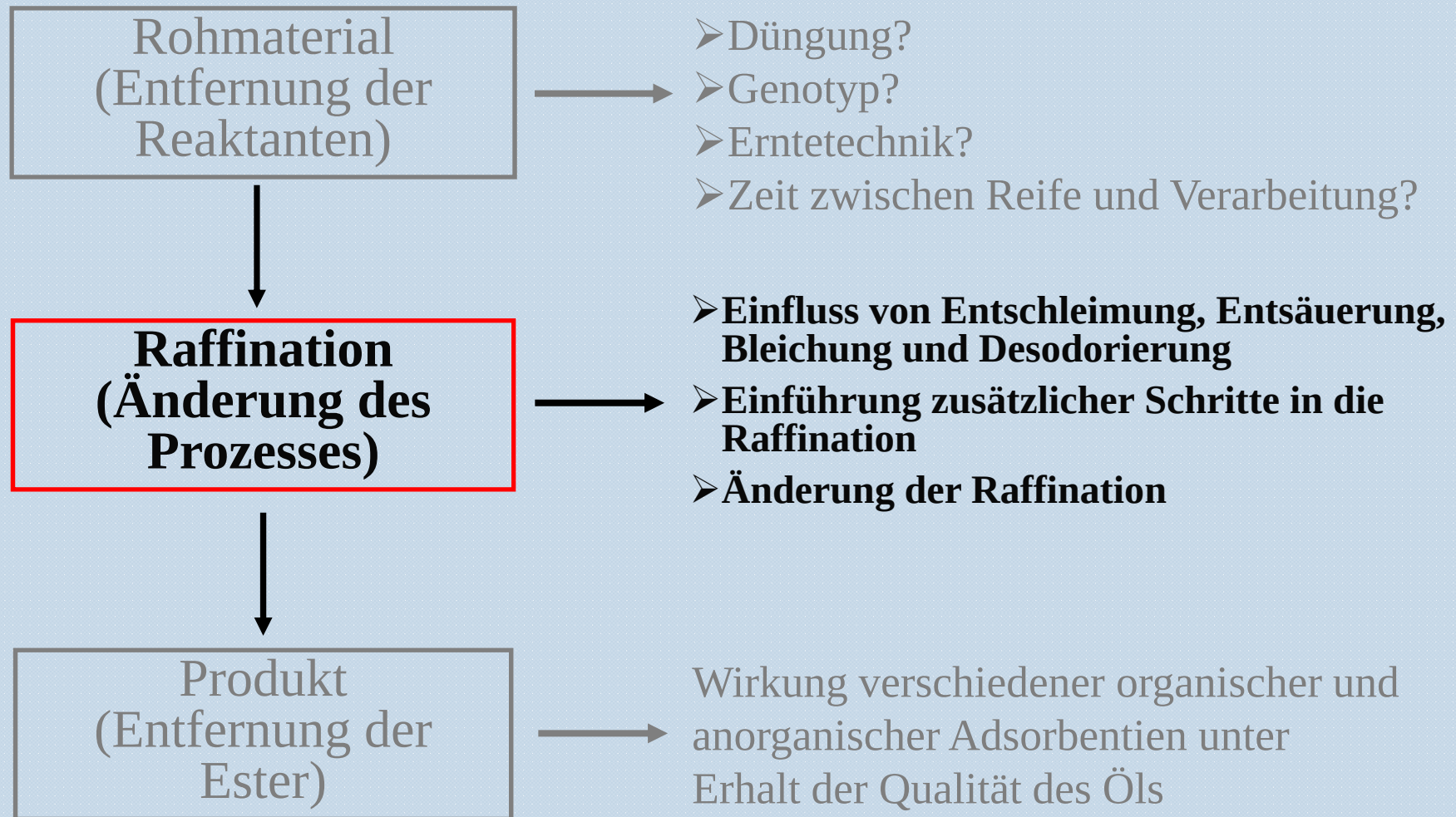
- Freien Fettsäuren
- Diglyceriden



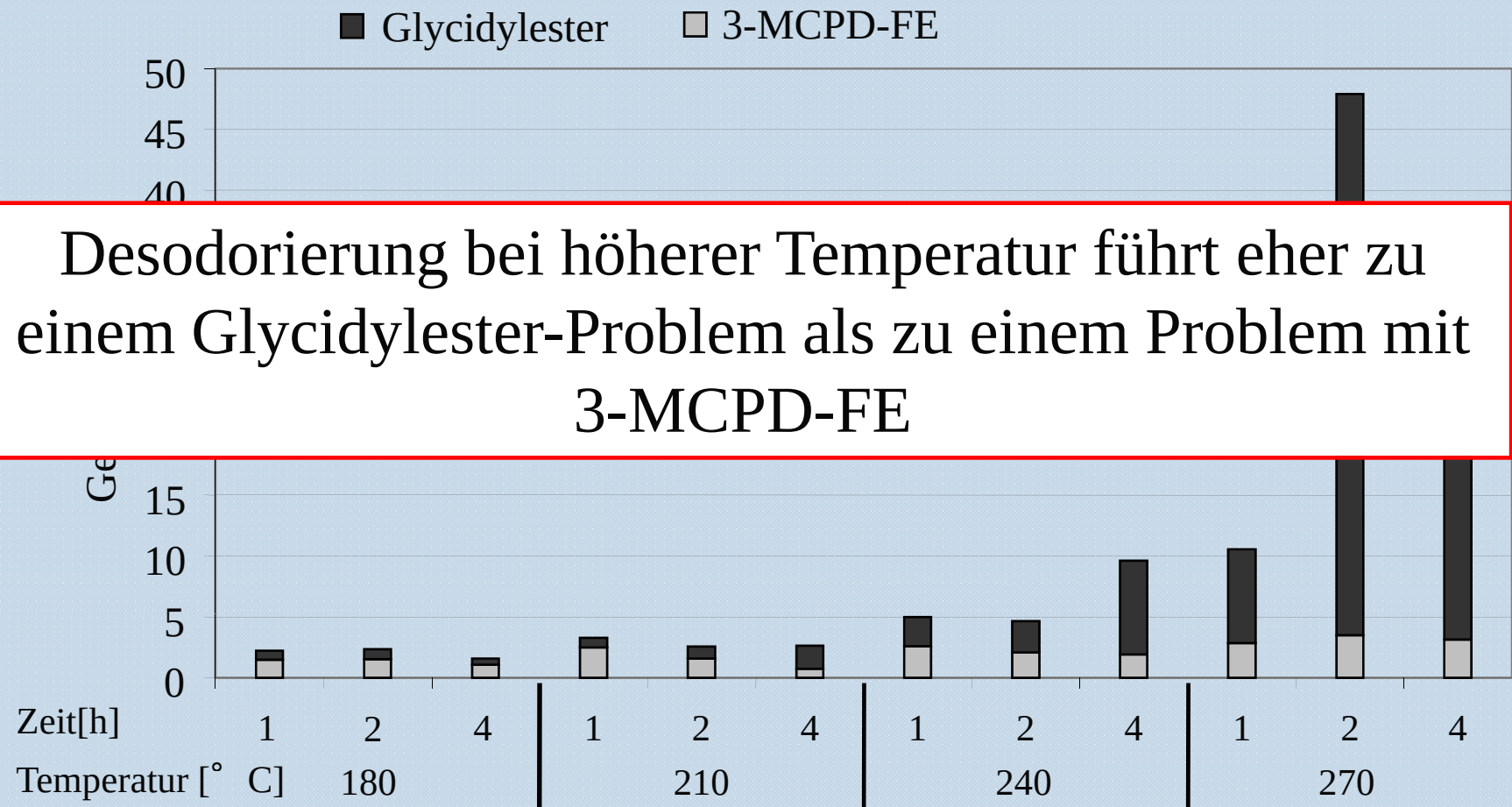
Korrelation zwischen Gehalt an Diglyceriden und Potential zur Bildung der Ester



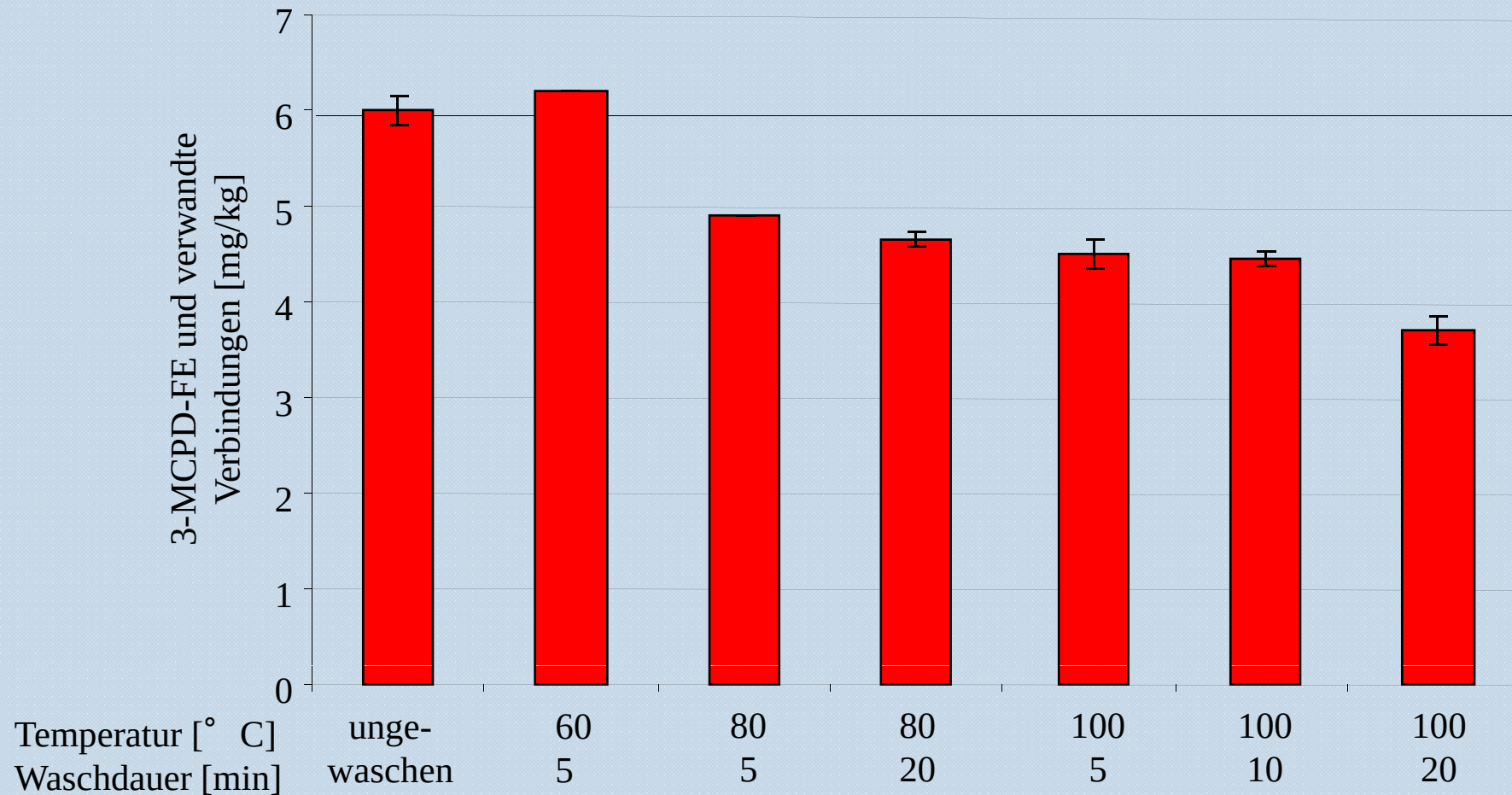
Untersuchung der relevanten Stellschrauben



Einfluss von Temperatur und Zeit während der Desodorierung

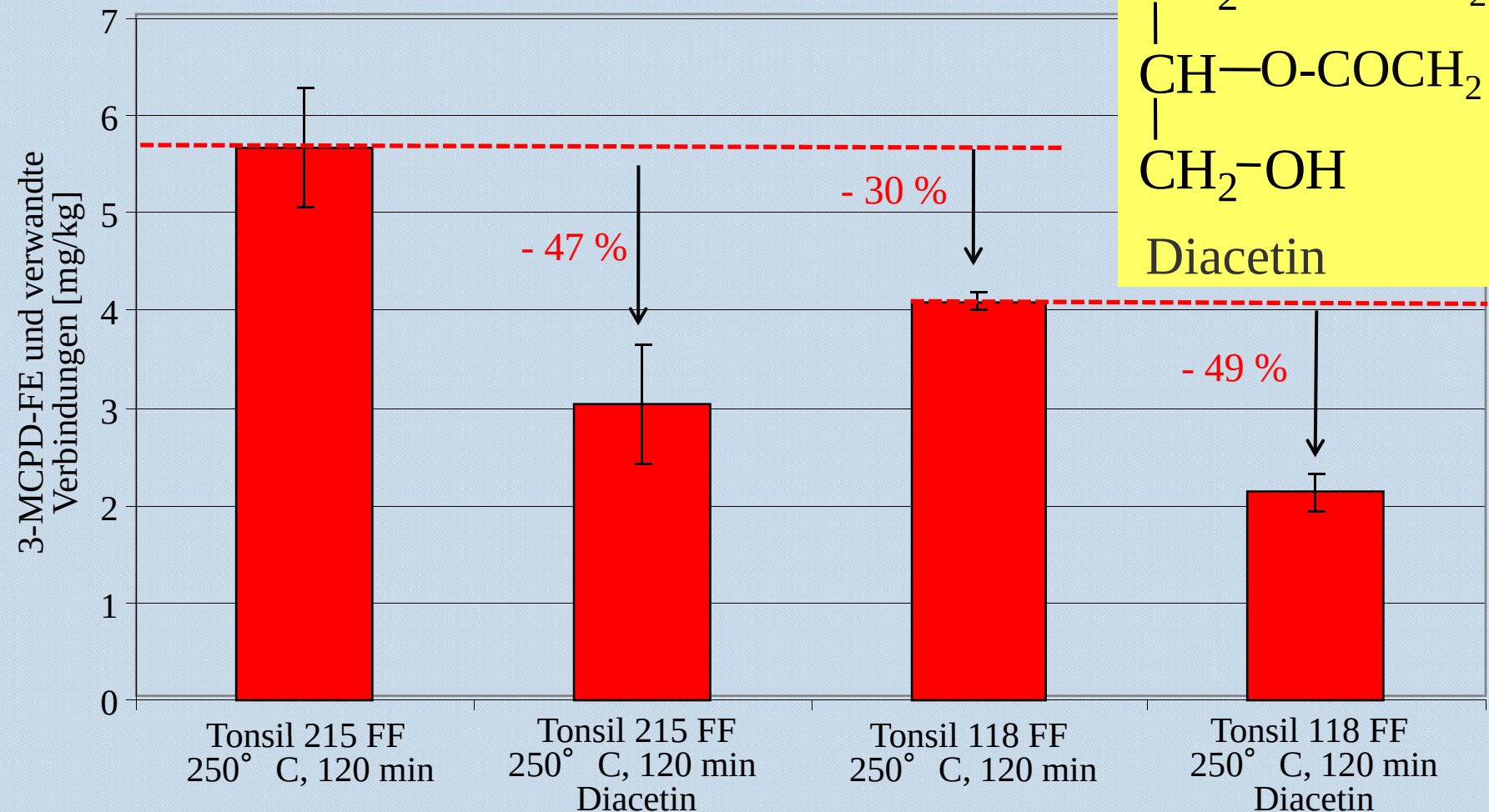


Einfluss von Temperatur und Dauer des Waschvorgangs

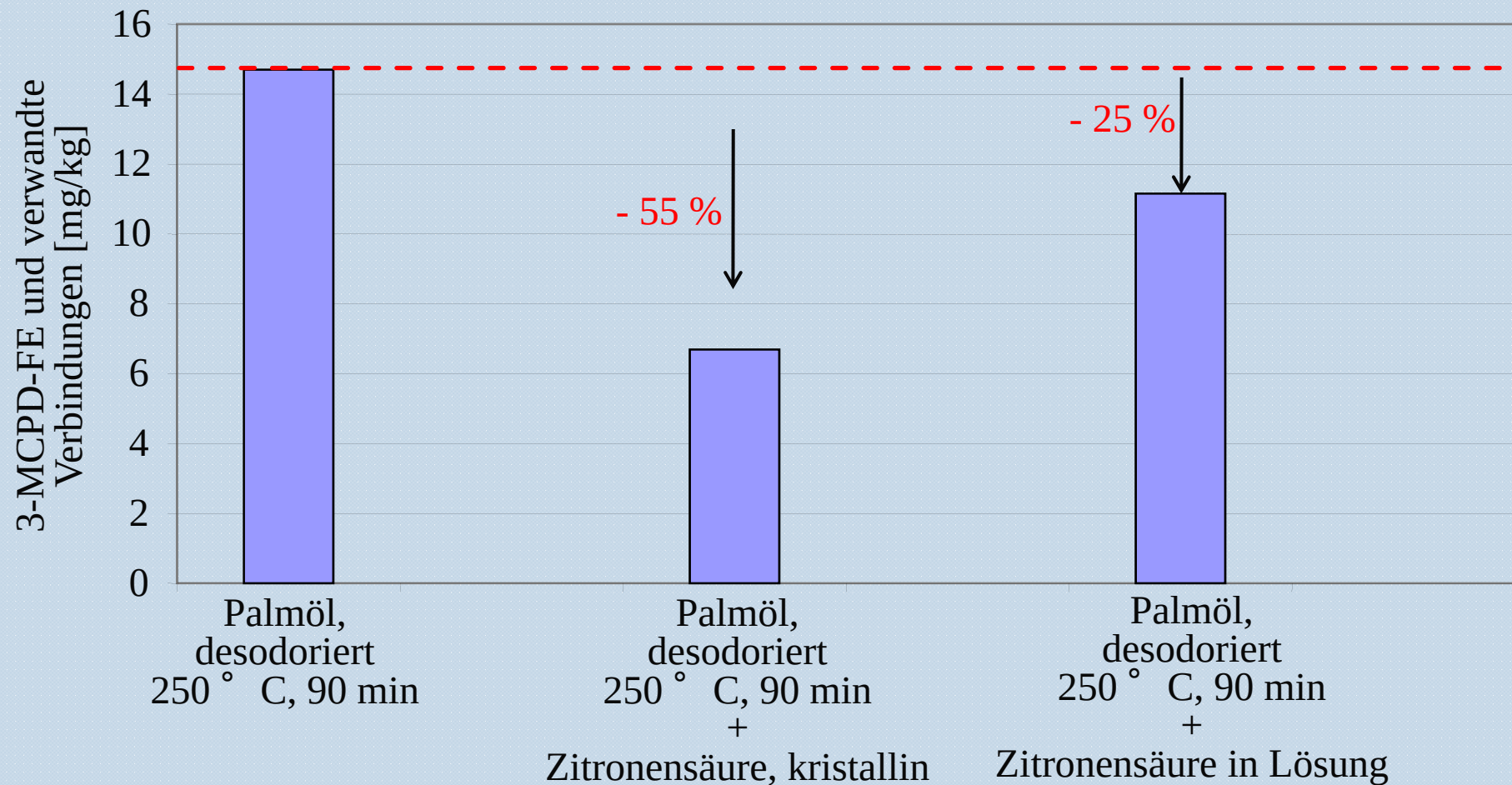


Abschätzung des Bildungspotentials: Erhitzung auf 240 ° C für 120 min

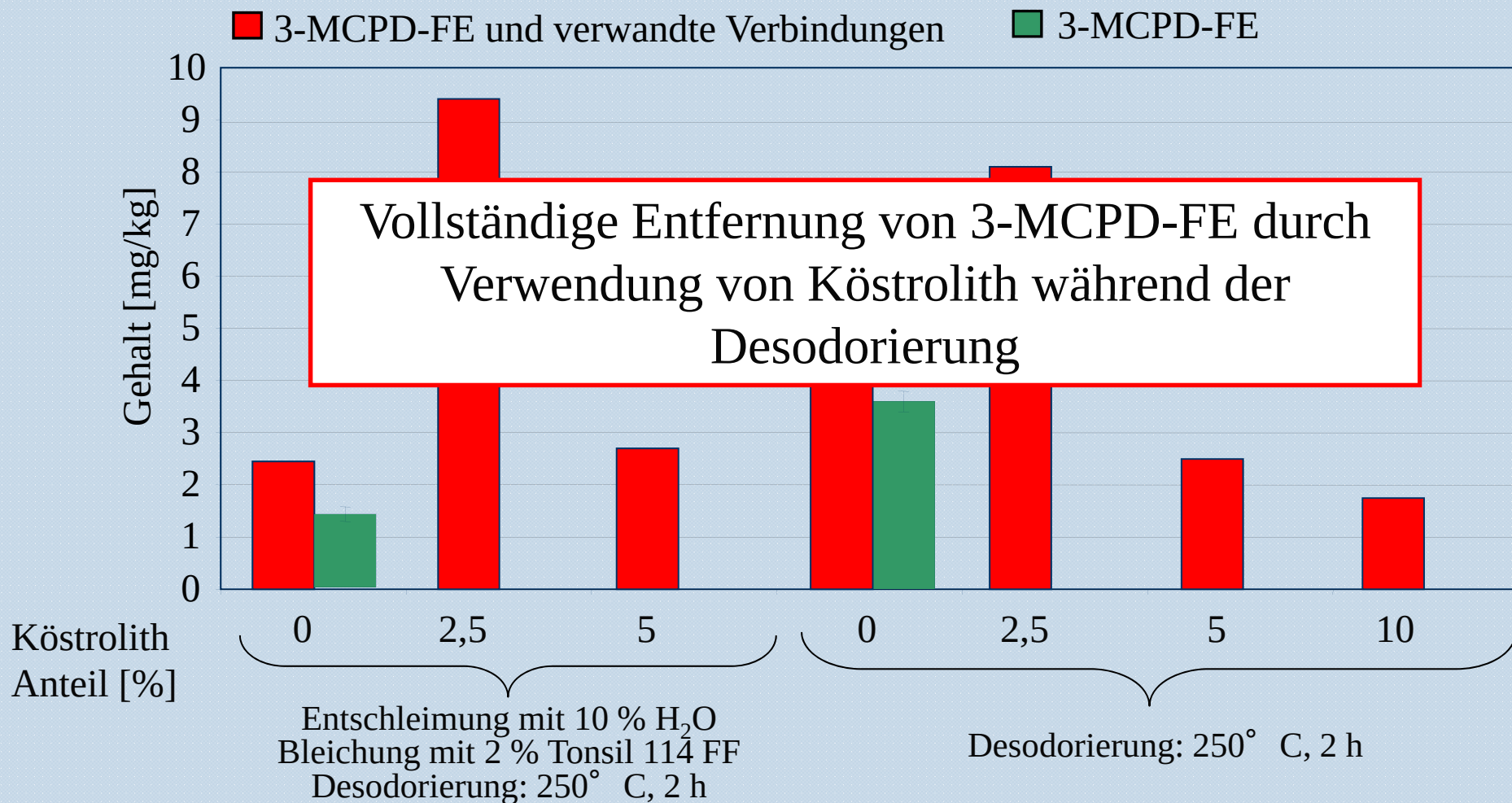
Einfluss des Zusatzes von Diacetin während der Desodorierung



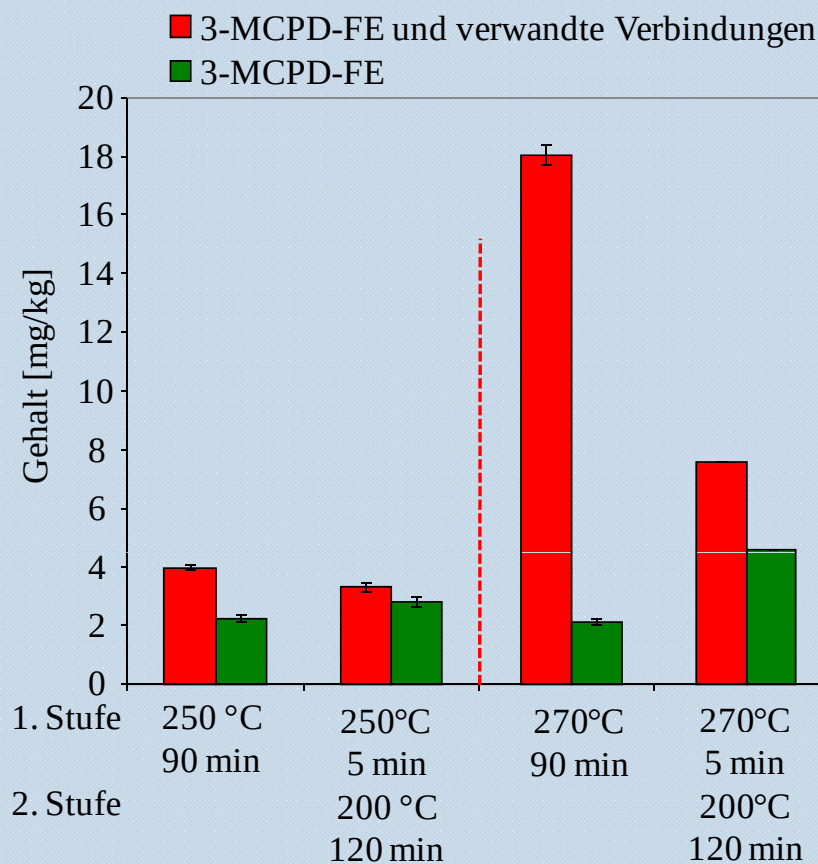
Einfluss eines Zusatz von Zitronensäure während der Desodorierung



Einfluss von Köstrolith auf die Bildung von 3-MCPD-FE und verwandten Verbindungen während der Desodorierung

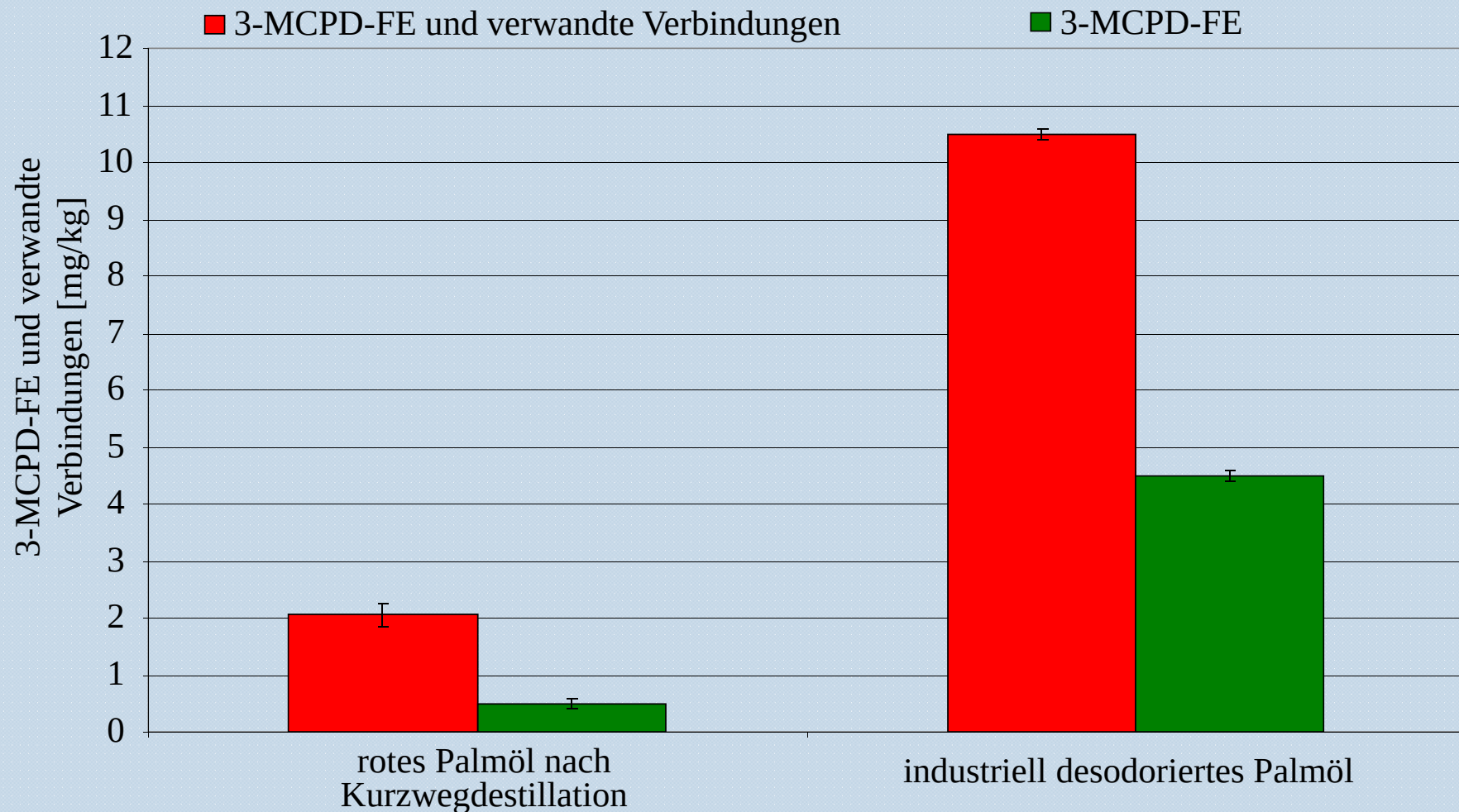


Vergleich von ein- und zweistufiger Desodorierung



Palmöl gebleicht mit 1,5 % Tonsil Optimum 215

Vergleich Kurzwegdestillation und industrieller Desodorierung



Empfehlungen aus dem FEI-Projekt zur Minimierung von 3-MCPD-Fettsäureestern

➤ **Allgemein**

- Desodorierung ist der entscheidende Schritt für die Bildung von 3-MCPD-FE und verwandten Verbindungen
- Die übrigen Raffinationsschritte senken das Potential zur Bildung der Ester

➤ **Maßnahmen zur Minimierung**

- Optimierung der Verarbeitung der Palmfrüchte mit möglichst kurzen Lagerzeiten von der Reife bis zur Verarbeitung
- Auswahl von Rohmaterial mit niedrigen Gehalten an Vorstufen
- Temperatur bei der Desodorierung möglichst niedrig halten
- Einführung eines Waschschrtes vor der Raffination
- Einsatz von Diacetin, Zitronensäure oder Köstrolith während der Desodorierung
- Einsatz der zweistufigen Desodorierung
- Einsatz der Kurzwegdestillation

Beispiele für den Transfer der Ergebnisse

Aktuell | Ernährungswissenschaften & Prävention

Nr. 1
Januar 2010

Öle und Fette sind aus der Speisenzubereitung nicht wegzudenken. Bevor das Öl in die Flasche oder die Manganne in die Verpackung kommen, müssen die fettliefernden Pflanzen zahlreiche Verarbeitungsschritte durchlaufen. Dabei werden das Spektrum der Inhaltsstoffe und teilweise die Inhaltsstoffe selbst verändert und es können sog. Artefakte entstehen, die gesundheitlich bedenklich sein können. Was es mit diesen Artefakten auf sich hat und wie ernst dieses Problem ist, stellt Herr Dr. Bertrand Mathias vom Max Rubner-Institut dar.

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Vorkommen und Bedeutung von 3-MCPD- Fettsäureestern in Fetten und Ölen

Research Article

Strategies for the reduction of 3-MCPD esters and related compounds in vegetable oils

Bertrand Mathias¹, Frank Pudel¹, Peer Felhing², Klaus
¹ Max Rubner-Institut, Federal Research Institute for Nutrition,
² FHM Fach Hochschule Magdeburg, Magdeburg, Germany

For the reduction of 3-monochloro-1,2-propanediol fatty esters in edible fats and oils, three different strategies from decrease material, changing of the refining process or use of new materials have been investigated. This paper discusses, on the one hand, the different capabilities to form 3-MCPD in oil, but also on the other hand, the highest potential of 3-MCPD esters and related compounds in palm oil for a given chain length and fatty acid composition. This paper discusses, on the other hand, the highest potential of 3-MCPD esters and related compounds in palm oil for a given chain length and fatty acid composition. This paper discusses, on the other hand, the highest potential of 3-MCPD esters and related compounds in palm oil for a given chain length and fatty acid composition.

Practical applications: In a first statement the German Food also often corresponded to search for alternative techniques lower levels of 3-MCPD esters and related compounds. C material, improving the new material before refining or use of new materials have been investigated. This paper discusses, on the one hand, the different capabilities to form 3-MCPD in oil, but also on the other hand, the highest potential of 3-MCPD esters and related compounds in palm oil for a given chain length and fatty acid composition.

Keywords: 3-MCPD esters / Glycidyl esters / Refining strategies /

Received: September 2, 2010 / Revised: January 20, 2011 / Accepted: January 20, 2011

1 Introduction

In the last years several examples for the formation of food-derived contaminants formed during the processing or the preparation of food, like acrylamide or nitroamines, have been found. Recently, fatty acid esters of 3-monochloro-1,2-propanediol (3-MCPD esters) in different kinds of oils in refined edible fats and oils were found. First 3-MCPD itself is a very toxic, carcinogenic compound, which was

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Fax: +49 521 141 120

Abbreviations: 3-MCPD, 3-monochloro-1,2-propanediol

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Research Article

On the necessity of edible oil refining and possible sources of 3-MCPD and glycidyl esters

Frank Pudel¹, Patrick Bernack², Peer Felhing², Anne Freudenstein², Bertrand Mathias¹ and Andrea Schwaiblmair²

¹ FHM Fach Hochschule Magdeburg e.V., Magdeburg, Germany
² Max Rubner-Institut, Bundesforschungsanstalt für Ernährung und Lebensmittel, Abteilung für Lipidforschung, München, Germany

A framework of collaborating research facilities in Germany investigates the reasons and conditions for the formation of 3-monochloro-1,2-propanediol (3-MCPD) and of glycidyl esters (GE) during edible oil refining. The aim is the detection of technological parameters to prevent or to reduce, respectively, the formation of these contaminants during the refining process, particularly for palm oil, because the highest contents of 3-MCPD-E and related compounds were found in refined palm oils. A strong influence of the deodorization conditions was proven on the potential to form 3-MCPD-E and related compounds. Above 240°C an increased formation especially of GE was observed. Deodorization temperature up to 240°C had to moderate concentrations <5 ppm. Degassing with water, neutralization with potassium hydroxide and bleaching before deodorization is advantageous with regard to reduce the capability of vegetable oils to form the contaminants 3-MCPD and glycidyl esters.

Practical applications: There is a strong demand to guarantee a stable and reliable quality of refined edible oils. The problem of 3-MCPD and glycidyl ester formation during refining has shown the sensitivity of the system to small variations in the refining conditions. In a first step it is necessary to replace the contribution of the different refining steps to the formation of contaminants.

Keywords: 3-MCPD ester / 3-monochloro-1,2-propanediol (3-MCPD) / Deodorization / Edible oil / Glycidyl ester
Received: September 10, 2010 / Revised: November 9, 2010 / Accepted: November 29, 2010
DOI: 10.1002/efp.201000480

1 Introduction

Since about 1975 the problem of 3-monochloro-1,2-propanediol (3-MCPD) formation during food processing, like the acid hydrolysis of vegetable proteins (acid-HVP), have been found. Recently, fatty acid esters of 3-monochloro-1,2-propanediol (3-MCPD esters) in different kinds of oils in refined edible fats and oils were found. First 3-MCPD itself is a very toxic, carcinogenic compound, which was

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Abbreviations: 3-MCPD, 3-monochloro-1,2-propanediol

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Mitigation of 3-MCPD esters in refined vegetable oils

WITHIN A RESEARCH PROJECT 0
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TO AVOID THE FORMATION OF CO

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Research Article

Influence of precursors on the formation of 3-MCPD and glycidyl esters in a model oil under simulated deodorization conditions

Anne Freudenstein¹, Julia Winkler² and Dr.

¹ Max Rubner-Institut, Federal Research Institute for Nutrition,
² Westfälische Wilhelms-Universität Münster, Germany

To find new ways for reducing the potential of 3-MCPD and glycidyl ester formation during the deodorization process, the deodorization conditions (temperature, time, and material) were investigated. The results show that the deodorization conditions have a strong influence on the formation of 3-MCPD and glycidyl esters. The deodorization conditions have a strong influence on the formation of 3-MCPD and glycidyl esters.

Practical applications: For the mitigation of 3-MCPD and glycidyl ester formation during the deodorization process, the deodorization conditions (temperature, time, and material) were investigated. The results show that the deodorization conditions have a strong influence on the formation of 3-MCPD and glycidyl esters.

Keywords: Deodorization / Glycidyl esters / 3-MCPD

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DOI: 10.1002/efp.201200028

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1 Introduction

The manufacturing process of various kinds of heating process. Depending on the results, the formation of 3-MCPD and glycidyl esters is strongly influenced by the deodorization conditions. The deodorization conditions have a strong influence on the formation of 3-MCPD and glycidyl esters.

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Processing Contaminants in Edible Oils

MCPD and Glycidyl Esters

Editor
Shaun MacMahon



2

Mitigation of MCPD and Glycidyl Esters in Edible Oils

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Frank Pudel² = FHM Fach Hochschule Magdeburg e.V., Berliner Chaussee 66, D-39114 Magdeburg, Germany

Introduction

In different ways of food processing, so-called heat-induced contaminants can be formed depending on the processing conditions. These contaminants are often produced with desired aroma compounds that strongly affect the quality of food and the taste experience, as with acrylamide, or they can form during purification of the raw material, as with new fatty acids. Thus, it becomes difficult in practice to avoid their formation completely without changing food to an extent that it no longer fits the expectation of the consumer or it decreases the safety of the food, respectively.

In a first publication, Zelikova et al. (2006) described the discovery of fatty acid esters of 3-monochloro-1,2-propanediol (3-MCPD esters) in a series of 25 virgin and refined edible oils. Although in virgin oils the levels were low, they found higher amounts of 3-MCPD esters in refined oils and oils obtained from treated raw materials. In December 2007, 3-MCPD esters became the focus of further attention when the official laboratory of Stuttgart and the Max Rubner-Institut, Germany, announced findings of 3-MCPD esters in different edible fats and oils.

3-MCPD esters are compounds in which the basic structure of the 3-monochloro-1,2-propanediol can be connected to different fatty acids. Monomers bearing one fatty acid at the glycerol base body, as well as diesters bearing two linked fatty acids, are possible. Free 3-MCPD, not esterified with fatty acids, has long been known to form as a reaction product in the processing of acid hydrolyzed vegetable proteins (Davidik et al., 1981; Válek et al., 1979).

The finding of 3-MCPD esters in edible oils is important because a recent assessment of the International Agency for Research on Cancer (IARC) identified free 3-MCPD as "possibly carcinogenic to humans" (group 2B) (IARC, 2012). The German Federal Institute for Risk Assessment (BfR) announced already in 2007 that 3-MCPD esters are 100% degraded by the enzymes in the human body, releasing free 3-MCPD (BfR, 2007), which is more or less justified by newer toxicological studies (Barocelli et al., 2011; Buhre et al., 2011; Czerny et al., 2011; Berger-Pfeiff, 2011). In addition, 3-MCPD esters and glycidyl esters were found in edible oils. These compounds are also considered to be potentially hazardous to human health. Herein, the

Herzlichen Dank für Ihre Aufmerksamkeit

