ZINSSER ANALYTIC
by Gardner Denver

High Throughput Analysis of Food and Oil Contaminants

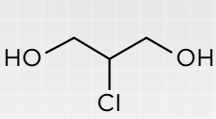
Fully automated analysis of MCPD, 2-MCPD, 3-MCPD and Glycidyl fatty esters.

www.zinsser-analytic.com

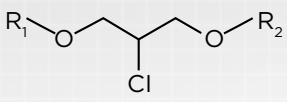
Analysis of Contaminants designed for your Challenges

Process contaminants of the food industry were evaluated by the EFSA (European Food Safety Authority). Zinsser Analytic invented a new system for contaminant analysis in food and oil samples in collaboration with a food quality and safety lab, addressing your everyday workflow challenges with the following substances:

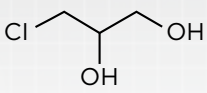
- **2-Monochloropropan-1,3-diol** (2-MCPD)
- **3-Monochloropropan-1,2-diol** (3-MCPD)
- **Esters of 2-MCPD and 3-MCPD** (2-MCPD-E, 3-MCPD-E)
- **Glycidyl esters** (GE)



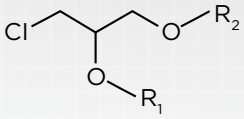
2-MCPD



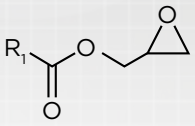
2-MCPD-E



3-MCPD



3-MCPD-E



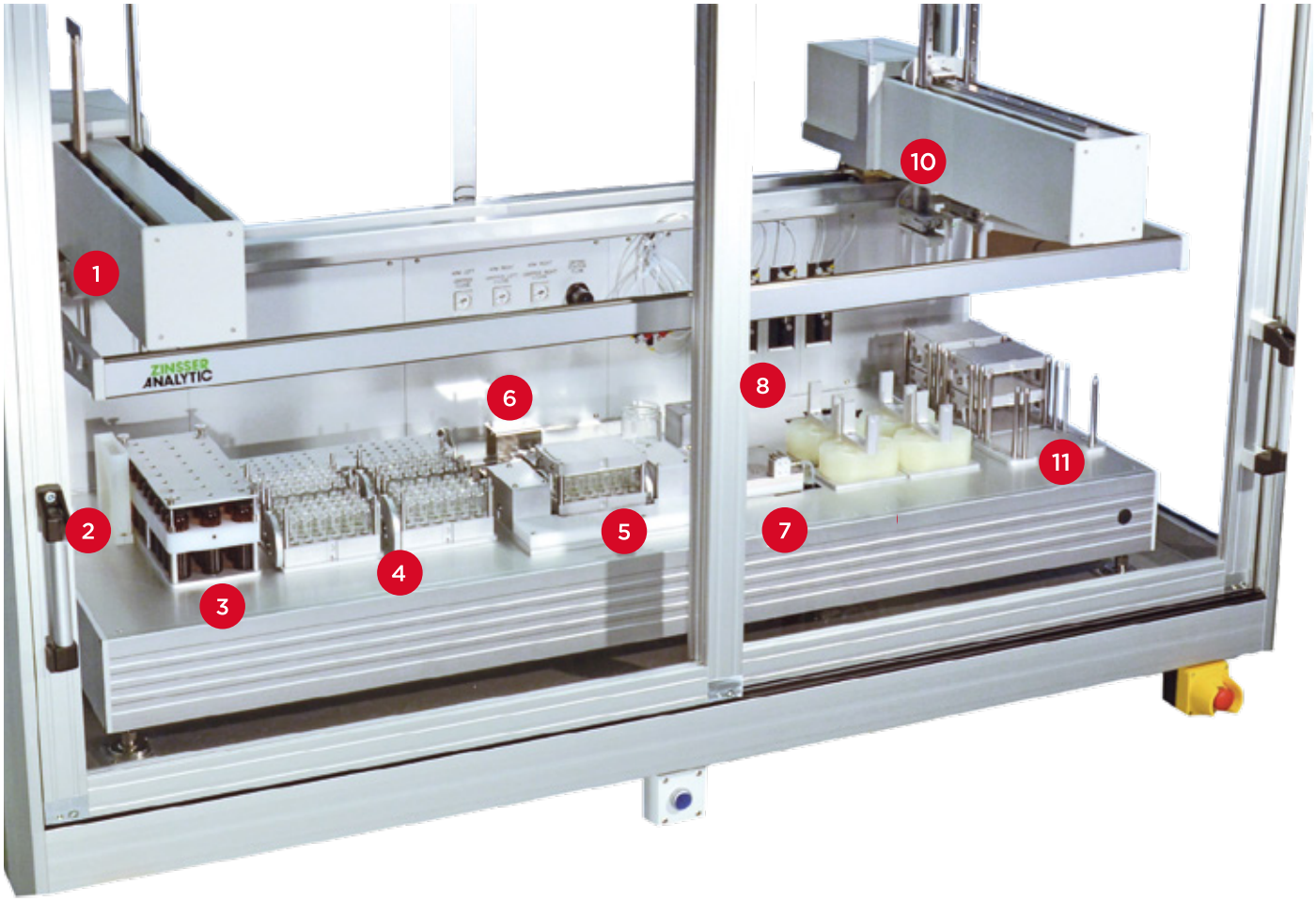
GE

Those substances are common food contaminants in the following oils and processed foods:

- Palm oil
- Corn oil
- Grape seed oil
- Coconut fat
- Olive oils
- Sunflower oil
- Soybean oil
- Avocado oil etc.
- Margarine
- Bread and rolls
- Fine bakery wares
- Smoked fish and meat products
- Fried or roast meat
- Chips, crisps and dough based analogues
- Infant and follow-on formulae

With our system you will have a lot of advantages combined:

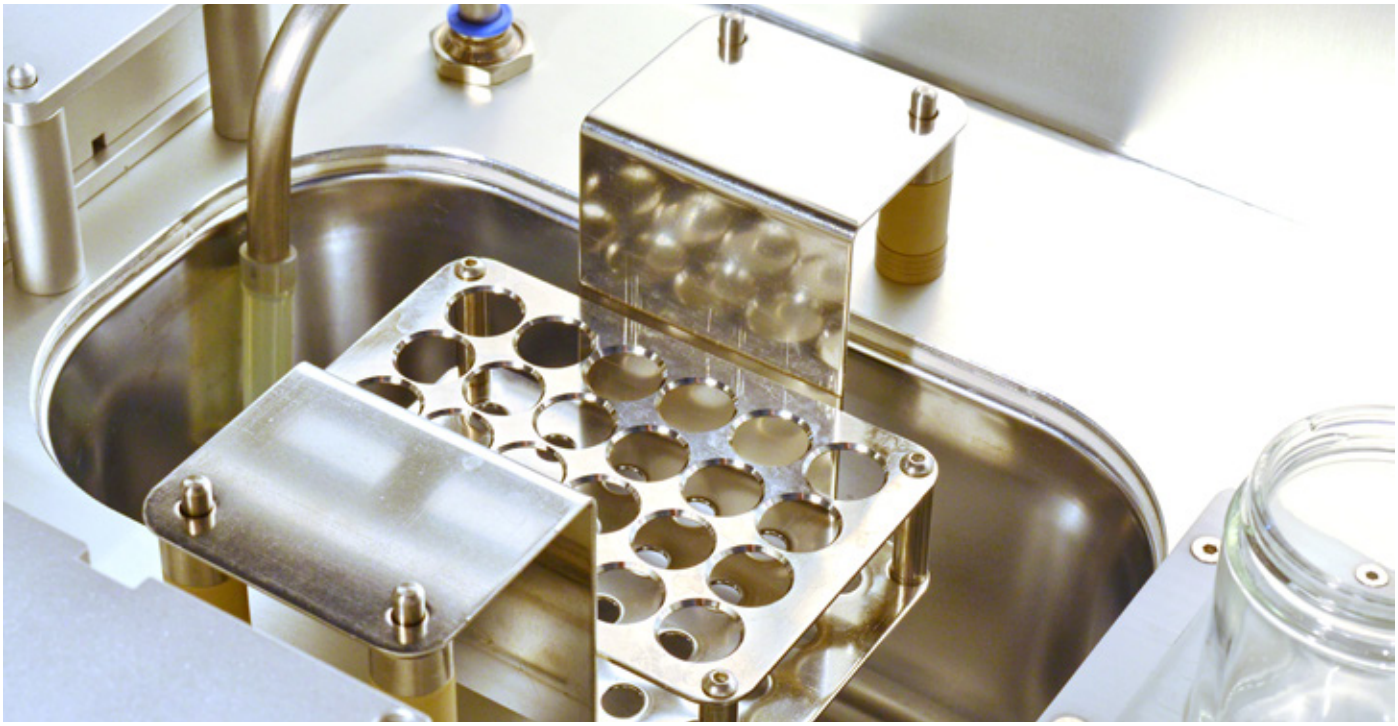
- ✔ Reproducible and reliable results
- ✔ Less health impaired staff from manual pipetting
- ✔ Certified workflow
- ✔ Simplified sample handling
- ✔ A larger throughput



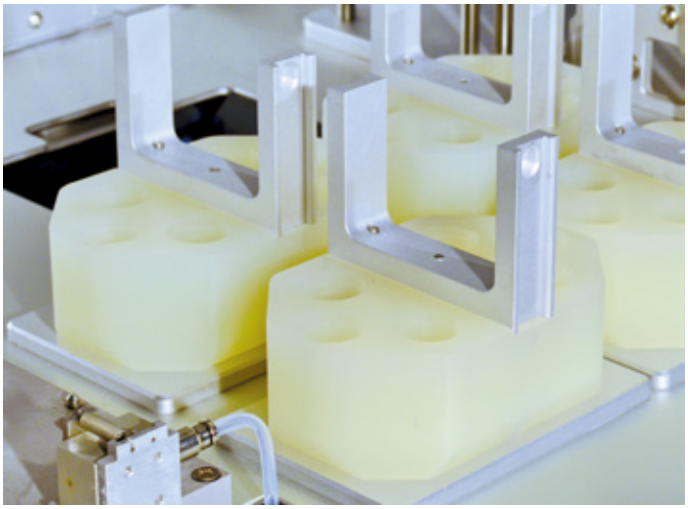
INTEGRATION

1	Left robotic arm with standard tips and pneumatic vial gripper.
2	Wash station for pipetting tips.
3	Reagents rack for 24 vials (40 mL or 80 mL).
4	DESYRE-Mix® racks for 24 vials each.
5	Lidding station for Desyre blocks.
6	Ultrasonic bath with 24 positions for vials.
7	DESYRE-Mix® for shaking of racks.
8	Workbench cut-out for centrifuge racks.
9	Centrifuge racks with six vial positions each.
10	Right robotic arm with gripper for lids and racks.
11	Stacker for lids.

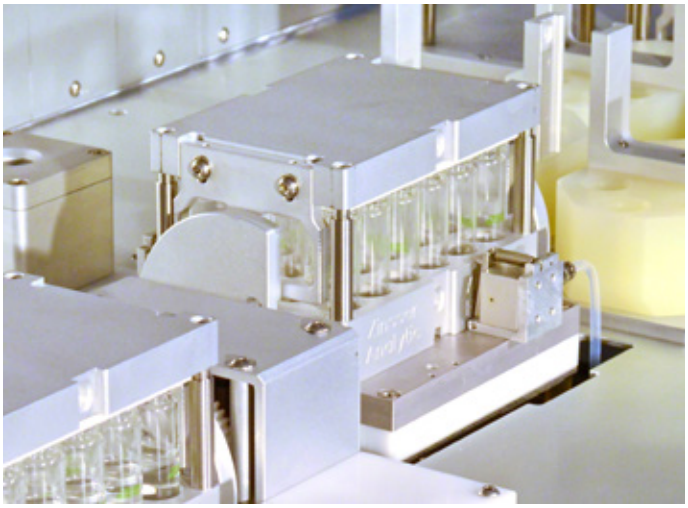
CERTIFIED AUTOMATABLE PROCESSES



Ultrasonic bath



Centrifuge racks



Lidding station

The presented automated high throughput sample liquid handling system performs four different well established methods to analyze 3-MCPD and 2-MCPD (free and ester form), as well as glycidyl ester in oil and fat containing samples.

With the standard pipetting tips almost every liquid can be handled. The gripper for racks and vials can handle every needed vial and rack type, as well as rack lids. Sonication of vials could be performed with the incorporated ultrasonic bath. The needed centrifugation steps are performed with the centrifuge underneath the workbench with a corresponding cut-out for the gripper to install the racks with the centrifuge.

The methods applied can be changed, depending on the certified process desired: Alkaline transesterification of glycidol to 3-MCPD (DGF method, Cd 29c-13), alkaline transesterification of glycidol to 3-MBPD (SGS 3-in-1 method, Cd 29b-13), acidic transesterification (Unilever combined method, Cd 29a-13) and single compound analysis.

SCHEME 1

Unilever combined method (Cd 29a-13) for the simultaneous quantification analysis of 2- and 3-MCPD and GE in edible oils and fats.

A: PREPARATION
1. Sample aliquot dissolved in THF
2. Add internal standards
3. Add acidified solution of NaBr (0.1%, w/v)
4. Heat to 50 °C and vortex for 15 min
5. Transfer organic phase into new vial
6. Evaporate organic solvent

↓

B: ACIDIC TRANSESTERIFICATION
1. Reconstitute in THF
2. Add H_2SO_4/methanol (1.8%, v/v)
3. Heat to 40 °C and vortex for 16 h
4. Neutralize solution
5. Add $NaSO_4$ solution (20%, w/v)
6. Discard aqueous phase

↓

C: DERIVATIZATION IN ORGANIC PHASE
1. Add phenylboronic acid in diethylether
2. Incubate for 5 min at room temperature in ultrasonic bath
3. Evaporate organic phase
4. Reconstitution in iso-octane
5. GC-MS analysis

SCHEME 2

SGS 3-in-1 method (Cd 29b-13) for the quantification analysis of 2- and 3-MCPD esters and GE in edible oil and fats.

Assay A	Assay B
A: ALKALINE TRANSESTERIFICATION	**A: ALKALINE TRANSESTERIFICATION**
1. Dissolve sample in diethylether	1. Dissolve sample in diethylether
2. Add internal standards	2. Add internal standards (different from assay A)
3. Mixture is cooled at -22 °C to -25 °C	3. Mixture is cooled at -22 °C to -25 °C
4. Add methanol/NaOH (0.25%, w/v)	4. Add methanol/NaOH (0.25%, w/v)
5. Vortex 16 h at -22 °C to -25 °C	5. Vortex 16 h at -22 °C to -25 °C
6. Add acidified NaBr solution (60%, w/v)	6. Add acidified NaBr solution (60%, w/v)
B: EXTRACTION	**B: EXTRACTION**
1. Add iso-hexane	1. Add iso-hexane
2. Vortex	2. Vortex
3. Discard organic phase	3. Discard organic phase
4. Add diethylether/ethylacetate (3/2, v/v)	4. Add diethylether/ethylacetate (3/2, v/v)
5. Vortex	5. Vortex
6. Discard aqueous phase	6. Discard aqueous phase
C: DERIVATIZATION IN ORGANIC PHASE	**C: DERIVATIZATION IN ORGANIC PHASE**
1. Add phenylboronic acid in diethylether	1. Add phenylboronic acid in diethylether
2. Incubate for 5 min at room temperature in ultrasonic bath	2. Incubate for 5 min at room temperature in ultrasonic bath
3. Evaporate organic phase	3. Evaporate organic phase
4. Reconstitution in iso-octane	4. Reconstitution in iso-octane
5. GC-MS analysis	5. GC-MS analysis

SCHEME 3

DGF method (Cd 29c-13) for the differential quantification of 3-MCPD esters and GE in edible oils and fats.

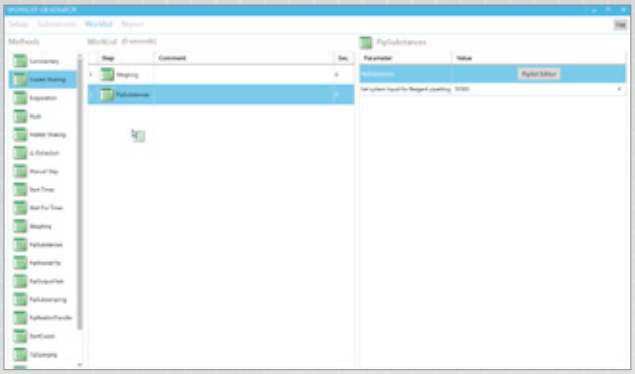
Assay A	Assay B
A: ALKALINE TRANSESTERIFICATION	**A: ALKALINE TRANSESTERIFICATION**
1. Sample dissolved in *t*-BME (*tert*-butylmethylether)	1. Sample dissolved in *t*-BME (*tert*-butylmethylether)
2. Add internal standard	2. Add internal standard
3. Add either methanol/NaOH (2%, w/v) or methanol/MeONa (2,5%, w/v)	3. Add either methanol/NaOH (2%, w/v) or methanol/MeONa (2,5%, w/v)
4. Vortex	4. Vortex
5. Add acidified NaCl solution (20%, w/v)	5. Add acidified chlorine free salt solution (e.g. NaBr) forming 3-MBPD esters
B: EXTRACTION	**B: EXTRACTION**
1. Add iso-hexane	1. Add iso-hexane
2. Vortex	2. Vortex
3. Discard organic phase	3. Discard organic phase
4. Add diethylether/ethylacetate (3/2, v/v)	4. Add diethylether/ethylacetate (3/2, v/v)
5. Vortex	5. Vortex
6. Discard aqueous phase	6. Discard aqueous phase
C: DERIVATIZATION IN ORGANIC PHASE	**C: DERIVATIZATION IN ORGANIC PHASE**
1. Add phenylboronic acid in diethylether	1. Add phenylboronic acid in diethylether
2. Incubate for 5 min at room temperature in ultrasonic bath	2. Incubate for 5 min at room temperature in ultrasonic bath
3. Evaporate organic phase	3. Evaporate organic phase
4. Reconstitution in iso-octane	4. Reconstitution in iso-octane
5. GC-MS analysis	5. GC-MS analysis

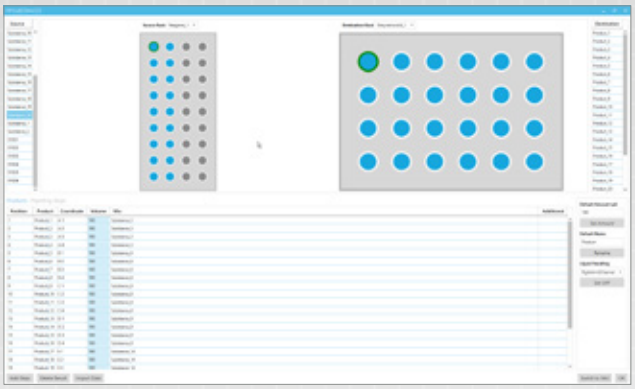
SOFTWARE TACKLING EVERY CHALLENGE IN YOUR PROCESS

Every process step is designed modularly. Therefore a variety of processes, using differing chemicals and solvents, may be carried out. The customized sequential arrangement of the process is composed with a specified MS Excel® file or our Worklist-Generator which is executed with our WinLissy®-software.

Worklist-Generator

With the Worklist-Generator you can create your individual processes with many adjustable parameters for sub steps. Drag and drop the needed methods to the desired positions of the worklist.



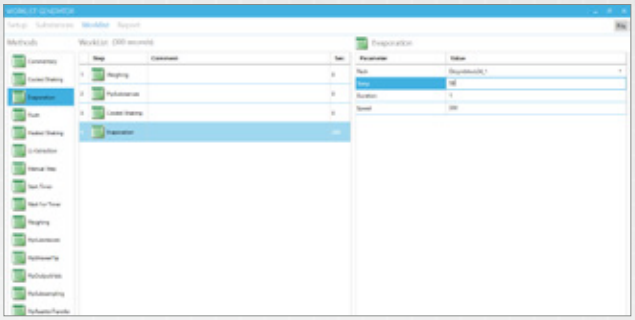


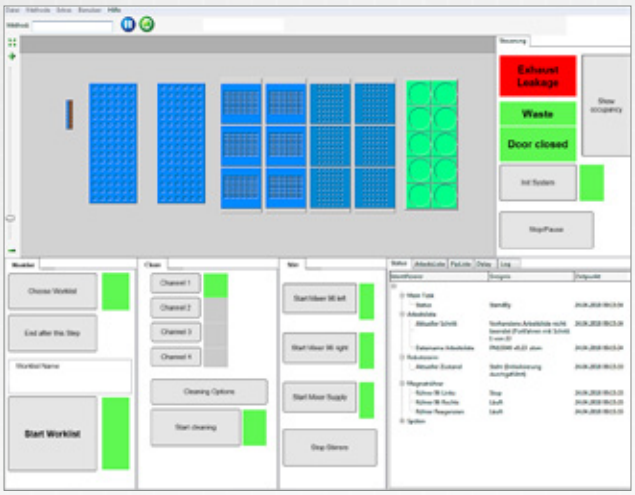
Pipetting-Editor

For pipetting steps, the Pipetting-Editor is opened for the definition of racks and number of steps. Every filled position is indicated blue and the selected positions are highlighted green.

Method Definition

Input the desired time or anything the method requires, while you are defining the process.





WinLissy®-Software

With our WinLissy®-software every prepared worklist of the Worklist-Generator is executable. Communication with customer specific databases or LIMS is easily conceivable.

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