



Eidgenössische Technische Hochschule Zürich  
Swiss Federal Institute of Technology Zurich

## Written Exam 529-0043-00S - Analytical Strategy Summer 2015

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Vorname : \_\_\_\_\_ Name : \_\_\_\_\_

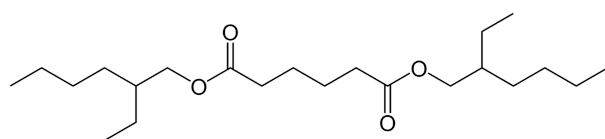
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- Zeit: 60 Min. Teilen Sie sich Ihre Zeit gut ein.  
*Time: 60 min, organize your time carefully.*
- Sie können auf Englisch oder Deutsch antworten  
*Answers are accepted in German or English.*
- Es sind alle Hilfsmittel mit Ausnahme von Computern und Telekommunikation erlaubt.  
*It is allowed to use all resources except for computers and communication devices.*
- Unleserliche Texte, unklare Formulierungen oder unsaubere Skizzen können nicht bewertet werden. Bitte bemühen Sie sich um eine saubere Darstellung.  
*Unreadable text, unclear formulations or graphs are not graded. Please try to use clear illustrations and descriptions*
- Schreiben Sie jedes abzugebende Blatt einzeln mit Ihrem Namen und Vornamen an.  
*Label every page with name and surname.*
- Dieses Deckblatt ist ausgefüllt abzugeben. Die Aufgabenstellung ist ebenfalls einzureichen.  
*Please fill in the first page. Hand in all pages including cover page and questions.*
- Wir bitten Sie um Fairness und wünschen Ihnen viel Erfolg!  
*We ask you for fairness and wish you good luck!*

## Exam question

About 50% of all plastic packaging is being used for food and drinks, including increasingly for ready-made meals. Thus there is a concern that plastic additives (stabilizers, colorants, plasticizers, etc.) can leach into drinks or into food. Consider the case of PVC wrap, which is used very often to wrap food, and is rendered flexible by the addition of plasticizers such as di-(2-ethylhexyl)adipate (DEHA). DEHA is present in PVC wrap at levels of a few % up to 30%, depending on the desired flexibility of the PVC foil.

The legal limit in the EU for global migration of plastic additives into food is 10 mg/dm<sup>2</sup> or 60 mg/kg.



Chemical structure of di-(2-ethylhexyl)adipate (DEHA)

Answer the following questions, assuming your laboratory is generally well equipped but does NOT have access to mass spectrometry:

- 1) Design a method to determine the DEHA content in PVC wrap. Describe the essential steps of your method as accurately as possible.
- 2) Design an experimental strategy to assess the migration of DEHA into cheese that is wrapped with commercial PVC wrap containing DEHA, at conditions relevant to actual storage and sale of portioned cheese, e.g., in a supermarket, followed by consumption at home. Describe your experimental design as accurately as possible.
- 3) How do you have to adapt the method you have described in 1.) to analyze cheese samples rather than PVC samples? What are the most important differences in terms of sample preparation / sample work-up?
- 4) For a contact time of 10 hours, a loss of 20% of the DEHA from a 15- $\mu\text{m}$  thick PCV (density = 1.2 g/cm<sup>3</sup>) wrap containing 28 weight-% DEHA was determined. Is this below or above the EU legal limit?
- 5) Using the numbers from 4) estimate how much DEHA is ingested by a person during 1 year from **(i)** cheese consumption alone, and **(ii)** from all PVC wrapped food. Explicitly describe the assumptions you make for this estimation.