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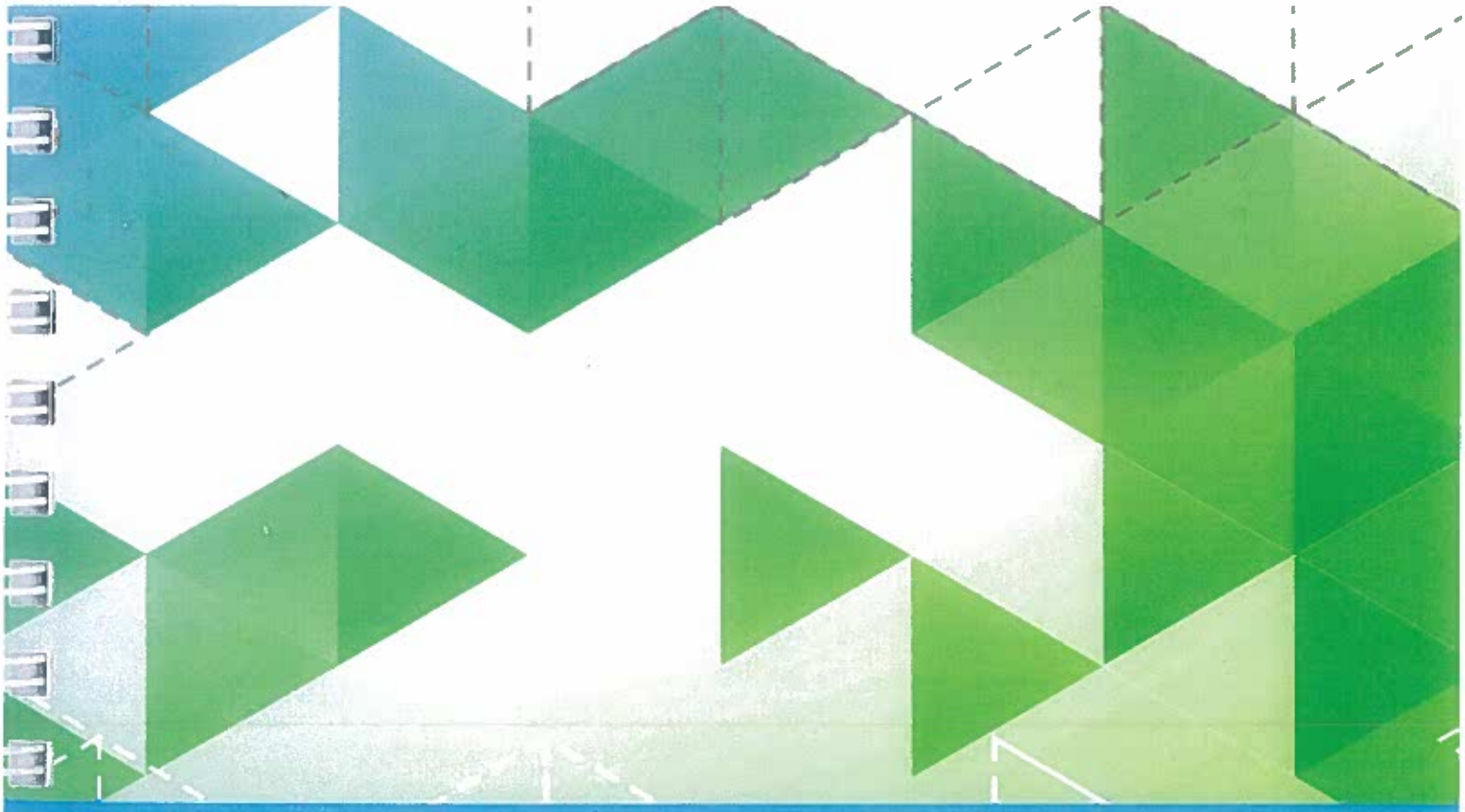
ILSI Europe
International Life Sciences Institute

ILSI Europe's Symposium

6th International Symposium on Food Packaging – Scientific Developments Supporting Safety and Innovation

16-18 November 2016
Crowne Plaza Hotel
Barcelona, Spain



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S4-17-A

Suitability of Food Simulants for Migration Study of Silver Nanoparticles

Maryam Jokar, Katrin Loeschner

Technical University of Denmark National Food Institute (DTU Food), Denmark

The importance of migration studies from food contact nanomaterials has attracted the interest of scientific and legislative communities. The potential health risk of the migrating nanoparticles is related to their small size and different physicochemical properties as well as potentially higher bioavailability in comparison to larger particles due to increased and faster permit thorough natural biological barriers. Current research in the literature about migration from food contact nanomaterials has often reached inconsistency. The suitability of food simulants, which are used to simplify food matrices, for migration studies of food contact nanomaterials needs to be questioned because standard food simulants are well established for molecular migrating substances, where the chemical and physical structure of the migrant remains stable during migration tests. In contrast to molecules, nanoparticles can undergo transformation processes, like dissolution, surface modification, agglomeration, and aggregation which lead to changes of their chemical composition, shape, and size. The behaviour of silver nanoparticles in standard food simulants (deionized water, ethanol 10% (v/v), ethanol 20% (v/v), ethanol 50% (v/v), acetic acid 3% (v/v), and olive oil) was studied for short term (4 hours) and long term (10 days) contact using inductively coupled plasma-mass spectrometry in single particle mode. Results showed that the food simulants and contact time had significant effects on particle mass concentration, mass concentration of ionic silver, and particle size distribution. These changes were caused by dissolution and agglomeration processes. The results of this study lead to a deeper insight into the behavior of nanoparticles in food simulants in migration studies of food contact nanomaterials. Besides the suitability of the standard food simulants, the suitability of the standard migration test conditions for food contact nanomaterials needs to be further studied as the migration test conditions are supposed to reflect worst case conditions of molecules.

DTU Food
National Food Institute

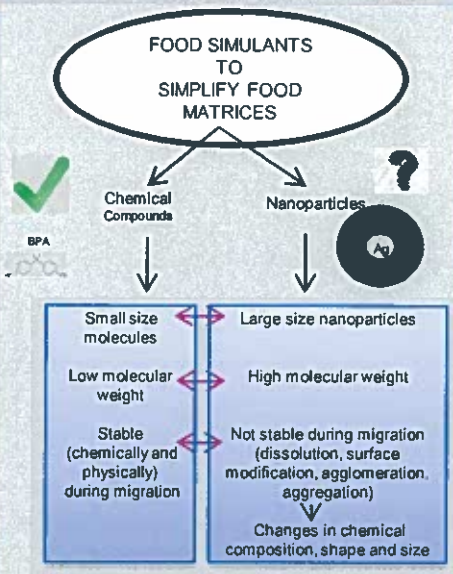
SUITABILITY OF FOOD SIMULANTS FOR MIGRATION STUDY OF SILVER NANOPARTICLES

Maryam Jokar, Katrin Loeschner

Abstract: The importance of migration studies from food contact nanomaterials has attracted the interest of scientific and legislative communities. Current research in the literature about migration from food contact nanomaterials has often reached inconsistency. The suitability of food simulants for migration studies of food contact nanomaterials needs to be questioned and revised because of unlike stability behavior of migrating conventional molecules and nanoparticles.

Introduction

Standard food simulants are well established for studying the migration of molecular substances whose structure remains stable during migration testing. The characteristics of nanoparticles (NPs) such as shape, size, agglomeration state, surface charge and chemical composition, which are critical from a safety point of view, may vary in different food simulants. One of the challenges in studying the migration of nanomaterials is the detection and characterization of NPs in migration solutions. Inductively coupled plasma-mass spectrometry in single particle mode (sp-ICP-MS) allows the determination of particle size distributions at low particle mass concentrations (pg/L to ng/L).



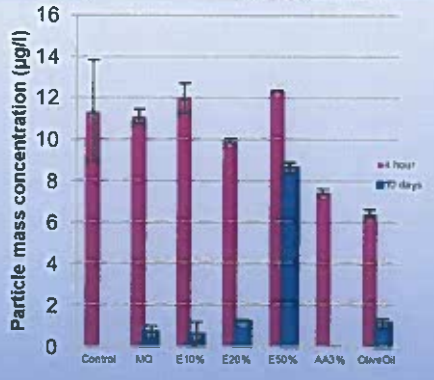
Experimental

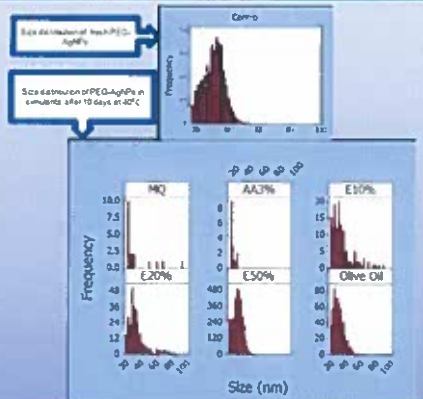
Food simulants (EU 10 /2011)
(ultrapure water, MQ) / 10% ethanol/ 20% ethanol / 50% ethanol / 3% acetic acid and olive oil
Real food
Low-fat milk
PEG coated silver nanoparticles (PEG-AgNPs)
Migration conditions
Short term exposure (4 hours), Long term exposure (10 days)
Gastro-intestinal (GI-tract) model
sp-ICP-MS

Results

The food simulants and contact time had significant effects on mass concentration of particles and ions, and particle size distribution.

These changes were correlated to dissolution and agglomeration processes.





Conclusive Insight

- ☐ The potential of detecting of NPs depends on the composition of simulants as well as contact time.
- ☐ A better understanding of what happens to NPs in real food *vs.* food simulants is required.
- ☐ The suitability of standard migration tests for nanomaterials needs to be further studied as they are supposed to reflect worst case conditions of migration.

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