

Lab on Chip (LoC)

Analysis of bacterial contamination in food



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Introduction

Microbial contamination is a major safety problem for food industries

Conventional methods to detect live bacterial contamination are time consuming

Fast, sensitive and specific methods for analysis of live bacteria are necessary

Immunomagnetic separation (IMS) together with flow cytometry into a microfluidic lab on chip platform is an ideal tool for rapid, direct and accurate assessment of microbial contamination

Three step detection of bacteria

1. Pre-enrichment steps, e.g. cross flow filtration are applied to concentrate microbial contaminants from a large volume of sample into microscale level
2. Immunomagnetic separation (IMS) inside a microfluidic chip for the specific enrichment of microbial contaminants (LoC - IMS)
3. Detection of microbial pathogen by microfluidic flow cytometer (LoC - Flow Cytometry)

Results and Conclusions

- Bacteria can be concentrated 160 fold
- IMS- and Flow Cytometry-Chip are produced as a matter of routine
- 1000 Bacteria can be specifically separated by IMS
→ We are ongoing for implementation to LoC - IMS
- We can detect the immunomagnetically separated (IMS) bacteria by the Microfluidic Flow Cytometry Chip (LoC - Flow Cytometry)

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Concentration of liquid by cross flow filtration

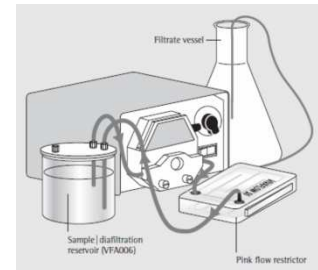
Cross flow filtration module with 50 cm² membrane area

Pore size of 0.2 µm

Permeation rate is 30 mL/min

We are able to concentrate 2 x 10⁶ bacteria in 1000 mL to 1.6 x 10⁶ bacteria in 5 mL

Recovery of bacteria > 80%



Immunomagnetic Separation (IMS) of Bacteria in Microfluidic Chip

Bacteria bind to specific molecules (e.g. antibodies, polymyxin B, polymers) coupled on paramagnetic beads

Paramagnetic beads with bounded bacteria were held by magnetic field in the IMS Chip (produced by Syddansk University, University of Southern Denmark)

After washing, bacteria were eluated out of the magnetic field



Bacteria were detected by Flow Cytometry Chip

The Microfluidic flow cytometry Chip (FCM) were (produced) developed by (Syddansk University, University of Southern Denmark).

The Chip enables the analysis of the physiological state of individual bacteria with high sensitivity and specificity

In comparison with conventional microbiological methods, there is a significant reduction in analysis time and cost saving

