High-throughput synthesis and characterization of microcapsules
J. Paul, E. Bauters, P. Castelein, T. Parasote, G. Rivero, S. Cakir, F. Du Prez
1Flamac, a division of SIM, Technologiepark 903A, 9052 Zwijnaarde, Belgium
2Polymer Chemistry Research Group, Department of Organic and Macromolecular Chemistry, Ghent University, Krijgslaan 281 S4-bis, 9000 Ghent, Belgium
johan.paul@flamac.be

Purpose
The aim of this research is to present a combinatorial approach to enhance the preparation and characterization of microcapsules. The utilization of a unique high-throughput platform with automated multiple synthesis modules allowed speeding up the number of syntheses. Additionally, Design of Experiments (DoE) provided a more complete and comprehensive overview of the links between different synthesis parameters.

Methods
Nowadays, numerous suppliers of high-throughput technologies offer standardized automated synthesis platforms to enhance the discovery, the research and development of new chemistries. Surprisingly, despite the intensive search to encapsulate various ingredients and due to the complexity of encapsulation processes, until now there was no existence of such high-throughput encapsulation platform. For the first time, a unique high-throughput platform for synthesizing microcapsules was developed. The realization of this high-throughput encapsulation platform allows us to mimic the synthesis procedure of a classical lab synthesis with the advantages of consuming less raw materials, fully controlled process and significant increase in the number of syntheses to name a few. The high-throughput encapsulation platform is built in a Chemspeed module which consists of several 100 ml reactors, pH trimming module, overhead gravimetric dispensing of powders and liquids and a high-shear mixing tool.

Results
Melamine-formaldehyde (MF) microcapsules have been extensively used during the last decades because of their low price, easily controlled preparation, high compatibility and good thermal and chemical stability [1]. A well-known microencapsulation approach is based on an oil-in-water (o/w) emulsion and an in-situ polymerization process [2]. In this research, the influence of several experimental parameters on the final properties of the capsules, have been evaluated using the developed high-throughput approach.

Conclusions
This paper describes a unique high-throughput platform to speed up the search for links between micro-capsule properties (e.g. morphology, size, core content, shell properties, etc.) and the synthesis parameters (such as pH, surfactant type and concentration, stirring rate, and core/shell ratio).

Acknowledgements
This research under the program H-INT-S (Looking at soft/hard matter composites), project InterPoCo (Mechanical properties and chemical bonding at the interfaces in polymer-based composite materials) was funded by SIM (Strategic Initiative Materials in Flanders) and IWT (Agency for Innovation by Science and Technology). The financial support from the foundations for this study is gratefully appreciated.

References