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COMBINATORIAL COMPOUNDING AND HIGH-THROUGHPUT-SCREENING A TOOL FOR THE RAPID DEVELOPMENT OF COMPLEX AND INNOVATIVE COMPOUND RECIPES

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The development of new and innovative plastic compounds is highly time-consuming as well as cost- and resource-intensive. Due to the increasing product requirements, compound recipes become more and more complex. In this context the understanding of the interactions between different recipe components is more and more important. Standard compound development methods are expensive and too slow to analyse these interactions in an acceptable time. So other techniques are required to speed up the material development process. For this reason methods from the pharmaceutical industry, including combinatory and screening methods, have been transferred to the compounding process.
The main idea behind the combinatorial compounding approach is the continuous variation of the different recipe components during the compounding process using a co-rotating twin screw extruder. Decreasing one recipe component and increasing another component at the same time is a convenient method to produce very fast and endless ratio of compound recipes. The second important key for an accelerated material development is the direct characterisation of the compound properties. Therefore directly after compounding a flat film is extruded. This flat film, which has the function “to store” the various compound recipes, can simply be used as a 1D library (specimen) for different online characterisation tests, e.g. light scattering, different spectroscopic methods or colour measurements. The focus of this paper is the mechanical online testing device. This mechanical online device consists of a tensile test, a tear test and a puncture test, which are integrated in one tool.
The combinatorial compounding (CC) and high-throughput-screening (HTS) approach, with focus on the mechanical online tests is explained. The challenge, and also a focus of this paper is to show, how the variation of the compound recipe in the extruder can be correlated to the “stored” recipe of the flat film.