## Description for general public

In the last years the rising interest in polylactide (PLA) – biodegradable polymer, obtained from renewable resources – has been observed. It is estimated that PLA market will reach the market size of around 5.5 billion dollars by 2020, which can be favoured by rising prices of fossil fuels, as well as new law limiting the usage of plastics in disposable packaging[1]. Polylactide, already called "nature's polyethylene"[2], is becoming more and more popular as a polymer used in packaging production (around 70% of its usage), or even in textiles and electronic accessories in the last years[3]. Because of its features, such as low toxicity, biocompatibility and biodegradability, PLA finds its use in medicine, e.g. for surgical threads, implants or drug delivery systems[4,5].

Because of the presence of a chiral center in the monomer, PLA can have different tacticity, i.e. the absolute configuration of mers in the PLA chain is the same or repeatable in a regular fashion. The physicochemical properties of polylactide depend strongly on its tacticity[6,7]. It must be also noted that recently published studies showed the influence of PLA's stereostructure on a rate of drug release from PLA-drug conjugates[5]. Therefore it is essential to use catalysts which enable controlled and stereoselective polymerization of *rac*-lactide to obtain PLA of desired microstructure and properties. Among the catalysts that can polymerize *rac*-lactide to PLA, only few of them can do that in a controlled and stereoselective fashion, and even fewer enable to synthesize PLA of new, original microstructure, as the result of stereoselectivity modifications during the reaction of polymerization.

Dialkylgallium complexes with N-heterocyclic carbenes (NHC), $Me_2Ga(OR)HNC$, which were described in our group, turned out to be promising catalysts in polylactide synthesis, as they are active in -20˚C as well as isoselective[8], which makes them one of the few isoselective catalysts for *rac*-lactide polymerization working under mild conditions[9,10]. The simple reaction of NHC with dialkylgallium alkoxide complexes, which are nonselective or heteroselective, leads to the formation of complexes that are isoselective, enabling for the synthesis of stereo-diblock PLA, with original microstructure and properties. Because of the very promising results, and the need of rational design of new catalysts, it is necessary to study the influence of NHC on the structure and activity in polymerization of *rac*-lactide.

Unfortunately, our knowledge about this group of compounds is still limited. On the basis of a few examples of $Me_2Ga(OR)HNC$ type complexes described in the literature[11,12], however, it can be noticed that the structure of N-heterocyclic carbene has essential influence on $Me_2Ga(OR)HNC$ complex synthesis, structure and activity in the polymerization of *rac*-lactide. My project focuses on broadening the knowledge about this group of complexes by applying asymmetric NHCs and synthesizing new, previously unknown dialkylgallium complexes with asymmetric NHC. I expect that the change in the structure of the carbene will allow me to observe effects in the structure, activity and stereoselectivity of $R_2Ga(OR^1)NHC$ complexes in the polymerization of *rac*-lactide. I also hope that the analysis of gathered data will allow me to explain some issues regarding their synthesis, activity, and stereoselectivity.

## References


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