Abstract

This Ph.D. thesis deals with synthesis of monosubstituted cyclodextrin derivatives and investigating their properties.

Alkylation of α-cyclodextrin with allyl or cinnamyl bromide followed by peracetylation of remaining hydroxyl groups and separation of isomers resulted in the set of peracetylated 2^{I}-*O*-, 3^{I}-*O*- and 6^{I}-*O*-alkylated cyclodextrins in up to 27% yields. Oxidative cleaveage of peracetylated allyl or cinnamyl derivatives resulted in a complete set of peracetylated 2^{I}-*O*-, 3^{I}-*O*- and 6^{I}-*O*- formylmethyl or carboxymethyl derivatives which are useful precursors for preparation of regioselectively monosubstituted derivatives of α-cyclodextrin. Moreover, a quick method to recognize single 2^{I}-*O*-, 3^{I}-*O*- and 6^{I}-*O*- monosubstituted peracetylated cyclodextrins from each other using only ^{1}H NMR spectrum has been proposed.

Ru-carbene complex catalyzed cross-metathesis of monoallyl α-, β-, and γ-cyclodextrins with perfluoroalkylpropenes resulted in the formation of the corresponding perfluoroalkylated cyclodextrins. The reactions proceeded under standard reaction conditions and the desired compounds were obtained in reasonable yields. Dynamic light scattering measurements proved the ability of the prepared compounds to aggregate in water solution forming nanoparticles in the range of tens and thousands of nanometers.

Regiospecifically monosubstituted carboxymethyl-α-cyclodextrins were successfully applied for the enantiomeric separation of several biologically important low-molecular weight compounds by capillary electrophoresis. The enantioselectivity of the individual monosubstituted carboxymethyl-α-cyclodextrins added into the background electrolyte was studied and compared with native α-cyclodextrin at pH of the background electrolyte ranging from 2.5 to 11. Experiments revealed a significant influence of the position of carboxymethyl group on the α-cyclodextrin skeleton on the enantioselectivity for all the studied analytes, the least common 3^{I}-*O*- regioisomer being the most effective chiral selector.