

ABSTRACT

Catalysis is one of the fastest-growing fields in chemistry, driven by high demand for selective catalytic systems. A particularly rapid increase in the number of catalysts being developed can be observed in polymerization and oligomerization processes. Coordination compounds, especially those containing d-block metals at the metal center, are among the most commonly used systems in homogeneous catalysis. Catalytic systems based on transition metal ions in combination with various ligands (e.g., N-donor ligands, pentadienyl ligands) are characterized by high reactivity, enable reactions to be carried out under mild conditions, and allow for the production of a wide range of functional materials.

This research included the synthesis of a series of coordination compounds based on nickel(II), cobalt(II/III), oxovanadium(IV/V), and molybdenum(VI), containing organic ligands in the coordination sphere, including 1,10-phenanthroline, 5-chloro-8-hydroxyquinoline, and 2,2'-bipyridine. The exact structure of the synthesized compounds and their physicochemical properties were determined using spectroscopic methods, XRD analysis, and thermodynamic stability studies in aqueous solution. The information gathered enabled their use as catalysts in oligomerization and co-oligomerization processes.

The catalytic properties of the synthesized complexes were investigated in the oligomerization of selected olefins (ethylene, prop-2-en-1-ol, 2-chloroprop-2-en-1-ol, and norbornene) and cyclohexyl isocyanide, as well as in the co-oligomerization of ethylene with norbornene. The resulting oligomerization products were subjected to quantitative and qualitative analysis to determine their physicochemical properties. The structural diversity of the synthesized compounds made it possible to determine and compare the influence of catalyst structure on their catalytic activity, as well as the physicochemical properties of the resulting products.

The results presented in this study represent a significant contribution to transition metal coordination chemistry, particularly in the context of structure-activity relationships in the coordination catalysis of olefins and isocyanides. The research conducted provided valuable information that can be used in the design of new, more efficient catalytic systems for the synthesis of polymeric materials.