Conclusion

An electrochemical technique offers the technological challenges and comprises a collection of advantages over the conventional methods in the synthetic organic chemistry. The tremendous selectivity, high speed, simplicity, one pot synthesis, low expense of instrument, flexibility in applications and above all in a single step synthesis make the utility of this electrochemical technique ideal for the synthesis of a variety of compounds. The object of our research was to explore the use of electrochemical technique for the preparation of inorganic, organometallic compounds and their adducts with different ligands at sacrificial cadmium and aluminium anode. A central feature of this method is an electrode which provides a surface where a redox process occurs and the potential and current in an electrochemical cell serves as the driving force for the reaction. But, in the present study we used a sacrificial electrode which in addition to acting as source or sink for electrons may also react with the species present in the solution or produced during the progress of the reaction. We have successfully demonstrated this electrochemical technique for the synthesis of cadmium and aluminium alkoxides, thiolates, carboxylates, glycolates, chelates, organocadmium and organoaluminium compounds in a single step in an H–type cell using tetrabutylammonium chloride as supporting electrolyte and acetonitrile as solvent. The potential was adjusted so that a current of 20 mA passed through the electrolytic solution. In some systems, nitrogen gas was bubbled through the solution to create the inert atmosphere. The present study reveal that in addition to the above advantages, the other features like high product yield, easy to isolate pure products, needs cheap starting material and routine laboratory equipment, reaction conducted at ambient temperature and pressure and maintains a pollution free atmosphere are also associated with this technique.

By this technique, we have successfully prepared the coordination complexes of these compounds with ligands 1,10-phenanthroline and 2,2’-bipyridyl in a single step. Generally, the metal ions in the metal alkoxides achieve their favoured coordination number through alkoxy bridging; and the coordination expansion through the addition of another ligand is very rare. It is reported in literature that the adducts of metal alkoxides can be prepared by using either bulky alkoxy groups or alkoxy groups having
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electron withdrawing group. The electron withdrawing substituents does weaken the alkoxy bridging present in the parent metal alkoxides and the coordination expansion by the external ligand becomes easier. But, the present technique provides a single route for the synthesis of the coordination compounds of these alkoxides and other compounds irrespective of the nature of the alkoxide group.

The use of extra pure metals as reagents has been widely used in the past few years because of the development of vapour phase synthetic technique. Such experiments include an efficient high vacuum system of appreciable pumping capacity, some means of evaporating metals, a cold trap for the collection of product and some sophisticated instruments to identify the species produced.

The use of the synthesized compounds like metal alkoxides are very good precursors for the synthesis of pure metal oxides, metal thiolates have several applications in laboratory and in medicines, metal carboxylates as precursors in catalyst synthesis, initiators of photo oxidative degradation in polymers, metal glycolates have industrial and environmental applications. The coordination compounds of all these products have been prepared electrochemically which are otherwise very difficult to be prepared by conventional chemical methods.

All the above compounds are associated with high current efficiencies which suggest that this electrochemical method can be used for the commercial preparations of these inorganic and organometallic compounds.

The main drawback of this electrochemical technique is that the products obtained are insoluble in various commonly used organic solvents that confine and limit further studies of these electrochemically synthesized products to certain level. Different efforts such as chemical modification of the substrate, increasing the size of the electro active molecules, variation in the experimental conditions etc. were made to synthesize the soluble products but could not be successful.

Nevertheless, it is believed that this fascinating and simple electrochemical technique has proved to be the useful tool for the preparation of a variety of inorganic and organometallic compounds in the laboratory as well as at the industrial level.