

A MINI REVIEW OF ORGANOMETALLIC COMPOUNDS AND THEIR ANTICANCER PROPERTIES

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ABSTRACT - Chemistry of organometallic compounds is a rapidly developing research area. In comparison with purely organic compounds, organometallic compounds show unique chemical properties including structural diversity, variety of available interactions, possibility of ligand exchange and redox and catalytic properties that can be used for medical purposes. The discovery of antitumor properties of cisplatin in 1979 by Rosenberg and its introduction to oncology brought a lot of interest in metal complexes chemistry containing other transition metals. Regardless of severe side-effects and frequent development of tumor resistance, cisplatin, oxaliplatin and carboplatin are still the most successful anticancer compounds. Nevertheless, it is essential to search for novel anticancer drugs with different modes of action, better selectivity and less side-effects. Organometallic compounds represent a new opportunity to achieve this goal.

INTRODUCTION

Cisplatin was the first member of organometallic compounds with anticancer properties. Regardless of severe side-effects (such as nephrotoxicity, ototoxicity etc.) and resistance development, cisplatin and its derivatives are so far the most successful and widely used drugs in the therapy of solid tumors. The success of cisplatin brought an increased interest in metal complexes chemistry. Since that time, a number of organometallic complexes with different transition metals has been synthesized in order to find novel anticancer drug candidates that will help to overcome cisplatin limitations.

Generally, organometallic compounds are metal complexes containing at least one direct covalent bond to the metal (GASSER *et al.*, 2011). There are few typical classes of organometallic compounds such as metallocenes, half-sandwich, carbene-, CO-, or π -ligands. Metallocenes are compounds with two cyclopentadienyl rings bonded to a metal atom. They can be subdivided into two groups: "classical" with parallel cyclopentadienyl rings and "bent" metallocenes with other ligands bonded to the metal. Metallocenes used in medicine usually contain Fe, Ru, or Co (classical) and Ti, Zr, V, Nb, or Mo (bent metallocenes). Notably, there is a structure similarity (*cis*-dihalide motif) between bent metallocenes and cisplatin.

FERROCENES

Ferrocene, discovered by 1954 (KOPF-MAIER *et al.*, 1954), was the first organometallic compound with reported anticancer properties (Fig. 1). Since that time numerous ferrocene