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Cobalt Compounds as Multifaceted Chemotherapeutic Agent: An Overview

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ABSTRACT: The discovery of cobalt led to the study of its chemistry. The chemistry of its position in the periodic table, the physical properties, its existence in combined state in the primary ores and chemical properties. The uses of cobalt and its compounds from ancient times to present era are in industrial and pharmaceutical sectors. Its less toxic nature has been utilized in anticancer, antimicrobial and antitumour chemotherapeutic studies, most especially, cobalt(III) complexes.

KEYWORDS: Cobalt, Industrial Use, Anticancer Agent, Antimicrobial Agent, Antitumour, Antiprotozoal Activities.

1. INTRODUCTION

A Swedish chemist, Georg Brandt, discovered cobalt incidentally in 1739 [1]. This was when he tried to prove that bismuth was responsible to colour glass, “blue”, which was the belief at that time [2]. Cobalt has a symbol of Co with an atomic number of 27 [1]. It is a grey transition metal that is hard, lustrous and has a close packed hexagonal (CPH) crystal structure at room temperature [2]. The primary ores are cobaltite (CoAsS) and erythrite (Co3 (AsO4)2) [3, 4]. Cobalt is a byproduct of mining and refining of copper, iron, lead, nickel and silver [5]. The use of cobalt started between 2000 and 3000 B. C. when the Egyptians’ craftspeople used cobalt as colouring agent [6]. The use has continued till the 20th century [7]. Cobalt is applied industrially as a dye, in electroplating, making of alloys in the 19th century and for colouring enamel, glass, porcelain, pottery and tile.

2. MULTIFACETED CHEMOTHERAPEUTIC AGENT

In microorganisms, cobalt is an effective nutrient for survival, while in multi-cellular organisms; it is an essential trace element where it is at the centre of coenzymes, known as, cobalamins [8]. In human nutrition, humans need a mass of 1 to 2.1 µg of cobalt daily and cobalt forms an essential part of vitamin B12 [8, 9]. Medically, a radioactive isotope of cobalt, Cobalt-60, is used as a medical tracer and used for treating other forms of cancer [10]. Cobalt is less toxic than platinum that led to its compounds, most especially their complexes to be applied as anticancer, antimicrobial and antitumour chemotherapeutic agents [9]. Cobalt has two common oxidation states of Co (II) and Co (III) [11]. Others are from -3 to +4. In recent times, both cobalt(II) and (III) oxidation states of cobalt and its compounds, most especially the cobalt complexes were considered as anticancer agents [8, 9, 12-17], antimicrobial agents [13, 18-23], antitumour agent [16], as well as, antiprotozoal agents Excess cobalt is genotoxic and carcinogenic in rodents [8]. A common side effect is nephrotoxicity [24].

3. RECENT STUDIES

The recent and current application of cobalt compounds is in material chemistry, where cobalt nanoparticles as biocompatible vehicle for drug delivery to specific target organs [26-27].

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4. Conclusion

Apart from the industrial applications of cobalt and the compounds, the less toxic nature of cobalt compounds had been justified with their uses as potential chemotherapeutic agents in anticancer, antimicrobial, antitumour and antiprotozoal research activities.

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