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Study of Dithiocarbamate acid wide range of uses and applications

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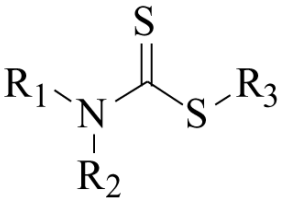
Abstract
Transition metal complexes have received much attention of metallo-organic and bioinorganic chemists because of their wide range of applications from material sciences to biological sciences. Since the already existing drugs in practice have several limitations, which also includes other side effects such as nausea, drug resistance and restricted effects in penetration and delivery. Hence, there is an urgent need to develop newer drugs with increased capabilities against diseases.

Keywords: metallo-organic, antifungal activity, modern medicine, anticancer activity

Introduction

Organic dithiocarbamates have attracted a great deal of importance due to their interesting chemistry and wide utility [1-7]. Dithiocarbamates have a wide range of uses and applications and are produced in great quantities throughout the world. Dithiocarbamate acid ester [1] is a common class of organic molecules. They exhibit valuable biological effects, including antibacterial activity, antifungal activity, antioxidant activity [8], inhibition of cardiac hypertrophy, [9] etc. Dithiocarbamic acid ester represents a new kind of compound with a novel structure, significant anticancer activity and very low toxicity. A Dithiocarbamate is a functional group in organic chemistry. It is the analogue of carbamate in which both oxygen atoms are replaced by sulfur atoms (figure 1).



(1)

Fig 1: General formula of the dithiocarbamate

The dithiocarbamate containing two donor sulfur atoms, which it is prepared from the reaction of primary amine or secondary amine with base and carbon disulfide.

Sodium diethyl dithiocarbamate is a common ligand in inorganic chemistry. Lots of primary and secondary amines react with carbon sulfide and sodium hydroxide to form dithiocarbamates; they are used as ligand when metal salts are added to it. It readily reacts with many metal salts such as Cu, ferrous, ferric, cobaltous, Ni salts. They are mostly octahedral complexes.

Despite major breakthroughs in many areas of modern medicine over the past 100 years, the successful treatment of cancer remains a significant challenge at the start of the 21st century. Because it is difficult to discover novel agents that selectively kill tumor cells or inhibit their proliferation without the general toxicity, the use of traditional cancer chemotherapy is still very limited. Besides being widely used as fungicides to protect crops from fungal diseases [10], dithiocarbamic acid esters have a number of other applications such as in photochemistry [11], catalysis in the sulfur vulcanization of rubber [12], detection and analysis of biological NO produced endogenously from NO synthases [13], and polymerization [14]. Furthermore, functionalized carbamates are an important class of compounds and their medicinal and biological properties warrant study [15]. Dithiocarbamic acid esters were recently reported as potent anticancer agents [16] and cell apoptosis inhibitors [17].

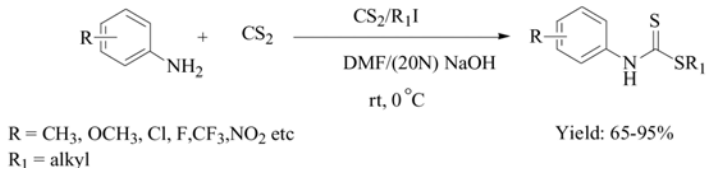
Organic dithiocarbamates are valuable synthetic intermediates [18], which are ubiquitously found in a variety of biologically active compounds. Functionalization of the carbamate moiety offers an attractive method for the generation of derivatives, which may constitute interesting medicinal and boilogical properties [19].

Dithiocarbamates (DTCs) are a group of organosulfur compounds that have extensively been used as pesticides in agriculture for more than 50 years with some products being already introduced in the 1930s. Today, the yearly consumption is between 25,000 and 35,000 metric tones [20]. Most of the DTCs are applied as fungicides and some are classified by the World Health Organization as being hazardous [21]. As a consequence, an array of various methods has been developed for the analysis of DTCs and their potential degradation products in environmental samples and in food stuff.

Results and Discussion

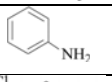
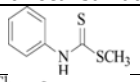
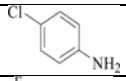
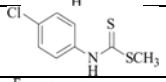
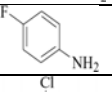
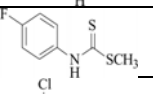
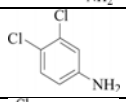
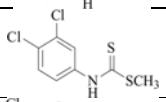
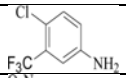
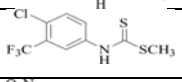
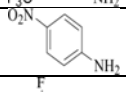
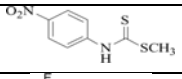
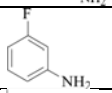
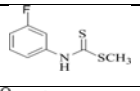
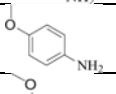
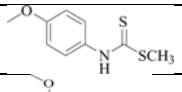
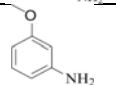
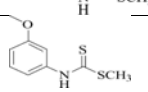
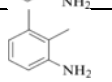
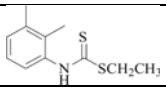
Synthesis of Dithiocarbamates

The reactions were carried out between simple aniline and various substituted anilines in presence of NaOH, CS_2, alkyl halides and DMSO. Stirring continued for 1-2 hours at room temperature and then followed by 0 ºC (Sceme 1). These reaction conditions are proved to be good synthetic procedure for various dithiocarbamates (Table 1) with 65-95% isolated yield.



Scehme 1

Table 1: Synthesis of dithiocarbamates

S No.	Aniline	Dithiocarbamate	Time (h)
1.			2
2.			2
3.			2
4.			2
5.			2
6.			2
7.			2
8.			2
9.			2
10.			2

Experimental section general

All reactions were performed using oven-dried glassware. Organic solutions were concentrated under reduced pressure using Buchi rotary evaporator. All other reagents and solvents were obtained from commercial suppliers and were used without further purification. Reactions and chromatographic fractions were monitored by thin layer chromatography. TLC Silica gel-60 F254, Merck was used for TLC and silica gel (100-200 mesh, SRL, India) was used for column chromatography.

Conclusion

We have developed an efficient and novel procedure for the direct synthesis of dithiocarbamates employing amines, CS_2, and alkyl halides, in one-pot, without the use of any catalyst in aqueous condition having functional groups like methyl, methoxy, nitro, halo and CF_3 from commercially available anilines and prepared some various substituted anilines with morpholine, 1-Methyl piperazine, cyclopropane carboxylic acid amide etc.

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