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# Synthesis and Biological Studies of Some Sulfur, Selenium and Tellurium Organic Compounds Based on Diethanolamine

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**Abstract**— Several new and known bis(2-(arylchalcogano)ethyl)amines (i.e. $HN(CH_2CH_2EAr)_2$; where E= S, Se and Te, Ar = $C_6H_5$, 4-$CH_3C_6H_4$, 4-$CH_3OC_6H_4$, 4-$CH_3CH_2OC_6H_4$, 4-$BrC_6H_4$, 4-$ClC_6H_4$ and 4-$PhC_6H_4$) were prepared by the reaction of bis(chloroethyl)amine with lithium arylthiolate or with the corresponding sodium arylchalcogenate (generated in situ by borohydride reduction of $R_2Ea_2$; i.e. $ArE^-Na^+$; E= Se and Te). All compounds were obtained in good yield and characterized by elemental analysis, IR, $^1H$ and $^{13}C$ NMR and mass spectroscopic data. Antibacterial activity study of these compounds showed some promising activity against *S. aureus*, *P. aeruginosa* and *E. coli*.

**Key words**— Diethanolamine, organotellurium, selenium, sodium arylchalcogenate, diaryl dichalcogenides, biological activity.

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## 1 Introduction

DIETHANOLAMINE has been used as surfactants for detergents and cleaning agent formulations and as a gas purification agent to remove carbon dioxide or hydrogen sulfide gas. Furthermore, diethanolamine was also used as an anticorrosion agent in metalworking fluids, and in preparations of agricultural chemicals. In addition, diethanolamine is raw materials to synthesize drugs and it is also a cross linking agent for production of high elasticity polyurethane foam [1-3].

Selenium and tellurium compounds were considered a poison for many years, until non-toxic selenium and tellurium compounds with high biological activity were found [4-10]. A variety of organoselenium compounds with potential antioxidant activity, including ebselen analogues, benzoselenazolinones, diaryl diselenides, selenamide and related derivatives have been reported in a variety of pathological situations [8-12]. Like organoselenium compounds, a number of organotellurium compounds exhibited high glutathione peroxidase-like activity [2-5]. The literature [4-12] indicates that among organotellurium compounds, mainly telluranes (four-valent tellurium compounds), showed high biological activity. Thus, the present work describes the synthesis of some new and knows organosulfur, organoselenium and organotellurium compounds based on diethanolamine in order to study their biological activity.

## 2 EXPERIMENTAL

### 2.1 *Physical measurements*

All melting points were determined on a Gallenkamp melting point apparatus and are uncorrected. FT-IR spectra were recorded on FT-IR spectrophotometer -8400s Shimadzu as KBr disc. The $^1H$ and $^{13}C$ NMR spectra were measured on a Bruker spectrometer at 400 ($^1H$ NMR) MHz and 100 ($^{13}C$ NMR) MHz using $CDCl_3$ solution with TMS as internal standard. Elemental analyses were determined on an MT-3 elemental analyzer within ±5 % of the theoretical values. Mass spectra were recorded on a HP-598 8A MS instrument at 70 eV.

### 2.2 *Synthesis*

All reactions were carried out under nitrogen or argon atmosphere and monitored by conventional TLC method. All organic solvents were dried prior to use according to standard methods. Diphenyl diselenide[13], bis(4-methylphenyl) diselenide [14] , bis(4-methoxyphenyl) diselenide [14], bis(4-ethoxyphenyl) diselenide [14], bis(4-bromophenyl) diselenide [14], bis(4-chlorophenyl) diselenide [14] and bis(4-pherlphenyl) diselenide[14] were prepared according to literature methods. Diphenyl ditelluride[15], bis(4-methoxyphenyl) ditelluride[15], bis(4-ethoxyphenyl) ditelluride[16] , bis(4-bromophenyl) ditelluride[16], bis(4-chlorophenyl) ditelluride[16] , bis(4-pherlphenyl) ditelluride[16], Bis(2-chloroethyl)amine was prepared by chlorination of diethanolamine with thionyl chloride in $CHCl_3$ as described in a literature method[17]. All the above compounds were characterized according to their mp's and IR spectra. Diphenyl disulfide and bis(4-methoxyphenyl) disulfide were obtained from Aldrich-Sigma company and used without further purification.

#### 2.2.1 *Bis(2-(phenylthio)ethyl)amine* (1)

To 0.18 mole of phenyllithium in 100 $cm^3$ THF was added cautiously sulfur(5.77 g; 0.18 g. atom) . The reaction was exothermic; the stirring was continued until all the sulfur had been disappeared. The resulting solution was stirred for additional 1 h at room temperature. The solution was cooled in ice-