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Synthesis and Study of New Derivatives of Diphenylcarbazide on the Base of N_1`, $N_1$`-Dioctoxymethylchlorazone Ether

Hajiyeva SR[1], Shamilov NT[1], Bayramov GI[1], Huseynov FE[1], Aliyeva TI[1]*, Rafiyeva HL[1], Jafarova NM[1] and Gullarli GH[2]

[1]Department of Ecological chemistry, Baku State University, Azerbaijan

[2]Azerbaijan Military Academy named after Haydar Aliyev, Azerbaijan

Review article

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***Corresponding author:** Aliyeva Tarana Ibragim, Candidate of Chemical Sciences, and teacher of "Ecological chemistry" department, Baku State University, Azerbaijan, Tel: (+994) 709701452; Email: tarana_chem@mail.ru

Abstract

A new derivative of diphenylcarbazide was synthesized on the base of chlorazone ether containing 2 units - $CH_2OC_8H_{17}$ group and 1 ozone group. During application of for the first time synthesised by us N_1-(N_1',N_1'-dioxtoxymethyl)azone-N_2-(N_1',N_1'-dioctoxymethyl)azone-N_4-(N_1',N_1'-dioctoxymethyl)azone-N_5-(N_1',N_1'-dioctoxymethyl)azone diphenylcarbazide (compound B-1) as an anti-corrosion inhibitor has been found that an ecological inhibitory efficiency of this compound in the most aggressive laboratory environment is 99.96-100%, even with density of 0.5, 1.0, 1.5. It is scientifically proven that the new diphenylcarbazide derivative (conventionally designated as B-1) is of great environmental and economic importance when used in corrosion protection of steel processing equipment operated in very aggressive environments in the oil-gas and petrochemical industries. The synthesized B-1 is an inhibitory substance that is highly responsive to the current ecological safety requirements.

Keywords: Octoximethyl Group; Chlorazone; Chlorazone Ether; Dioctoxymethyl Chlorazone; Corrosion; Aggressive Environment; Inhibitor; Environmental Effect; Steel Technological Equipment

Introduction

As it is known, one of the main causes of environmental problems at the end of unforeseen accidents during technological processes in the oil and gas and petrochemical industries are corrosion of steel process equipment. Therefore, as in other industries, one of the main methods of corrosion protection of steel technological equipment in the oil and gas and petrochemical industries is the use of ecologically effective inhibitors. Synthesis and research of new nitrogen-containing organic compounds that meet all the requirements of ecological safety and which are low-cost

in the field of organic and petrochemical synthesis are considered as one of the topical issues of the era.

In this regard, as noted in the literature [1], organic compounds containing high quantity of nitrogen atoms possess effective inhibitory properties. Based on the results of our studies [2-4], it has been proved that in fact, various functional groups and organic compounds with high nitrogen atoms have an anti-corrosive effect.

$C_8H_{17}OCH_2Cl$ (α-chloroctoxymethyl) and $N_1`N_1`$-dioctoxymethyl chlorazone ethers [2-3] for the synthesis of the new derivative of diphenylcarbazide (compound B-1) were obtained according the methods described in literature. The composition and structure of these ethers were determined by known methods. The results obtained are in line with the indicators given in the literature [2-3]. In view of the foregoing, we have synthesized a new derivative of diphenylkarbazide B-1, based on the chlorazone ether of the two-$CH_2OC_8H_{17}$ group. Carrying out the reaction of diphenylcarbazide with $N_1`N_1`$-dioctoxymethylchlororazone ether according to the procedure described in the literature [2-3], a new, unknown in the literature diphenylcarbazide derivative N_1-($N_1`N_1`$-dioctoxymethyl) azone-N_2-($N_1`N_1`$-dioctoxymethyl)azone-N_4-($N_1`N_1`$-dioctoxymethyl)azone-N_5($N_1`N_1`$dioctoxymethyl)azone)diphenylcarbazide, compound B-1 (Figure 1).

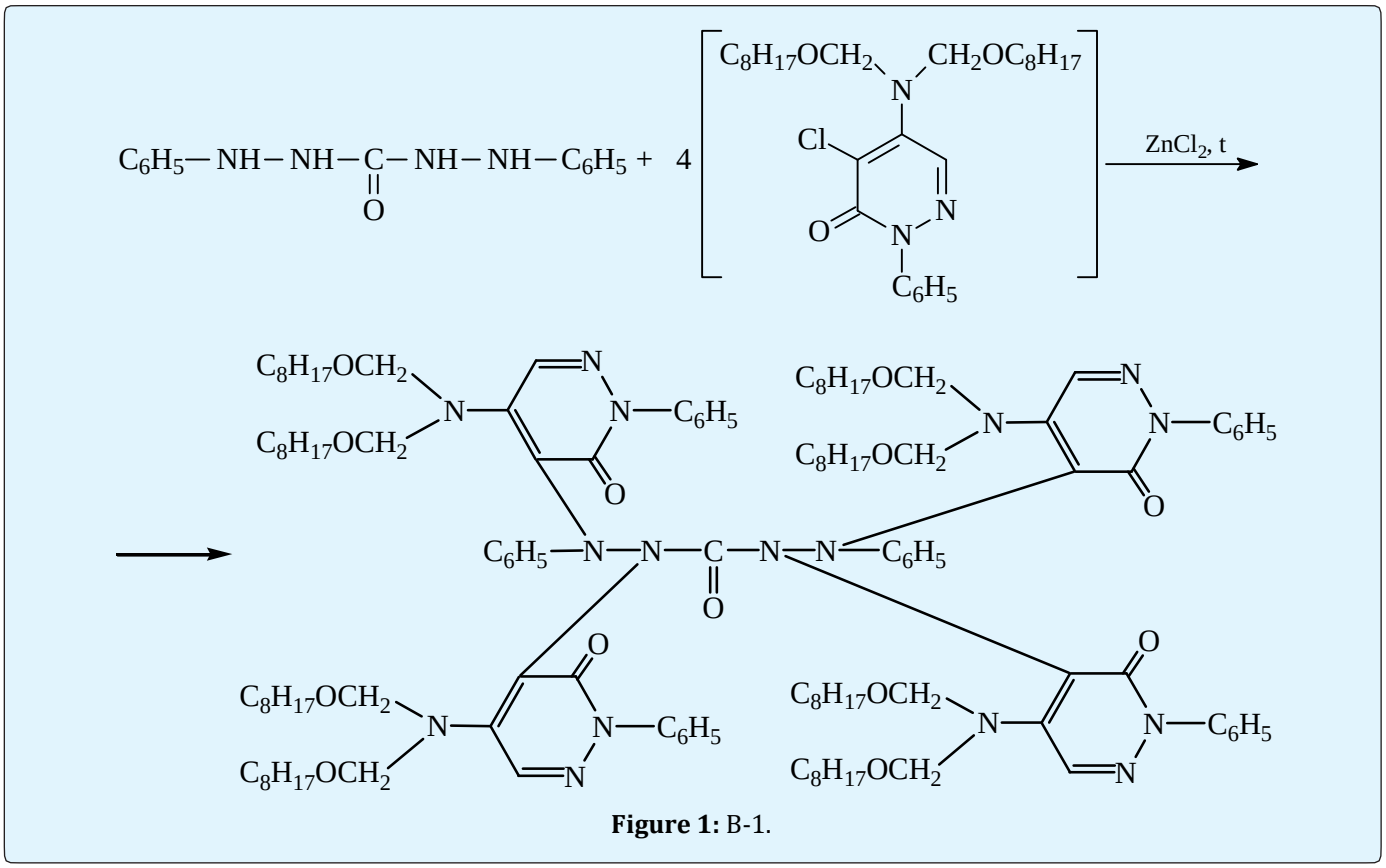


Figure 1: B-1.

The output of the synthesized new B-1 compound of the diphenylcarbazide, its the physical and chemical constants, and the element analyzes are given in Table 1.

Research has been carried out to determine the corrosion rate and inhibitory efficacy of this compound in a highly aggressive environment. According to the study, the inhibitory effect of this compound at the lowest 0.5, 1.0, 1.5 mg/l density was 99.96-100%. Determining the inhibitory efficiency of the new derivative of the synthesized diphenylcarbazide (compound B-1) has been investigated in accordance with method specified in "gravimetric".

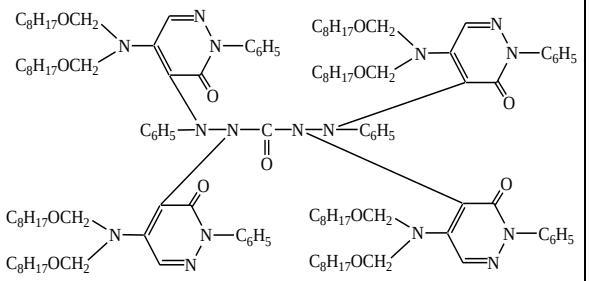
Chemical formula and conditional No. of the compound	Output%	$T_{boil.}$ ^{0}C (760 Torr)	d_4^{20}	n_d^{20}	MR_D found / calculated	Brutto formula, mol. weight	Elemental analysis %, calculated / found		
							C	H	N
 *B-1*	98.94	278-279 (2)	1.5158	1.8627	63096/ 630.74	$C_{125}H_{186}N_{16}O_{13}$ 2118	70.82/ 70.61	8.78/ 8.66	10.58/ 10.43

Table 1: Data on the composite output, physical and chemical constants, elemental analysis of the synthesizedN1(N1`N1`dioctoxymethyl)azoneN2(N1`N1`dioctoxymethyl)azoneN4(N1`N1`dioctoximethyl)azone-N5-(N1`N1`-dioctoximethyl)azonediphenylcarbazide compound (B-1).

The ecological efficiency of the inhibitory property of the new derivative of diphenylcarbazide – compound B-1, can be explained as follows. Based on the results of our previous studies [2-4] and also the research data in the literature [1,5-12] it can be noted that with the formation of 16 nitrogen atoms in the new diphenylcarbazide derivative, 8 $CH_2OC_8H_{17}$ groups, 31 double bond set, the metal surface becomes passive due to an increase in the influence of electron density and the internal Van der Waals forces of the compound. As a result, the compound B-1 even at low densities completely reduces the corrosion rate of the metal in the most aggressive environments. Thus, the new derivative B-1 of diphenylcarbazide, shown in Table 2, can be used as an ecologically and economically important inhibitor of corrosion protection of steel technological equipment operated in the most aggressive environments in the oil and gas and petrochemical industries.

conditional No. of the compound	Inhibitor density, mg/l	3 % NaCl (10:1)+H_2S 500 mg/l		0.3N HCl+benzine (1:7)+ H_2S 1000 mg/l	
		Corrosion rate g/cm hour	Inhibitor efficiency, %	Corrosion rate, g/cm hour	Inhibitor efficiency, %
Without Inhibitors	-	2.56	-	3.65	-
B-1	0.5	0.0003	99.96	0.0002	99.99
	1.0	0.0002	99.99	0.0001	100
	1.5	0.0001	100	-	-
A[4]	200	0.038	98.5	0.078	98

Table 2: Results of the study of the inhibitory efficiency of a new derivative of diphenylcarbazid (B-1) based on N1`N1`-dioctoxymethylchlorazone ether.

Conclusion

Synthesis of N1-(N1`N1`-dioctoxymethyl)azone-N2-(N1`N1`-dioctoxymethyl) azone-N4-(N1`N1`-dioctoxymethyl)azon-N5-(N1`N1`-dioctoxymethyl)azonedi-phenylcarbazide compound (B-1)

The synthesis tube is filled with 2g $ZnCl_2$ catalyst and 0.01 g/mol diphenylcarbazide, and 50 ml of C_2H_5OH alcohol is added and at 70^{0}C is mixed until complete dissolution of diphenylcarbazide. Then, 0.04 g-mol N_1',N_1' -diocoxymethylchlorazone ether was added to the mixture from a dropping funnel at regular intervals and stirred for 6 hours at 76 °C. After the reaction is complete, 100 ml of 10% NaOH solution and 100 ml of distilled water are added to the mixture. Then, 25 ml of diethyl ether is added to the reaction mixture and mixed. The mixture is filled into a separation funnel, and after the organic layer is separated from the water layer, diethyl ether in the organic layer is distilled off by a water pump.

After being deposited on $CaCl_2$, an organic layer is pumped into vacuum. The composition and structure of the new derivative of diphenylcarbazide (compound B-1) on the basis of N_1`$N_1$`-dioctoxymethyl chlorazone ether was determined by IR and magnetic mass spectra [13].

In the IR spectrum of the synthesized N_1-(N_1`$N_1$`-dioxtoxymethyl)azone- N_2-(N_1`$N_1$`-dioctoxymethyl)azone-N_4-(N_1`$N_1$`-dioctoxymethyl)azone-N_5-(N_1`$N_1$`-dioctoxymethyl)azonediphenylcarbazide (B-1) compound there are -C-O-C- simple ether group 1050, 1080 cm^{-1}; CH_2 group 2950 cm^{-1}; CH_3 group 1380, 1460, 2960, 3030 cm^{-1}; C-N bond 1310-1350 cm^{-1}; N-N group 900, 1580 cm^{-1}; C=C bond 1680 cm-1 in the azone group; C = C bonds 1440, 1465, 1500, 1510, 1590-1600 cm^{-1} in benzene nuclei; C_6H_5 group 700-780 cm^{-1}.

The molecular mass of that compound in the magnetic mass spectrum corresponds to the molecular ion of 2118 m/e.

Summary

For the first time we synthesized a new diphenylcarbazide derivative N1-(N1`N1`-dioctoxymethyl) azone N2(N1`N1`dioctoxymethyl)azoneN4(N1`N1`dioctoxymethyl)azoneN5(N1`N1`dioctoxymethyl)azonediphenylcarbazide com-pound B-1. The inhibitory effect of this compound in the most aggressive environment in the laboratory conditions was determined. The effectiveness of this compound was 99.96-100%, even at the lowest densities of 0.5, 1.0, 1.5 mg/l. One can assume that this new diphenylcarbazide derivative by 100% protects steel processing equipment in the most aggressive environments in the oil and gas and petrochemical industries, and it is important to ensure economic and environmental safety. 100% corrosion protection and great economic and environmental importance can be considered scientifically sound.

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