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Research paper

On the use of Some Heterocyclic Compounds as Anti - Fire to Improve the Properties of Composite Polymer

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Abstract

In this study, a number of thiazol compounds were prepared and were diagnosed with infrared techniques, NMR spectrum and C13NMR spectroscopy and measurement of the melting point where results were shown to be consistent with what was published in the literature. These compounds were used as anti-fire agents to inhibit the insoluble polysaccharide resin used in the construction process, which is highly flammable. ASTM E 285-80 was used in this specification. Unsaturated polystyrene sheets were used with dimensions of cm15 cm, The width of cm2, thickness of mm4) and the percentage added of each of the prepared compounds (0.51%) The results obtained from the standard (ASTM E 285-80) that the compound (1) had the best results from the other compound, It showed high efficiency as an anti-fire additive by significantly reducing the combustion time, and for the other compounds.

Keywords:

1. Introduction

1.1 Fire Retardant Polymers

The term "anti-fire" does not mean that the polymeric materials containing these antibiotics do not burn. In some cases, they may be difficult to burn. Polymers may also fight fire extinguishers from self-extinguishing after ignition if the source of self-extinction is removed. Combustion agents burn slowly, however, so the desired purpose of fire extinguishers is either self-extinguishing or slow combustion rate. (1) The flammability of polymeric materials is usually chosen as the combustion rate of the specified model and the susceptibility of materials to be self-extinguishing (SE) Important properties for external flame removal (2) Polyurethane urethanes are characterized by their burning or flammable ignition after removal of the flame source so they are self-extinguishing polymers (SE), 4,3). In general, the ignition of polyurethane and proteins produces smoke and toxic gases such as CO and ... HCN and some polymers are used in fireproof clothing and furniture and it is necessary to have a good flame resistance, and many organic polymers and other carbon compounds are Flammable additives when exposed to a flame source or at high temperatures. The good anti-flame additives (FR) must have some conditions, the most important (5):

1. It must be thermally stable even at the temperature of the polymer processing.
2. Stable to light.
3. Do not react with the polymer key chain.
4. It should be non-toxic.
5. It should not adversely affect the physical properties of the polymer.
6. Some of the other polymers melt when ignited such as polystyrene fibers (2).

1.2 Unsaturated Polyester Resin

The unsaturated polysaccharide resin was first formulated in 1930, and was commercially produced in 1933 from the reaction of malic acid anhydride by gasoline-oxidizing oxidation. Carlton Ellis (4) produced unsaturated polyesters mixed with styrene, It is used for reinforcement with fiber glass to give products of high mechanical strength and low density (the majority of unsaturated polystyrene resins were used with glass fiber and gave high strength and rigidity to the molded parts). When an unsaturated group is present in the repeated units of the polystyrene series, the polysaccharide is called unsaturated 6, and the polysaccharides are called polyesters, which are dependent on the large molecules involved in the polysaccharide, Such as phthalic, azophthalic, adipic, or oxalic acid, or unsaturated acids such as phthalic anhydride, or formic acid. These acids are condensed with dihydroxy alcohol (Diol) (7)

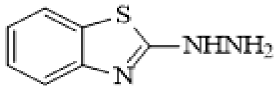
Unsaturated polystyrene resins are typically produced by intensifying the double-carboxylic acid or anhydride with dihydroxy alcohol (8). The unsaturated groups in the polystyrene chains interact with the binary (double) bonds of the molecules (such as the most common styrene) to form three-dimensional, rigid, vacuum products. These bonds have an effect on the plastic change from thermoplastic to thermosetting and thus increase the strength, , Electrical resistance and resistance to the effect of solvents and other chemical compounds. And in a study by ALSammarie 16 and a group on the use of thiazol compounds as antifungal agents. A number of compounds containing thiazol were prepared, showing good efficiency in the flame chamber. In a study by Al-Issa (9) and his group, they used borax and paraffin chlorinated as independent additive and a third supplement (50% borax and 50% paraffin chlorinated) as flame retardants for epoxy resin and unsaturated polyesters, The results showed that the three additives had a good effect on inhibition of epoxy resin and unsaturated polysaccharide, but the third tasaric additive was more effective and clearly increased as the added ratio. The production areas of polyunsaturated polyunsaturated are wide, they enter the marine, electrical, electronic, Construction, Furniture, (10) In the polystyrene mixture that is not saturated with styrene, the reaction range, which begins with an unbroken molecular network, forms the so-called gel point, and the continuous interaction of the gel state and the association of more polystyrene molecules With each other and in several points of the polymeric network.

2. Procedure

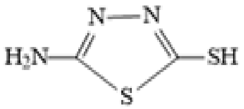
2.1Test of Prepared Compounds for Fire Retardants

2.1.1 Preparation of standard matrix ASTM E 285-80

ASTM E 285-80 (11) has been prepared using rectangular glass rulers with internal dimensions (length 15cm, width 2 cm, thickness 4mm) as shown in figure (2-1). The Marmolit adhesive is used, It is a commercial polymer consisting of styrene mixed with polyester-polyole by mixing compounds prepared with polymer and with specific proportions. Adding the material used for polymerization is the benzoyl peroxide, which is added by 1% to the polymer For hardening within 15 minutes, this polymer is used as a quick adhesive for marble, granite and stones instead of cement in the way This polymer is very resistant to the fire and is easily ignited with a source of flame .



2-hydrazino benzothiazole



2-amino 1,3,4 thaadiazole-5-thiol

2.1.2 Preparation of standard sheets for fire retardant compounds

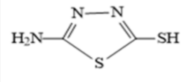
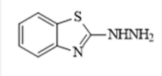
The composites of anti-combustion compounds were prepared by adding the prepared compounds (thiosol compounds) to the commercial polymer (styrene mixed with polystyrene first polycarbonate). The prepared compounds were added by w / w (0.5%). Prepared with a weight of 0.51gm of each compound to 25gm of commercial polymer and mixed well, then mixed with the diBenzoyl peroxided quickly. The product was poured into the mold prepared for this purpose and left for 15 minutes to solidify and become Weights and dimensions are very equal and very large.

2.1.2 Testing of the burning samples prepared according standard ASTM E 285-80

In accordance with ASTM E 285-80 ASTM E 285-80, a test was carried out for sacrificing the polymer model frames containing the prepared compounds as shown in Fig. (2-3). The source of the fire in this test is a benzene gas with butane gas). In this test, the time to burn the model, the insulation constant for each model, the corrosion ratio of each model were estimated. The flame was placed approximately 15mm away from the free model side .

3. Results and Discussion

The results were progressively sequenced as a compound of excellent efficacy, not bad and weak as antigens, as in the table below:

Erosion Rate (mm/sec)	Insulation Index (sec/mm)	Burning Time (sec)	Symbol of Compound	prepared compound
0.005	179	716	**USPE**	**Styrene + Poly ester** **Poly-ole**
0,018	54	216	**1**	
0,012	83	332	**2**	

3.1. Diagnosis of Organic Compounds

3.1.1 - A table showing the most important beams shown in the infrared spectra of prepared compounds

C-S-C	C-H	C=C-	NH_2	C-S	C=N	S-H	S.No
---		----	3353 - 3249	754	2769	2636	1
663	3180	1423-1496	3923-3240	--	1664	--	2

3.1.2 - Table showing the most important NMR packets for prepared compounds

C-H-1	C-H-2	C-H- 3	C-H-6	SH	NH	NH2	S.No
---	**--**	**--**	**---**	**13,16**	**--**	**7,08**	**1**
7.26-7.32	7.41-7.37	7.32-7.26	7.69	----	13.69	4.54	**2**

3.1.3 - Table showing the most important packages for C13 for prepared compounds

S.NO	C-N the aromatic ring	Carbon Thysol Ring
1	161,93	181,45
2	124,56	129,82
	127,58	141,72
	122,19	190,31
	112,88	

3.2.1 IR spectrum of composite (1)

The infrared spectrum, as shown in Fig. 3.1, shows a weak absorbance at 2636 cm^{-1}, which returns to the shingles (12) (SH), and an absorption beam at 2769cm^{-1}) (754cm^{-1}) and CS (CS). Two packages were also shown at the range (3249-3353cm^{-1}) of the NH_2 series, both symmetric and asymmetrical.

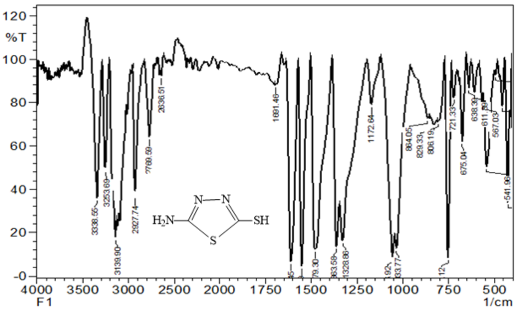


Fig. 3.1: Shows the infrared spectrum (FT-IR) of the compound (1)

3.2.2 NMR spectrum of the compound (1)

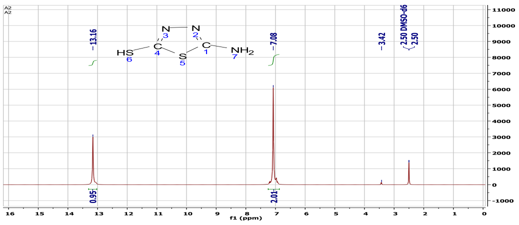


Fig. 3.2: Shows the spectrum of the nuclear resonance magnet (H-NMR) of the compound (1)

3.3.3 NMR spectrum of the compound C13 (1)

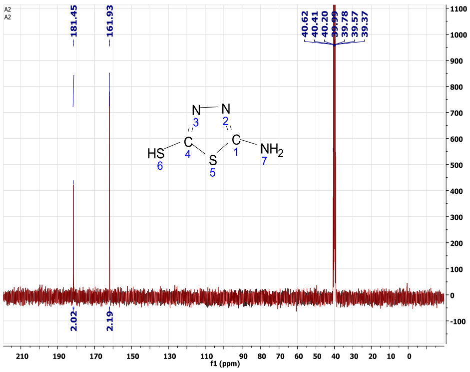


Fig. 3.3: Shows the NMR spectrum of the compound (MAT)

3.3.4 Infrared spectrum of compound (2)

In the study of the IR spectra of this compound, as shown in Figure (2), the two NHNH2 bands were present at 3392-3240 cm-1 for the asymmetric and asymmetric beams, a reference to the formation of 2-hydrazino benzothiazole formation, 3180cm-1) is due to the aromatic C-H matrix, which is the base of the two aromatic bands (C = C), which appeared at cm-1 (1496-1423), in addition to the survival of the cathode (C = N) (1664cm-1) with the disappearance of a pack in the original material of the SH and a absorption package at 663cm-1 for the C-S-C. The packets were identical to the literature (16)).

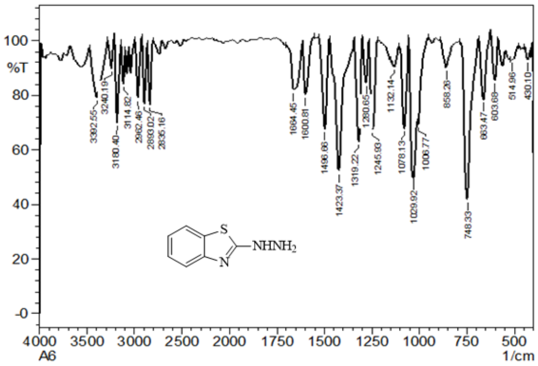


Fig. 3.4: Shows the infrared spectra (FT-IR) of the compound (2)

3.3.5 NMR spectrum of the compound (2)

The NMR spectrum of the compound, as shown in Fig. 1, showed a 13.69ppm signal from the amino acid group NH, which is associated with the carbon atom number 8 and also in 4.54ppm, Two signals within the range (7.69-7.67ppm) of the hydrogen atom associated with carbon seed No. (6). The spectrum also showed three signals within the range (7.41-7.37ppm) of the hydrogen atom associated with carbon atom number (2) Within the range (7.32-7.26ppm) of the hydrogen atoms associated with the carbon atom (3,1), which corresponds to the infrared spectrum.

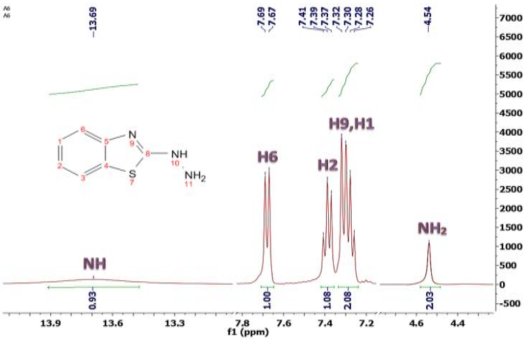


Fig. 3.5: Illustrates the spectrum NMR magnet (1H-NMR) of the compound (2)

Magnetic Resonance Spectrometer (C13) for Compound (2)
The NMR spectrum (13C-NMR) of the compound as shown in Figure (-) showed a reference at 190.31ppm to carbon atom 8 and a signal at 141.72ppm for carbon atom 5 and 129.82ppm) Belong to the carbon atom number (4). Each of the above badges belongs to the thiazol ring associated with the NHNH2 group. The spectrum also showed a signal at (127.58ppm) of carbon thrill (2), a signal of (124.56ppm) of carbon atom (1), a signal of (122.19ppm) of carbon atom (3) and a trace of (112.88ppm) No. 6, these signals belong to the benzene ring associated with the thiazol ring.

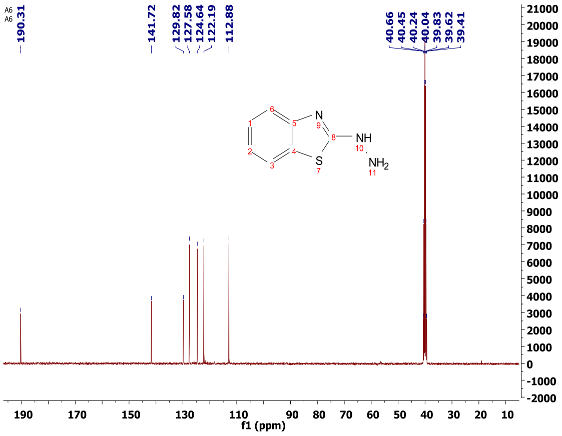


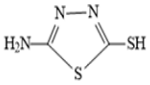
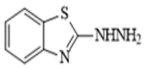
Fig. 3.6: Shows the NMR spectrum of the compound (2)

4. Test method for standard ASTM E 285-80

4.1 Results of the burning test for prepared compounds

The measured combustion time is the primary factor and is based on the results of the detection of the sacrifice, in which we can determine the resistance of the material to the fire (FR) 13 and find the other factors, the Insulation Index, the Erosion Rate, Obtained from the burning of the models of the prepared structures according to ASTM E 285-80 as follows :

Table 4.1: Variables obtained from the combustion test of prepared compounds

prepared compound	Symbol of Compound	Burning Time (sec)	Insulation Index (sec/mm)	Erosion Rate (mm/sec)
Styrene + Poly ester Poly-ole	**USPE**	716	179	0.005
	**1**	216	54	0,018
	**2**	332	83	0,012

As shown in the table above, we note that the model of the ruler made of commercial polymer (Marmolit) and without any additive was burned at a time of (716 sec), indicating the high possibility of this polymer to ignite. However, when the compound (1) contains two sulfur atoms and three hydrogen atoms, a decrease in polymer combustion time was observed. This indicates that the polymer is not flammable. It is extinguished over a very short period of time. The effectiveness of these compounds is due to the presence of sulfur and nitrogen atoms in the ring In the compositions prepared and which have a significant role in reducing the time of combustion where the atoms above as an anti-fire (FR) in its compounds added to the commercial polymer, The free radicals that act to terminate the chain reaction will be formed by the decomposition of these nitrogen-containing additives. As a result, the free radicals formed will contribute to the formation of inert compounds such as HCL, NH4OH. Consequently, the latter compounds will inhibit the continued degradation of the material surface The synergistic action between the sulfur and nitrogen elements can be observed in their ability to act as antifungal agents in the same compound (14,15). This interpretation applies to additive (1). It is worth mentioning that the addition of (0.51%) of one of the additives (2,1), which contain a high percentage of sulfur and nitrogen in their composition to the commercial polymer (Marmolit), reduced the polymer burning time by more than (60%) compared to With the combustion time of the polymer without any addition, and this gives importance to the use of these compounds in practical applications to reduce the commercial flammability of the polymer effectively. This polymer is used as adhesive material for ceramics and ceramics in kitchens where fire sources are available, increasing the likelihood of fires. The low combustion time (in seconds) reduces the Insulation Index by sec / mm and clearly increases the Erosion Rate by (mm / sec)

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