



DERIVATOGRAM ANALYSIS OF AO-3 BRAND ANTIOXIDANT PY-342, POLYETHYLENE SAMPLES

Karaev Sherali

Applicant for Shurtan Gas-Chemical Complex,
Republic of Uzbekistan, Guzar

Djalilov Abdulakhat

Academician, Doctor of Chemical Sciences, Director of Tashkent Research
Institute of Chemical Technology LLC
Uzbekistan, Tashkent region, Tashkent district

Karimov Masud

Professor, Doctor of Technical Sciences, Deputy Director
Uzbekistan, Tashkent region, Tashkent district
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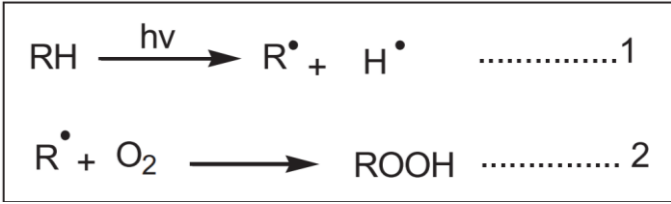
Abstract. The introduction of stabilizing antioxidants into polymers gives polymer compositions a number of valuable properties and their production and practical application become important. It is possible for these polymer materials to oxidize under the influence of sunlight. In this article, AO-3 brand stabilizer antioxidant modified different PY-342 and F-0220 S polyethylene brands and studied their properties such as thermal stability and thermal oxidation.

Keywords: polymer, stabilizer, antioxidant, phenoxy radicals, derivatogram, thermogravimetry, endothermic effect, exothermic effect, temperature range, thermal-oxidative degradation.

Introduction. Plastics are usually protected from such destruction by adding antioxidants, light and heat stabilizers [1; 171–177 p]. UV stabilizers are widely used in plastics, cosmetics and films. The main purpose of the UV stabilizer is to prevent photodestruction or photocuring of polymers under the influence of ultraviolet rays present in sunlight and artificial light sources [2; p. 279–285].

Physical or chemical stabilization of polymers against environmental degradation can be achieved by blocking any step in the degradation process. Because exposure to UV radiation is the most serious threat to environmental longevity, several strategies have been developed to combat it. UV radiation can be eliminated with various coatings or paints. Fillers such as carbon black can also be used as shielding agents, or the radiation can be harmlessly sorbed by chemicals that dissipate the photon energy without chemical change. Radical scavengers can be used to terminate chain radicals and stop the propagation steps, and there are various deactivators that serve to stabilize hydroperoxide groups formed during photolytic oxidation, as reflected in equations (1 and 2):





Photostabilization of polymers can be achieved in many ways. The following stabilization systems have been developed depending on the effect of the stabilizer: light screens, UV absorbers, excited state quenchers, peroxide decomposers and free radical scavengers are the most effective methods [3; pp. 56-67].

The main part. The derivatogram of the PY342 polyethylene sample with AO-3 stabilizer antioxidant is presented, which consists of 2 curves.

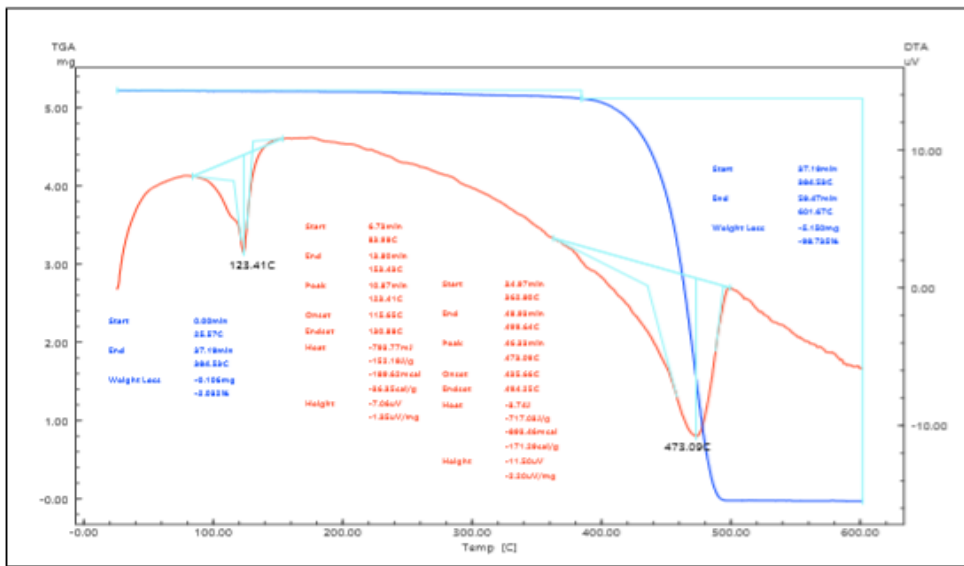
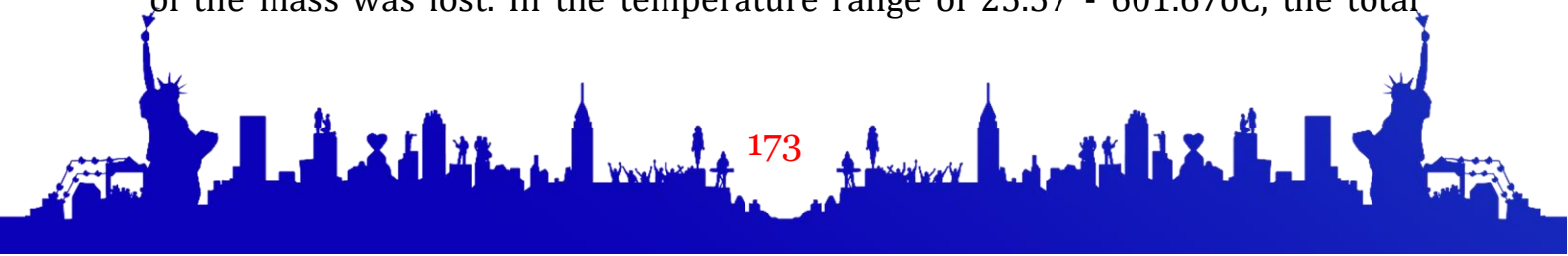


Figure 1. Derivatogram of PY342 polyethylene sample with AO-3 stabilizer antioxidant applied

TGA - thermogravimetric analysis curve;
DTA - differential thermal analysis curve.

In the derivativeogram (DTA) curve, two endothermic effects were detected at 123.410S and 473.090S, and no exothermic effect was observed. Analysis of the thermogravimetry (TGA) curve shows that 2 intense decomposition takes place in the TGA curve temperature range. The 1st decomposing interval occurred in the temperature range of 25.57-384.53oC and 0.106 mg or 2.032% of mass was lost. The 2nd decomposing interval was observed at the temperature of 384.53-601.67oC. It was determined that 5.150 mg or 96.703% of the mass was lost. In the temperature range of 25.57 - 601.67oC, the total





mass reduction was found to be 5.256 mg or 98.735%, which took 59.47 minutes.

An analysis of the thermogravimetric analysis curve and the differential thermal analysis curve is given in Table 1 below. From the table, we can see that the highest mass loss occurs in the 2nd interval, that is, 96.703% of the mass is lost in this interval.

Based on the results obtained from DTA and TGA analysis, kinetic parameters were determined for different temperature ranges of the process. Its advantage is that the kinetic properties of the reaction over the entire temperature range were calculated from a series of measurements and from a single sample.

The degree of mass loss (vm) was determined by the method of graphical differentiation of the TGA curve:

$$vm = Dm/Dt$$

here, Dm—mass loss, mg; Dt - time interval, min.

A detailed analysis of thermogravimetric analysis curve and differential thermal analysis curve is given in the table below. A detailed analysis of thermogravimetric analysis curve and differential thermal analysis curve is given in the table below.

In this TGA analysis, 98.735% of the total mass was thermally decomposed up to 600oC. (Table 1).

Table 1.

Thermogravimetry (TGA) curve analysis.

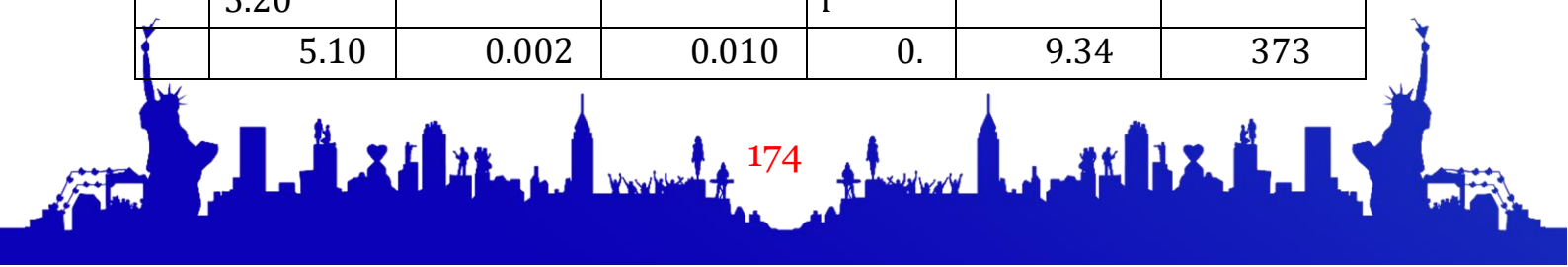
Temperat ure °C	Time minutes	Mass (mg)	Mass lost (%)
27,92- 383,22	37,19	0,106	2,032
383,22- 601,83	22,28	5,150	96,703

A detailed analysis of the thermogravimetric analysis curve and the differential thermal analysis curve is given in Table 2 below.

Table 2.

Effect of temperature on weight loss of PY342 polyethylene sample with stabilizer antioxidant AO-3

dw	1/T	dw/dt	M. r	M	T ⁰ +K
5.20					
5.10	0.002	0.010	0.	9.34	373





		6		1		
	4.85	0.002	0.018	0.	19.34	473
		1		35		
	3.96	0.001	0.042	1.	29.34	573
		7		24		
	2.97	0.001	0.056	2.	39.34	673
		4		23		
	1.33	0.001	0.078	3.	49.34	773
		2		87		
	0.17	0.001	0.084	5.	59.4	874.6
		1		03		7

The activation energy values of this process are shown for the PY342 polyethylene sample with AO-3 stabilizer antioxidant. (Table 3).

Table 3.

Results of thermal-oxidation analysis of PY342 brand polyethylene sample with AO-3 stabilizer antioxidant.

Nº	dw	5.20	$\ln(W_1/W_2)$	$1/T * 10^{-3}$
1	5.10		0.019	2.6
2	4.85		0.069	2.1
3	3.96		0.272	1.7
4	2.97		0.560	1.4
5	1.33		1.363	1.2
6	0.17		3.423	1.1

Thus, on the basis of the experimental data obtained on the kinetics of processes in the temperature range from 298.57 to 874.67 K, the properties of the thermal-oxidative degradation of the PY342 polyethylene sample with AO-3 stabilizer antioxidant were studied.

Used literature:

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2. E. Yousif, E. Bakir, J. Salimon, N. Salih, Evaluation of Schiff bases of 2,5-dimercapto-1,3,4-thiadiazole as photostabilizer for poly(methyl methacrylate), J. Saudi Chem. Soc. 16 (2012) 279–285.
3. Bagheri R., Darvishi R. Study of the effect of natural weathering on degradation of Polypropylene/starch filled polymer containing photo initiators by spectroscopic methods //International Journal of Plastics Technology. – 2015. – T. 19. – C. 56-67.

