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REFRACTOMETRIC METHOD FOR DETERMINING THE AMOUNT OF WATER IN A HOMOGENIZED SOLUTION

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Abstract. The influence of the temperature regimes of the PET esterification process on the kinetics of the process, determined by the amount of released water, was studied. At the first stage, the amount of water in the isolated azeotropic mixture was studied by refractometry and IR spectroscopy. Samples of the separated azeotropic mixture were studied at various stages of PET esterification under various temperature regimes of synthesis. Using the calibration curve and the refractive index of the by-product of PET synthesis, the results of the water content in the studied homogenized mixture were obtained. Model solutions were also studied using IR spectroscopy. The quantitative content of water was determined from the intensity of the peak of vibration of hydroxyl groups. The obtained IR spectroscopy data can be used to calibrate the analyzed solutions. The sec-

ond stage of the study was to confirm the values obtained by the refractometric method, using calculations of the acid number of the ester, determined by the acid-base titration method. The acid number for the PET-2 sample decreases with almost ninety percent conversion to terephthalic acid and at a higher temperature in the esterification step than for the PET-1 sample.

It was found that the rate of the esterification reaction increases with increasing temperature. It has been established that the depth of the esterification stage can be judged from the value of the acid number.

Keywords: Polyethylene terephthalate, ethylene glycol, water, azeotropic mixture, homogenized solution, esterification, acid number, physicochemical properties, refractometry.

[1]. () , -
[2]. , -

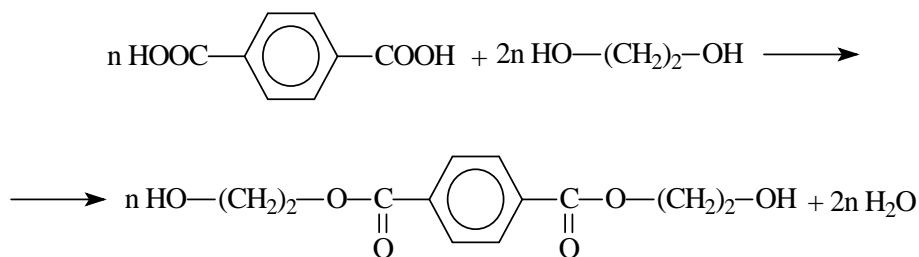
[3]. -

[4]. -

220–240 ° , -2
240–260 ° . 10 -1 -2, -1 -

-454 2 , 18995.2-2022. -
Spectrum Two, Perkin Elmer, 4000 450 ⁻¹.
22304-2015 -PT960 PRO [5].

1 [6]. , 2,6043:5,2083 ,
94 .



1. (2-)

1 [7].

$$= 2 \cdot n \cdot 56 \cdot 10^3 / (n \cdot M + n \cdot M), \quad (1)$$

n – ; M – ; n – ; M – ; M – ; / ; M – ; / .

1:2 . (1) , (2).

$$= 2 \cdot 1 \cdot 56 \cdot 10^3 / (1 \cdot 166,13 / + 2 \cdot 62,07 /) = 385,84 / , \quad (2)$$

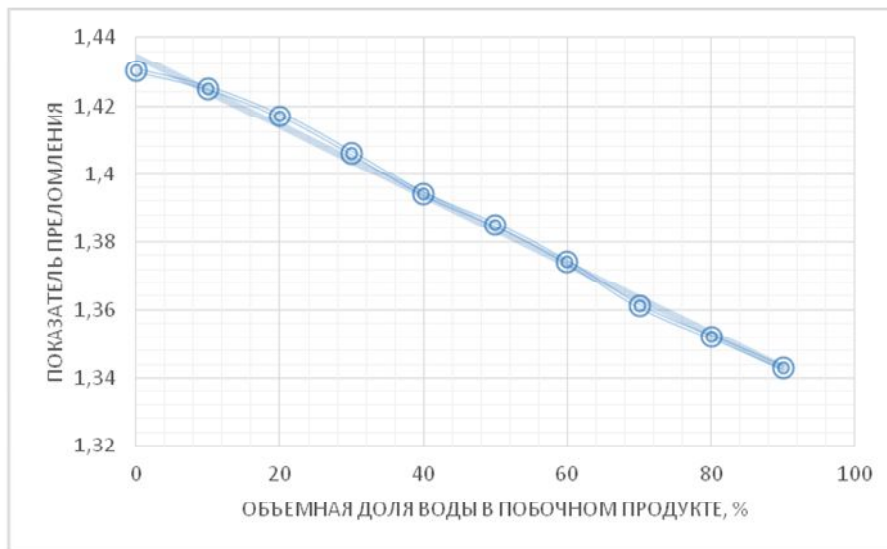
– (1) , 1 m(H₂O), (), :

$$m(H_2O) = (1 - /) \cdot 18 \cdot n , \quad (3)$$

(3)

[6].

(. 1).



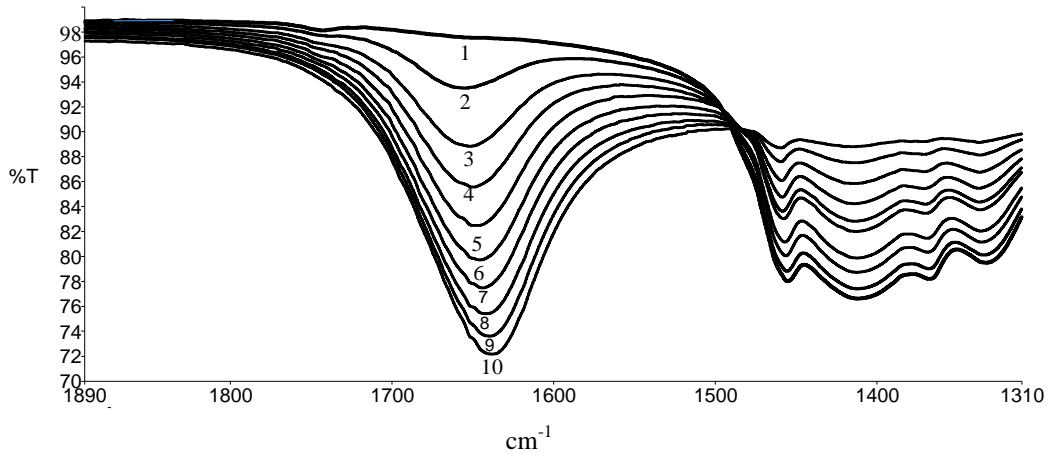
. 1.

1640

–¹,
[8].

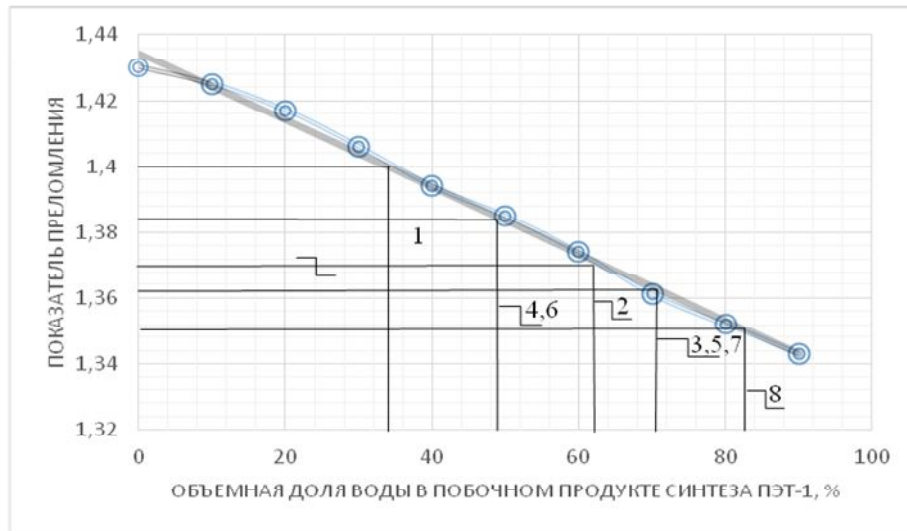
(. 2).

[9].



2. - : 1 - ; 2 - / - 90/10 %; 3 - / - 80/20 %;
 4 - / - 70/30 %; 5 - / - 60/40 %; 6 - / - 50/50 %; 7 - / - 40/60 %;
 8 - / - 30/70 %; 9 - / - 20/80 %; 10 - / - 10/90 %

3 -1. , 80



3. -1: 1 - 10 , 2 - 20 ,
 3 - 30 , 4 - 40 , 5 - 50 , 6 - 60 ; 7 - 70 , 8 - 80

(. 1).

80

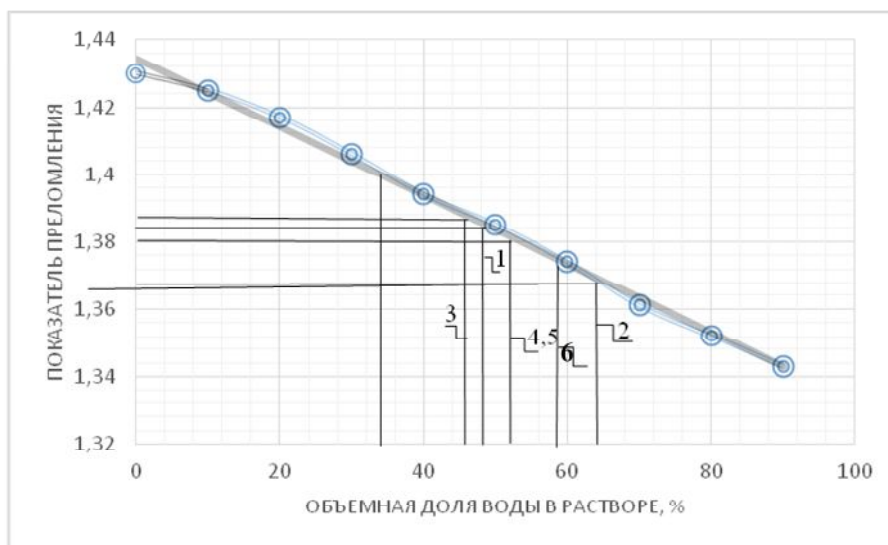
(. 1) [10].

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-1

	10	20	30	40	50	60	70	80	90
,	14,8	8,6	12,4	18,4	27,4	29,8	19	16,6	0
,	5,76	5,28	8,93	9,34	19,57	16	14,12	16	0

80
10
-
-
-
-1
-2
-2
(.4).
(.2).
60
-2.
-2 [11].



.4.
1 - 10, 2 - 20, 3 - 30, 4 - 40, 5 - 50, 6 - 60
-2:

2

-2

	10	20	30	40	50	60	70
	26,8	28	50	25	41	12	0
	13	18	21,5	13,75	21,775	6,975	0

.3
-1,

(1)-(3).

-1

-1

(.4).

3

-1

	10	20	30	40	50	60	70	80
	445,03	336,8	258,6	228,5	204,5	174,4	126,3	10
	5,76	5,28	8,93	9,34	19,57	16	14,12	16

-1

	10	20	30	40	50	60
, /	445,03	336,8	258,6	228,5	204,5	174,4
,	13	18	21,5	13,75	21,775	6,975

.4,

-2

90 %-

-1.

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