POLYMERIC COMPOSITION FOR MANUFACTURE OF FOAMED PRODUCTS

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To date, the production of foam materials and products from them is given considerable attention. New innovative technologies for the production of foamed plastics allow to obtain products with much lower weight, which reduces the need for materials, without reducing their physical and mechanical properties, but on the contrary to obtain products with unique properties that make them indispensable in operation [1].

The development and study of the composition of a copolymer of ethylene with vinyl acetate for the production of foamed products by injection molding [2]. As a result of experimental research the composition with the improved physical and mechanical indicators and a competitive price policy is developed.

When choosing the components for the development of the composition, the copolymer of ethylene with vinyl acetate (EVA) of EV101 and EVATHENE UE653 - 04 brands was chosen as the basis. which reduces cycle time and increases production productivity. Polyethylene (PE) was also added to the polymer base in the amount of 13-16%.

Due to inert fillers it was possible to significantly reduce the content of the main component of ethylene with vinyl acetate group. Inert fillers, such as calcium carbonate and talc, reduce the cost of the composition, which makes the composition competitive, while slightly reducing the physical and mechanical properties.

A foaming group has been developed, due to the foaming agent - porophore (azodium carboamide) and inert fillers - zinc oxide, zinc stearate. The foaming group provides an increase in the volume of the product during thermoforming and an expansion factor of 1.6, which is accepted in many productions of foamed products. The crosslinking group of the composition consists of two peroxide crosslinkers: a) Perkadox16 (Di (4-tert-butylcyclohexyl) peroxydicarbonate); b) dilauryl peroxide. The structuring agent of the Perkadox16 brand provides peroxide crosslinking of the EVA copolymer. It is used for giving nd fixing the shape of the product to increase strength and resistance to physical stress. Due to the introduction of dilauryl peroxide into the composition, the crosslinking group becomes more thermally stable. Recommended dosage of the additive - 0.8 - 1%.

Due to the functional impurities (foamer and crosslinker), the composition under the action of the temperature of the mold takes on additional properties, due to which the product at high volume has low weight and high strength. A 0.25% processing additive (Dynamar FX 5920 A) was introduced into the composition, which improves the properties of the composition and also speeds up the production process by reducing the time of cleaning the molds and the transition from one color to another. Formulations of the compositions that are developed as a result of research are presented in table 1. The table shows that the content of the base in the compositions ranged from 47.15 wt. % to 78.49 wt.%, fillers - calcium carbonate and talc were administered in an amount of from 7 wt. % to 15 wt. %, the number of modifying additives ranged from 8 wt.% to 15 wt.%.

Table 1– Formulations of the developed compositions based on EVA copolymer

№	Matrix			Fillers		Modifying additives		Pigment	Staplers		Foaming agent
	EVA (EV101)	EVA (EVATHENE UE653-04)	PE (158-03)	Calcium carbonate (TC-1)	Talc	Zinc stea-rat	Zinc oxide	Soot (N-220)	Perka-dox 16	Dilau-ryl peroxide	Porofor (Azodikar-bonamid)
1	78,3	-	-	15	-	1,2	2	1	0,55	0,4	1,3
2	-	78,49	0	15	-	1,2	2	1	0,55	0,4	1,3
3	58,3	7	13	15	-	1,2	2	1	0,55	0,4	1,3
4	57,3	7	14	7	8	1,2	2	1	0,55	0,4	1,3
5	57,3	7	14	7	8	1,2	2	1	0,95	0	1,3
6	57,3	7	14	7	8	1,2	2	1	0,8	0,15	1,3
7	57,2	7	14	7	8	1,2	2	1	0,475	0,475	1,4
8	55,31	7	16	7	8	1,2	2	1	0,7	0,24	1,3
9	54,02	7	16	8	8	1,2	2	1	0,53	0,7	1,3
10	47,15	7	16	8	8	1,2	2	1	0,5	0,5	1,4
11	54,3	7	16	8	8	1,2	2	1	0,5	0,45	1,3
12	55,2	7	15	8	8	1,2	2	1	0,58	0,45	1,32
13	54,19	7	16	8	8	1,2	2	1	0,52	0,44	1,4

Developed 13 compositions, of which, as further studies have shown the most optimal in composition and having improved properties was composition 12. The composition of the optimal composition is as follows: EVA (EV101) -55.2 wt.%; EVA (EVATHENE UE653-04) - 7 wt.%; PE - 7 wt.%; calcium carbonate and talc of 8 wt.%; modifying impurities - zinc stearate 1.2 wt.% and zinc oxide 2 wt.%. To determine the optimal composition of the developed composition used modern mathematical methods of experiment planning. The program of calculation of coefficients of pair regression of interaction of components of a composition was used. When conducting studies of the developed compositions determined the technological indicators – table. 2.

Table 2 - Technological performance of tests of compositions based on copolymer EVA

№	Test methods			
	Melt fluidity index, g / 10 min	Determination of specific density,kg / m^3	Coefficient of expansion	Coefficient of shrinkage
Baze	4,65	1165	1,6	0,9
1	5,35	1226	1,6	0,9
2	6,48	1213	1,6	0,88
3	6,46	1210	1,62	0,9
4	7,49	1200	1,61	0,92
5	6,91	1119	1,6	0,95
6	6,46	1115	1,6	0,91
7	6,52	1117	1,59	0,9
8	6,83	1109	1,6	0,96
9	6,61	1110	1,61	0,87
10	6,5	1108	1,6	0,92
11	6,69	1109	1,62	0,9
12	6,93	1119	1,6	0,87
13	6,35	1113	1,62	0,94

Experimental studies have shown that the most optimal in composition and with improved technological properties, was composition 12. The melt flow index is 6.93, g / 10 min, and the shrinkage coefficient is 0.87.

Foamed molded products are subject to certain requirements of the standards, based on which the quality of products is assessed by the main properties: a) wear resistance, b) strength and elongation. Wear resistance on the machine Tabera composition 12 is 2.56 g / 1000ob, tensile strength – 1.51 MPa, elongation at break – 35.05%.

Reference

1. Производство изделий из полимерных материалов / Крыжановский В.К., Кербер М.Л., Бурлов В.В., Паниматченко А.Д. - СПб: Профессия, 2004. 464 с.

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