Black Concentrates for Polyethylene

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ABSTRACT

This article describes the comparative analysis and scientific basis of the chemical properties and markets of black concentrates used in increasing the light resistance of polyethylene to be obtained in Chemical Technology.

KEYWORDS: *polymer, paint, concentrate, insulation coating, pigment, saja, structure, technical uglerod.*

Introduction

Paints and modifier concentrates used in the production of polymer materials recycling have a significant share of the paint concentrates market after White concentrates accounted for black concentrates. The main directions of the use of black concentrates are the reception and painting of packaging materials, technical products, insulation coatings from non-transparent polymers, as well as the stabilization of their resistance to light.

Literature review:

The current policies of President of the Republic of Uzbekistan Sh. Mirziyoyev, the role of Science in the development of the country's economy is incomparable [1,2,3].

2020 year in our country was declared "The year of development of Science, Education and digital economy", the priority goals in this regard were set. Taking into account the potential of the previously formed scientific schools in our country, proceeding from the directions of our national interests and development at the present stage, this year the development of the fields of Mathematics, Chemistry, Biology, Geology was selected.

Therefore, the production of polymers, including polyethylene and the receipt of various products from it, is developing rapidly. But even if the main raw material polyethylene is produced in our republic, there are enough problems with the provision of additives, superconcentrates to it.

Many polymers exhibit traditional Komplex properties. Giving them specific properties is carried out by different methods of modification. In particular, a lot of research has been carried out on the modification of polyethylene with superconcentrates. Polymers are mostly colorless, transparent, slightly changing the color of transparency, depending on the degree of crystallization. Polymers can be painted in different colors, for example yellow, red, black, brown, depending on the chemical structure, on the account of the additives added to them. The dyeing properties of plastics have made them widely used in various industries. And this is one of the main components of the technology of processing polymers.

Polymer materials can be painted in 3 Ways: 1. Coloring during the formation of polymer material; 2. Painting in the process of processing polymers; 3. Paint the resulting material in a colouring solution [4].

Methods

Thermal differential analysis, infrared spectroscopy methods, Brabender and physico-mechanical, chemical characterization equipment were used in the performance of the work.

Results and discussion

At first glance, it turned out that the demand for them is much less than for concentrates filled with white and chalk. The main pigment for the production of black concentrates is technical uglerod (saja), only in very rare cases (fibers and special-purpose concentrates) black iron oxide pigments are used. Technical uglerod has a hidden strength, in addition to painting the material in black, so it gives the properties necessary in the manufacture of polymer coatings for polymer products: pressure-resistant pipes, cables or metal pipes. An additional factor that contributes to the wide use of technical uglerod color for black concentrates is its low cost - most of it is lower than the cost of polymers. Therefore, here, unlike white concentrates, the more the amount of saja in the concentrate, the lower its price will also be.

When analyzing the properties and application of technical uglerod black concentrates, it is very important to take into account what type of technical uglerod color is used in the formation of the concentrate under consideration.

Since the Saja is mainly used as a compounding compound in rubber production (90% of the volume of production), its international classification is based on the resistance of rubber vulcanizers to feed (Table 1).

Table 1: **Basic types and descriptions of technical uglerod used for the production of black concentrates and compositions**

International name	Name of the type	Particle size, nm	Relative surface in nm	Number of m2 / g iodine	Coloring power in g/kg, %
ISAF (Intermediate Super Abrasion Furnace)	Robust in space for feeding-lik, stove	20-30	115±5	120±5	115
HAF (High Abrasion Furnace)	High-durable, stove-like for feeding	28-36	85±5	90±5	110
FEF (Fast Extrusion Furnace)	Fast extruded-digan, stove	39-55	40±5	45±5	85
SRF (Semi-Reinforcing Furnace)	Semi-conductor, stove	70-96	30±5	30±5	60
P-type	Extremely clean water to taste-noti for waterproofing	20-25	100±5	115±5	105

Concentrates with a high degree of structure in composition, a high relative surface (ISAF, HAF) have an excellent coloring ability and a maximum hiding ability, but such types of technical uglerod colors can be distributed only if the content of the concentrate is not more than 40%.

At the same time, a large part of the 50% and 60% Black concentrates are produced, that is, technical uglerod, which is well dispersible, brand SRF. The size of the granules also affects the color of the painted products - the saja in the upper structural structure with a particle diameter 20-30 nm gives

the product a blue color, the saja in the lower structural structure gives the product a brown. However, the color of the SRF technical uglerod is better distributed in the polymer, and its price is lower, so such concentrates will be cheaper.

When choosing a concentrate, it should also be taken into account that saja varieties with a high degree of structure have a strengthening effectirga on the entire surface of the polyethylene film. With the introduction of technical uglerod 2% and HAF saja 40% concentrate on the composition of the Material, the strength of the break in the stretch and the relative strain in the stretch increase. A number of foreign companies, as well as in addition to the Black color of technical uglerod for general use, add to the composition of polymer compositions saja p-type type, for the production of very clean varieties that can paint plastics and withstand light, especially pressure-resistant pipes (gas and water supply).

The difference of Saja from industrial rubber varieties is mainly in the composition of a very small amount (less than 0,1%) of zol, sulfur and extractable substances.

Therefore, these brands are approved for use in products that come into contact with food and water supply pipes, and their prices significantly exceed the prices of technical uglerod in general use. Usually, exactly the same R-Type technical uglerod is used in the production of" high-level concentrates".

The "Premium" segment includes concentrates used for painting thin polymer films and fibers, as well as high-quality polymer packaging. To create them, ISAF, HAF and P-type type high-structure PE stamps are used, and linear low-density polyethylene is used as the basis, since it has the best wetting and dispersing properties. The composition of such concentrates includes inorganic fillers with fine dispersion (chalk, talc and b.) does not enter. They have excellent internal strength ability and dark black color, so the saja should be spread so thin that the dimensions of the filter test gauge yachts should not exceed 5 bar/g when passing through a net of 5 μm. 40% li import-based and domestic "Premium-concentrates" are compared with each other, the indicators are presented in Table 2 below:

Table 2: 40% import and local "Premium-concentrates" properties compared among themselves

Indicator	Premium-concentrate 1 «BARS-2»	Premium-concentrate 2 «BARS-2»	Premium-concentrate (Belgium)	Premium-concentrate (Israel)
Polymer	PBCHPE	PBCHPE	PBCHPE	PBCHPE
Technical uglerod type	ISAF	P-type	P-type	P-type
Amount of Saja, %	40	40	40	40
Fluidity corset (21,6 kgs; 1900S), g / 10 min	85	15	120	42
Internal power (Optical density)	0,55	0,57	0,48	0,58
Filter-test, bar / g (tuh 5 microns)	1,9	0,75	2,7	7,4

Despite the fact that the price of Black"premium-concentrates " is expensive, the pace of their use is growing from year to year. In terms of their proximity to each other, calcium carbonate with fine dispersion is also approaching the "premium class" of concentrates used to stabilize the tube and cable compositions to sunlight. As a rule, they contain 30-40% of ISAF or P-type type saja with a high structure. The same type used in the production of pressurized gas and water pipes as the polymer basis is linear PE or low pressure derived PE.

Saja ointment is spread evenly on the dispersants, at low pressure is added in the composition of the obtained PE in an amount of not less than 2,5% and does not adversely affect the consistency properties of the composition. Only PE compositions obtained at low pressure, stabilized to light, such as PE-80 and PE-100, can be certified.

The following table 3 lists the composition and properties of some local and import-based black concentrates for composition production:

Table 3: Comparison of domestic and import-based 40% technical uglerod concentrate properties used for the production of black compositions

Indicator	Concentrate «BARS-2»	Concentrate (Russia)	Concentrate (Belgium)
Polymer	PBCHPE	PBCHPE	PBPE
Technical uglerod type	ISAF	ISAF	P-type
Amount of Saja, %	40	40	40
Fluidity corset (21,6 kg s; 1900S), g / 10 min	7	3	20
Internal power (Optical density)	0,68	0,60	0,52
Consistency in stretching, MPa	31,2	25,5	24,8
Relative stretching, %	1020	890	680
Filter-test, bar/g (to‘r 5 mkm)	1,0	8,7	1,5

The volume of production of special saja concentrates accounts for 40 percent of the total production volume of concentrates, but they are mainly produced in the factories themselves, compositions that can be stabilized against light as an intermediate product and are not withdrawn for sale in free trade. Black polyolefin concentrates of "standard grade" are well known in the market for their ability to be used for dyeing a variety of polymer products - details used for structural purposes, curtains, profiles and polymer packaging films. Expensive, very clean, highly structured saja varieties are no longer required for their production; it is enough to add a technical uglerod or HAF/ FEF mixture of FEF type. As a polymer basis, neither can be used not only from linear PE, which is obtained at high pressure, but also from more inexpensive brands of PE.

But the most important thing is to add calcium carbonate (chalk) with a fine dispersion in the concentration of 5-20% to reduce the cost of the recipes.

Generally speaking, the little introduction of chalk into saja concentrates can enhance the color rendering ability due to the dispersion of submicron saja particles on the surface of large particles of calcium carbonate, give hardness to polymer profiles and slightly increase the cross-strength for

films, improve technological properties such as payvandation of films on account of antifibrillation and anti-corrosive effectadorlik.

Comparison of imported-based and domestic black concentrates properties, which are included in the "standard-concentrate" type, is presented in Table 4 below:

Table 4: Comparison of imported-based and domestic black concentrates properties of "standard-concentrate" type

Ko‘rsatkich	Standart-konsentrat 1 «BARS-2»	Standart-konsentrat 2 «BARS-2»	Standart-konsentrat (AQSH)	Standart-konsentrat (Germaniya)
Polimer	YUBPE	YUBPE	YUBPE	YUBPE
Technical uglerod type	HAF/ FEF	FEF	p/b	p/b
Amount of Saja, %	45	35	50	45
Amount of chalk, %	-	20	10	10
Fluidity corset (21,6 kg s; 1900S), g / 10 min	10	50	15	17
Internal power (Optical density)	0,55	0,48	0,51	0,56
Filter-test, bar/g (10 MGM)	4,5	8,5	5,0	6,2

"Iqtisodiy konsentratlar" qo‘llanilish doirasining kengligi esa ularni mustahkamlik sifatlari, plyonkalar, pardalar va profillarning quyuq qora ranglarda bo‘lishi kabi unchalik muhim bo‘lmagan sohalarda qo‘llanilishidir. Ular axlat va arzon bo‘lgan qadoqlash paketlari, qora qurilish qoplari va plyonkalari, drenaj va kanalizatsiya quvurlari va arzon bosim ostida quyish mahsulotlari (kiyim ilgichlar, iplar uchun bobinalar va boshqalar) ishlab chiqarishda ishlatiladi.
Sajaning miqdori HAF, FEF yoki SRF kabi tiplari tarkibida 30% dan oshmaydi, ammo mayda dispersli bo‘rning ulushi 50% dan oshishi mumkin.

The breadth of the scope of application of" economic concentrates " is the application of them in areas of non-essential qualities of consistency, such as the presence of films, curtains and profiles in dark black colors. They are used in the production of garbage and inexpensive packaging bags, Black Construction bags and films, drainage and sewage pipes and low-pressure bottling products (hangers for clothes, bobbins for threads, etc.).

The amount of SAJ does not exceed 30% in the composition of such types as HAF, FEF or SRF, but the percentage of fine dispersion chalk can exceed 50%.

Comparison of domestic and import-based black "economic-concentrates" properties is presented in Table 5:

Table 5: Comparison of domestic and import-based black "economic-concentrates" properties

Indicator	Economic-concentrate 1 «BARS-2»	Economic-concentrate 2 «BARS-2»	Economic-concentrate (Israel)	Economic-concentrate (China)
Polymer	PEVD	PEVD	PEVD	PEVD
Technical uglerod type	FEF	HAF	HAF	p/b
Amount of Saja, %	30	20	20	30
Amount of chalk, %	35	55	45	35
Fluidity corset (21,6 kg s; 1900S), g / 10 min	50	34	200	44
Internal power (Optical density)	0,34	0,28	0,26	0,35
Filtr-test, bar/g	10 mkm	7,7	5,5	-
	15 mkm	-	-	6,6

The comparison of the data from Tables 3 and 4 shows that the" economic class "concentrates are much worse than the" standard concentrates", while the filter-test indicators have also deteriorated. Therefore, they can be used with caution for painting thin PBPE films and domestic products.

In addition, the presence of a large amount of calcium carbonate affects the color of the painted products (it acquires a whitening color). But Everything is determined by the price – on account of significantly cheaper components (calcium carbonate and saja), the cost of black "economic concentrate" can also be lower than the cost of the polymer being painted. Therefore, such" anti-crisis " recipes are in great demand in the market - their share has almost doubled in the last 3 years.

Conclusion

This brief overview of the black concentrates market shows that now the consumer can find the desired product for almost any purpose, and the local black concentrates do not stay out of the imported products in terms of their basic technical characteristics.

Just do not chase the cheap price, it is necessary to take into account the requirements for the quality of the products produced, with the right choice of black concentrate, optimal dosage and good spacing of the concentrate. The polymer physical and mechanical properties are improved, the polymer product is stable to sunlight, and the Black color is capable of long-term performance [9].

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