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PLASTIFICATION OF POLYMER COMPOSITIONS BASED ON POLYVINYL CHLORIDE AND ETHYLENE COPOLYMER WITHVINYL ACETATE

G.O.Samieva
D.N. Yusupova
G.M.Mukhtarova
Bukhara Engineering – Technological Institute
Bukhara, Uzbekistan

Abstract: *The effect of dibutyl phthalate, chlorinated paraffinic oil and industrial oil on changes in the deformation and strength properties of polymer compositions based on polyvinyl chloride and ethylene vinyl chloride copolymer has been studied.*

Key words: *polymer composition, plasticizers, polyvinyl chloride, ethylene-vinyl acetate copolymer, deformation and strength properties.*

Almost all polymer materials used in industry are multicomponent systems.

Multicomponent polymer materials fully include plasticized and filled polymers, mixtures of polymers, which are compositions of higher degrees of complexity.

It is well known that the properties of such simple compositions as a homopolymer - plasticizer or homopolymer - filler can no longer be considered within the framework of additivity schemes, i.e. based on the known characteristics of the original components. Even greater deviations from additivity are observed in mixtures of two or more polymers [1]. In such mixtures, depending on the level of compatibility of the components, a wide range of modifications of the values of various property indicators is possible. A correct description of plasticized and filled polymer mixtures requires taking into account their multicomponent nature.

Plasticizers are widely used in polymer compositions, changing the values of the technological properties of mixtures and the technical parameters of polymer materials. As a result of plasticization of polymer compositions, viscosity decreases and plasticity increases, energy costs for the production and processing of compositions decrease, and the cost of materials decreases.

A prerequisite that determines the possibility of practical use of plasticizers is their compatibility with the polymer.

It is quite difficult to select the type of plasticizer for polymer compositions based on polyvinyl chloride and ethylene-vinyl acetate copolymer due to the two-phase nature of its compositions.

As a base composition to identify the influence of various types and quantities of plasticizers on changes in the deformation-strength properties of TPC, a polymer mixture based on suspension polyvinyl chloride and a copolymer of ethylene with vinyl acetate having the initial values of the property indicators given below was used.

Density, kg/m^3	1,25
Shore hardness, conventional units	78
Tensile strength, MPa	12,0
Elongation at break, % Relative Residual	 250 18

The influence of three types of plasticizers was studied: dibutyl phthalate (DBP), liquid chlorinated paraffin (HP-418), industrial oil (I-12 A).

The indicated plasticizers in amounts of 5, 10, 15, 20% were introduced into the polymer composition by thermomechanical mixing under certain conditions in the mixing chamber of a plastic corder from Brabender (Germany) model PLV-651. Technical characteristics of the plastic corder:

Load volume	60-600 см^3
Front rotor speed	2-150 об/мин
Mixing chamber temperature	18-300 ^{0}C.

The technology for manufacturing polymer mixtures consists of the following operations:

1. Preparation of raw materials and ingredients.

1.1. Drying of polymers.

1.2. Grind clumped ingredients.

2. Mixing components.

2.1. Mixing and melting of the thermoplastic with the copolymer was carried out in the mixing chamber of the plastic corder with constant intense stirring at a temperature 10-40 0C above the melting point of the thermoplastic for 2-6 minutes.

3. Cooling and granulation.

3.1. The resulting homogeneous thermoplastic mixture was cooled on cold rollers.

3.2. Granulation was carried out on a granulator from Marris (Italy). As a result of granulation, granules measuring 2-4 mm were obtained.

4. Recycling. To increase the homogeneity of the mixture, the composition was re-melted, cooled and granulated.

5. Samples for testing were obtained by pressing on vulcanization presses and by casting on an automatic molding machine from Marris (Italy). At a plate temperature of 190-200 0C and a pressure of 15 MPa for 5 minutes. The size of the test samples is 150x100x6 mm.

To assess the qualitative and quantitative indicators of the properties of thermoplastic polymer compositions, standard and original research methods were used using modern equipment and devices.

The introduction of plasticizers makes it possible to expand the range of sub-zero temperatures, reduce the processing temperature, and, in the optimal version of the latter, ensure a decrease in the viscosity of the melt of the compositions.

The most effective plasticizer for TPC should be recognized as HP-418 and DBP (Fig. 1, a, b), the introduction of which in an amount of 10-15% increases the tensile strength from 1.5 to 2.5 MPa.

The different degrees of influence of plasticizers on reducing the viscosity of the composition can be explained by the chemical composition of plasticizers and, as a consequence, different compatibility with TPC.

DBP is an active plasticizer that combines well with both polyvinyl chloride and ethylene-vinyl acetate copolymer, so the plasticization effect is most pronounced.

HP-418 has better compatibility with polyvinyl chloride than with ethylene vinyl acetate copolymer, and a higher molecular weight than DBP. All this leads to a decrease in the plasticization effect.

I-12A is compatible with the copolymer phase of TPK, which is a discrete phase of the polymer mixture, therefore its influence on the change in effective viscosity is significantly lower than other types of plasticizers under consideration.

The degree of influence of plasticizers on changes in the values of deformation-strength properties of compositions is determined by their compatibility with the two-phase TPC matrix.

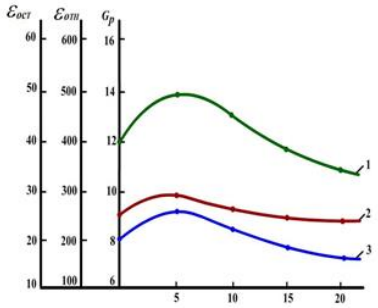
The elongation at break indicator is characterized by a linear dependence with increasing content of the DBP plasticizer in the composition. I-12A has practically no effect on this indicator. The optimal amount of HP-418 in the composition is 5-10%; an increase in the content of HP-418 leads to a decrease in the elongation at break.

The residual elongation index decreases with the introduction of plasticizers KhP-418 and I-12A into the composition.

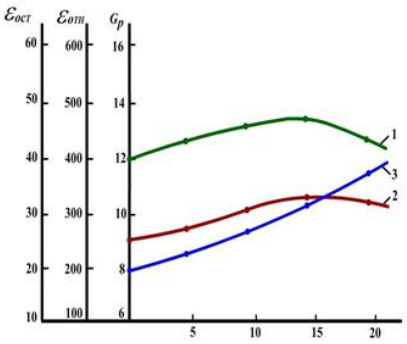
The introduction of DBP into the composition leads to a sharp increase in the values of the residual elongation index, which may be due to the effect of structural plasticization [2]. This hypothesis is confirmed by the complete restoration of the

original dimensions of the samples after they were kept in a thermostat at a temperature of 70 0C for 2 hours.

The main disadvantage of using plasticizers is the reduction in the strength values of plasticized polymer compositions. The studied types of plasticizers have different effects on the strength values of the compositions (Fig. 1, a, b): an additive decrease in tensile strength when using I-12A and a non-additive decrease for other types of plasticizers.



a)



b)

Fig.1. a) Content of chlorinated paraffin, parts by mass. per 100 parts by mass polymer composition. b) DBP content, parts by mass. per 100 parts by mass polymer composition.

The introduction of 5% HP-418 into the composition sharply increases the value of the strength indicator; when adding more HP-418, a monotonous decrease in strength occurs.

A small amount of 5-15% DBP in the matrix sharply increases the strength characteristics of the composition, which can be explained by the effect of structural plasticization of the continuous polyvinyl chloride phase of TPC.

Thus, the identified dependencies make it possible to specifically regulate the process of processing polymer compositions.

REFERENCES:

1. Manson D.J., Sperling L. Polymer mixtures and composites. M., 1979.

2. Andrianova G.P. Physico-chemistry of polyolefins (structure and properties). M., 1974.

3. Musaev S.S., SamievaG.O. Determination of one indicators of the quality of shoe sources of the understanding materials // International Journal of Advanced

Researh in Science, Engineering and Technology. Volume 6. Issue 9, September 2019. P.10865-10869.

4. Musaev S.S., SamievaG.O. The study of thermodynamic compatibility of polymers. EPRA International Journal of Researh & Development (IJRD).Impact Factor:7.001. Volume 5. Issue 5, May 2020, pages 411-420.

5. Musaev S.S., Samieva G.O., Majidov Z.Z. Investigation of the Possibility of using Suspended Polyvinyl Chloride and Ethylene – vinyl Acetate Copolymer to Produce a Thermoplastic Polymer Composition.International Journal of Emerging Trends in Engineering Research. Volume 8. No.10, October 2020. P.7105-7110. ISSN 2347 – 3983.

6. Askarovich, M. S., Uljaevna, U. O., & Inomjohnovna, O. N. (2020). Applying case study-method in teaching chemistry. Проблемы современной науки и образования, (3 (148)), 62-64.

7. Уринова, О. У., Абдуллаева, У. Г., & Матмуродов, У. У. У. (2020). СОВРЕМЕННЫЕ АКТИВНЫЕ И ИНТЕРАКТИВНЫЕ ТЕХНОЛОГИИ ОБУЧЕНИЯ ХИМИИ. Вестник науки и образования, (21-2 (99)), 62-64.

8. Нишонов, М. Ф., & Уринова, О. У. (2019). Оптимизация процесса повторения в системе непрерывного образования. Проблемы современной науки и образования, (12-1 (145)), 81-83.

9. Уринова, О. У. (2019). Дидактическое усовершенствование курса «Технологии обучения химии и проектирование». Проблемы современной науки и образования, (11-2 (144)), 78-80.

10. Нишонов, М. Ф., & Уринова, О. У. (2019). Оптимизация процесса повторения в системе непрерывного образования. Проблемы современной науки и образования, (12-1 (145)), 81-83.

11. Уринова, О. У. (2019). Дидактическое усовершенствование курса «Технологии обучения химии и проектирование». Проблемы современной науки и образования, (11-2 (144)), 78-80.

12. Уринова, О. (2022). Бўлажак мутахассисларни касбий фаолиятга тайёрлаш мазмуни. ИННОВАЦИИ В ПЕДАГОГИКЕ И ПСИХОЛОГИИ, 5(1).

13. Уринова, О. У., & Хайиткулов, Д. Х. ИННОВАЦИОННЫЕ ТЕХНОЛОГИИ ОБУЧЕНИЯ ХИМИИ. УЧЕНЫЙ XXI ВЕКА, 33.

14. Уринова, О. У., & Саттаров, Б. С. (2015). Использование интерактивных мультимедийных технологий в обучении студентов-химиков в университетах Узбекистана. Актуальные проблемы гуманитарных и естественных наук, (4-2), 168-171.

15. . Fozilovich, N. M., Uljaevna, U. O., & Bakhtiyorovna, I. N. (2020). Modern technologies of project work in teaching chemistry. Проблемы современной науки и образования, (3 (148)), 52-54.

16. Юсупова, О. (2023). DIFFERENT CLASSIFICATION OF FAIRYTALE DISCOURSE IN WORLD AND UZBEK FOLKLORE. Ижтимоий-гуманитар фанларнинг долзарб муаммолари/Актуальные проблемы социально-гуманитарных наук/Actual Problems of Humanities and Social Sciences., 3(8).