



URGANCH DAVLAT TIBBIYOT INSTITUTI JANUBIY OROLBO'YI TIBBIYOT JURNALI

2 - TOM, 3/1 - SON. 2026

14.00.00 - TIBBIYOT FANLARI ISSN: 3093-8740

UDC: 678.743.22:678.01:547.7

ENHANCEMENT OF THE STABILITY OF POLYVINYL CHLORIDE BY CERTAIN HETEROCYCLIC SALTS AND EVALUATION OF ITS ANTIMICROBIAL ACTIVITY

Masharipov Sobir Masharipovich



Professor of the Department of Pharmacy and Chemistry,
Alfraganus University;
Professor, Tashkent State Medical University, Tashkent, Uzbekistan
Tel.: +998991324049

E-mail: masharipov_sobir@mail.ru

ORCID: <https://orcid.org/0009-0002-0371-039X>

Here is the correct academic English translation:

Matyakubova Dinara Shukhratovna



Assistant, Department of Medical and Biological Chemistry,
Urgench State Medical Institute, Urgench, Uzbekistan

Tel.: +998970906119

E-mail: dinaraashuxratovna9588@gmail.com

ORCID: <https://orcid.org/0009-0005-0343-043X>

Tillayeva Adolat Farkhodovna



Assistant, Department of Medical and Biological Chemistry,
Urgench State Medical Institute, Urgench, Uzbekistan

Tel.: +998999436388

E-mail: tillayevaadolat328@gmail.com

ORCID: 0009-0008-8002-3523

Abstract:

During the production, storage, and use of polyvinyl chloride products, as a result of aging under the influence of ultraviolet rays, radiation, temperature, air oxygen, humidity, and other factors, HCl release, double bond formation, and oxidation are observed, along with certain disruptions in the macrochain. To prevent such phenomena, i.e., the use of low-molecular-weight stabilizing additives in the industry to stabilize polyvinyl chloride products, i.e., their high-molecular-weight counterparts instead of low-molecular-weight stabilizers, or the prolongation of the useful life of polymer products by chemically binding the same substances to the chain of the polyvinyl chloride macromolecule, can solve many economic problems of the consumer.

Keywords: Polyvinyl chloride, benzimidazole, 2-crotonoilaminobenzimidazole, 2-metacryloilaminobenzimidazole, sodium salt of benzimidazole, tin salt of benzimidazole, cadmium salt of benzimidazole, cobalt salt of benzimidazole.



URGANCH DAVLAT TIBBIYOT INSTITUTI JANUBIY OROLBO'YI TIBBIYOT JURNALI

2 - TOM, 3/1 - SON. 2026

14.00.00 - TIBBIYOT FANLARI ISSN: 3093-8740

POLIVINILXLORIDNING AYRIM GETEROTSIKLIK TUZLAR TA'SIRIDA BARQARORLIGINI OSHIRISH VA UNING ANTIMIKROB FAOLLIGINI BAHOLASH

¹Masharipov S.M., ²Matyakubova D.Sh., ³Tillayeva A.F

¹Alfraganus Universiteti, Toshkent davlat tibbiyot universiteti, Toshkent sh., O'zbekiston

²Urganch davlat tibbiyot instituti, Urganch sh., O'zbekiston

³Urganch davlat tibbiyot instituti, Urganch sh., O'zbekiston

Annotasiya:

Polivinilxlorid mahsulotlarini ishlab chiqarish, saqlash va foydalanish davridagi ultrabinafsha nurlar, radiatsiya, harorat, havodagi kislorod, namlik hamda boshqa omillar ta'sirida eskirishi natijasida HCl chiqishi, qo'shboq' hosil bo'lish, oksidlanish bilan bir qatorda makrozanjirdagi ayrim buzilishlar kuzatiladi. Bunday hodisalarni oldini olish uchun ya'ni polivinilxlorid mahsulotlarini stabillash uchun sanoatda kichik molekulyar massali stabillovchi qo'shimchalar ya'ni kichik molekulyar massali stabillovchi moddalar o'rniga ularni yuqori molekulyar massali safdoshlarini ishlatish yoki aynan shunday moddalarni polivinilxlorid makromolekulasi zanjiriga kimyoviy bog'lab polimer buyumlarning foydali xizmat muddatini uzaytirish iste'molchining ko'plab iqtisodiy muammolarini hal qilishi mumkin.

Kalit so'zlar: Polivinilxlorid, benzimidazol, 2-krotonoilaminobenzimidazol, 2-metakriloilaminobenzimidazol, benzimidazolni natriyli tuzi, benzimidazolni qalayli tuzi, benzimidazolni kadmiyli tuzi, benzimidazolni kobaltli tuzi.

ПОВЫШЕНИЕ СТАБИЛЬНОСТИ ПОЛИВИНИЛХЛОРИДА ПОД ВОЗДЕЙСТВИЕМ НЕКОТОРЫХ ГЕТЕРОЦИКЛИЧЕСКИХ СОЛЕЙ И ОЦЕНКА ЕГО АНТИМИКРОБНОЙ АКТИВНОСТИ

¹Машарипов С.М., ²Матякубова Д.Ш., ³Тиллаева А.Ф

¹Университет Аль-Фраганус, Ташкентский государственный медицинский университет, г. Ташкент, Узбекистан

²Ургенчский государственный медицинский институт, г. Ургенч, Узбекистан

³Ургенчский государственный медицинский институт, г. Ургенч, Узбекистан

Аннотация:

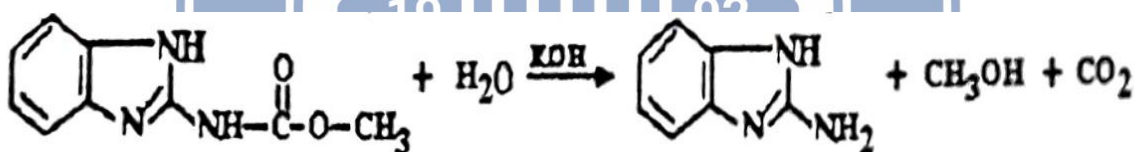
В процессе производства, хранения и использования поливинилхлоридных изделий в результате старения под воздействием ультрафиолетовых лучей, радиации, температуры, кислорода воздуха, влажности и других факторов наряду с выделением HCl, образованием двойной связи, окислением наблюдаются некоторые нарушения в макроцепи. Для предотвращения таких явлений, то есть для стабилизации поливинилхлоридных изделий в промышленности вместо низкомолекулярных стабилизирующих добавок, то есть низкомолекулярных стабилизирующих веществ, использование их высокомолекулярных аналогов или химическое связывание таких же веществ с цепью макромолекулы поливинилхлорида может решить многие экономические проблемы потребителя.

Ключевые слова: Поливинилхлорид, бензимидазол, 2-кroтоноиламинобензимидазол, 2-метакрилоиламинобензимидазол, натриевая соль бензимидазола, оловянная соль бензимидазола, кадмиевая соль бензимидазола.

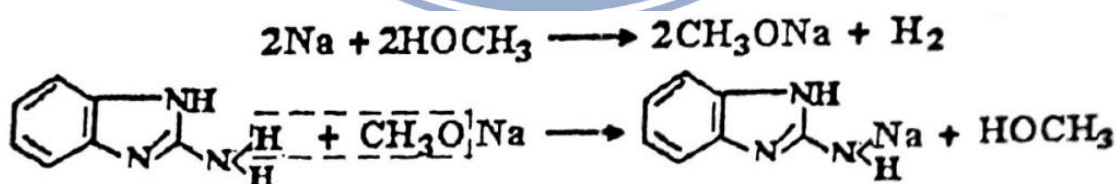
Relevance. Taking into account that quality is the first indicator in the development of polyvinyl chloride (PVC) products, which are displacing metal products from the consumer market every day, extending the service life of polymer products can provide an opportunity to solve many economic issues of the consumer [1,2]. Based on the information in the literature, the presence of heteroatom nitrogen in the aromatic ring of 2-aminobenzimidazole (AB), based on its structure and properties, it is possible to predict that the substance has thermal stability and antioxidant capacity [3].

The main objective of this research work is to stabilize PVC in the presence of heterocyclic compounds with multidirectional functional group and to produce an efficient, harmless, and harmless AB derivatives with industrially added stabilizers. study of the synergistic nature of mixtures in terms of one or more operational indicators and stabilization compounds containing lead metal used in the production of PVC-based artificial leather, linoleum and various household utensils replacement.

PVC (S-7059-M, $\eta=129000$, $\rho=1.38 \cdot 10^{-4} \text{ mol/kg PVC}$, $d=0.45-0.55 \text{ g/cm}^3$) was immersed in ethanol three times from its solution in tetrahydrofuran, and then "It was purified by extraction with ethyl alcohol in the Soxhlet apparatus. AB was obtained by hydrolysis of 2-methylcarbomatebenzimidazole using a 10% solution of KOH as follows:



The purity of the substance was checked on silofol plates, $R_f = 0.58$ if the eluent was benzene:acetone (1:1). To synthesize the sodium salt of AB (Na-AB), methanol, sodium metal and AB were dissolved in a reflux flask and the reaction was carried out using a water bath:



Results and its discussion: A white, very hygroscopic crystalline substance was dried over P2O5 in a vacuum cabinet. To obtain other salts of AB, Na-AB solution in absolute methanol was treated with chlorides of the desired metals. The formed salts were easily washed off with water because they are poorly soluble in water. Thermostability of PVC was determined by changing the color of Congo red paper indicator. Studies of the kinetics of dehydrochlorination of PVC were carried out using an alcohol solution of an indicator (a mixture of metal red and bromcresol blue) in an oxygen flow at a speed of $\theta = 0.12 \text{ l/min}$. Studying the effect of the compounds taken for research on the thermal stability of PVC in isothermal and dynamic conditions shows that the



URGANCH DAVLAT TIBBIYOT INSTITUTI JANUBIY OROLBO'YI TIBBIYOT JURNALI

2 - TOM, 3/1 - SON. 2026

14.00.00 - TIBBIYOT FANLARI ISSN: 3093-8740

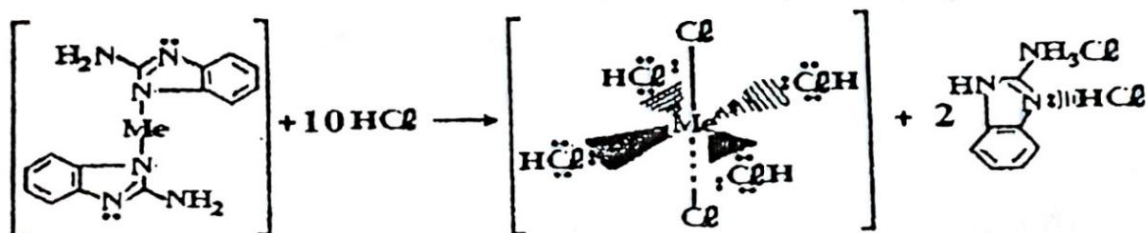
period of thermal stability depends on the metal that formed the salt, the group in its composition (table).

table 1.

The effect of nitrogen-containing heterocyclic compounds (0.1 mol/kg PVC) on the thermal stability of PVC in isothermal ($T = 448$ K) and dynamic conditions

Name of the compound	Thermal stability period, 10^2 s	Decomposition temperature, K		E kJ/mol
		beginning	maximum	
No PVC additives	3	463	523	108
Benzimidazole (BI) sodium salt	18	-	-	-
Tin salt of BI	24	500	528	125
Cadmium salt of BI	40	500	528	130
Cobalt salt of BI	60	500	532	139
Zinc acetate complex salt of BI	106,2	498	535	148
Cobalt acetate complex salt of BI	108	503	540	163
tin salt of 2-aminobenzimidazole (2-AB)	39	483	540	127
2-AB cadmium salt	50	493	543	138
Cobalt salt of 2-AB	60	498	540	147
Zinc acetate complex salt of 2-AB	112,2	498	535	159
Cobalt acetate complex salt of 2-AB	115,8	503	545	165
2-aminoquinazalone-4 cobalt salt	22,8	493	533	120
Cobalt salt of N-acryloylbenzoxazalone	31,8	-	-	134
Calcium stearate	15	473	530	120
Lead silicate	17	470	525	117

Stabilization activity is high in cobalt salts, increasing the period of thermal stability by 4 (20) times compared to the composition (pure PVC) with the addition of industrial stabilizer calcium stearate. A clear slowdown in the weight loss of PVC samples undergoing thermooxidation and destruction in non-isothermal conditions was observed in the presence of 2-AB salts. It can be concluded that the introduction of the NN2 group into the 2nd state of the heterocycle leads to a partial increase of this indicator, which is related to the fact that it has a relatively greater ability to bind HCl released from the PVC macromolecule, or [4,5]:



It is known that it is possible to obtain a good synergistic effect from mixtures of stabilizers used in industry with benzimidazole (BI) derivatives, which can be exchanged for an HCl atom and a labile chlorine atom. Based on this conclusion, the influence of mixtures of various compositions consisting of salts synthesized with calcium stearate and lead silicate on the thermal decomposition of PVC was studied. Measurements of the values of the thermal stability period of polymer samples show that calcium stearate and salts of BI and 2-AB give a synergistic effect.

Conclusions: The effect of salts as a stabilizing agent can be explained as follows:

- its effect disappears when the labile chlorine atom of the irregularly formed carbonylallyl groups in the chain is replaced by a stabilizing group;
- heteroatom nitrogen absorbs HCl by forming a donor-acceptor bond;
- It is also observed that metals form coordination compounds with HCl in salts of d-metals.

LIST OF LITERATURE:

- [1] Wilkie Ch., Summers Dj., Daniels Ch. Polyvinyl chloride. M.: Profession. 2017 year.
- [2] Kerber M.L. Polymer composite materials. Structure. Svoystva. Technologii. M.: Profession. 2020.
- [3] Azotsoderjashchiiyeheterosikly / Pod red. V.G. Karseva. V 2t. M.: IBS PRESS, 2021.
- [4] Haustkraft K., Constable E. Sovremennyy kurs obschei khimii. V 2t. T. 2: Per. s angle. M.: Mir, 2020.
- [5] Lyamkin D.I., Jemerikin A.N., Kobets A.V. I am a doctor. Vliyanieusloviytermicheskogostarenianastrukturno – mekhanicheskiesvoystva PVC plasticata // Plasticheskiye massy. 2019.