# AKRIL KISLOTA ASOSIDA ANTIPIREN SINTEZI

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**Annotasiya:** Ushbu ishda akril kislota bilan ammoniy digidrofosfat asosida galogensiz antipiren sintez qilish usuli keltirilgan. Jarayonga turli omillar: harorat, erituvchining tabiati, reaksiya vaqtining ta'sirini o‘rganish asosida optimal sharoitda reaksiya unumi 88% bo‘lishi aniqlangan. Sintez qilingan moddaning strukturasi IQ-spektral tadqiq usuli yordamida aniqlangan. Sintez qilingan mahsulotning IQ spektrida $NH_4^+$ guruxining valent tebranishlariga xos bo’lgan yutilish chizig‘i 3136 $cm^{-1}$ sohada, -C=C- bog‘ining valent tebranishlari kuzatildi.

**Kalit so‘zlar:** antipiren, ammoniy digidrofosfat, metakril kislota, olovbvrdosh, polimer.

**Аннотация:** В данной работе представлен способ синтеза безгалогеновых антипиренов на основе акриловой кислоты и дигидрофосфата аммония. На основании изучения влияния различных факторов на процесс: температуры, природы растворителя, времени реакции, установлено, что выход реакции в оптимальных условиях составляет 88%. Структура синтезированного вещества установлена методом ИК-спектрального исследования. В ИК-спектре синтезированного продукта в области 3136 $см^{-1}$ наблюдается линия поглощения, характерная для валентных колебаний группы $NH_4^+$, и валентных колебаний связи -C=C-.

**Ключевые слова:** антипирен, дигидрофосфат аммония, метакриловая кислота, антипирен, полимер.

**Abstract:** This paper presents a method for synthesizing halogen-free flame retardants based on acrylic acid and ammonium dihydrogen phosphate. Based on a study of the influence of various factors on the process, including temperature, solvent, and reaction time, it was found that the reaction yield under optimal conditions is 88%. The structure of the synthesized substance was established by IR spectral analysis. The IR spectrum of the synthesized product exhibits an absorption line at 3136 $cm^{-1}$, characteristic of the stretching vibrations of the $NH_4^+$ group and the stretching vibrations of the -C=C- bond.

**Keywords**: fire retardant, ammonium dihydrogen phosphate, methacrylic acid, fire retardant, polymer.



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## Kirish

Hozirgi kunda, jahon miqyosida polimer mahsulotlariga bo'lgan ta'lab kundan-kunga oshib bormoqda. Polimerlarning yonuvchanligini kamaytirish uchun ularga qo‘shimchalar – olovga chidamli moddalar (antipirenlar) kiritiladi. Polimerlarning yonish mexanizmini va olovga chidamli moddalar qo‘shimchalari orqali ularning yonuvchanligini kamaytirish mexanizmini o‘rganish, ham nazariy, ham amaliy ahamiyatga egadir.

## ADABIYOTLAR TAHLILI

Polimerlarning yonuvchanligini antipirenlar yordamida kamaytirish bo‘yicha bir qator tadqiqot ishlari amalga oshirilgan. Polimerlarning yonuvchanligini kamaytirish uchun tarkibida xlor va brom kabi galogenlar tutgan antipiren moddalar ham qo‘llanilgan [1-3]. Hozirgi vaqtga kelib ularning zaharliligi va kanserogen xavfi ishlab chiqaruvchilarni ushbu moddalarni qo‘llashdan voz kechishga majbur qilmoqda. Shu sababli galogensiz azot va fosforli antipirenlar tadqiqotlariga bir qator ishlar bag‘ishlangan [4-7]. Unda azot-fosfor tarkibli antipirenlarning sinergizmi masalalari muhokama qilingan. Ushbu maqolalarda azot va fosforning birikishi olovga chidamli tizimlar uchun sinergizm hisoblanishi va u azotli-fosforli antipirenlarning tabiatiga, shuningdek, barqarorlashtirilayotgan polimerning kimyoviy tuzilishiga bog‘liqligi ko‘rsatilgan [8-13].

Yuqorida keltirilgan ilmiy ishlar tahlilini hisobga olgan holda, yangi reaksion qobiliyatli birikmalarni, shu jumladan azot va fosfor saqlovchi issiqlik va tutun hosil bo‘lish ko‘rsatgichlari past bo‘lgan, olovga chidamli antipiren birikmalarni sintez qilish istiqbolli yo‘nalishlardan biri ekanligini ko‘rsatish mumkin.

## TADQIQOT METODOLOGIYASI

Dastlabki reagentlar – ammoniy digidrofosfat (suyuqlanish harorati 190 ºC) qayta kristallash, metakril kislota (qaynash harorati 190 ºC), aseton (qaynash harorati 56 ºC) haydash orqali tozalab olindi. Sintez qilingan moddalarning strukturasini aniqlash uchun IK-Fure spektrometr SHIMADZU IRAffinity-1S asbobidan foydalanildi.

Sintez jarayoni: 250ml uch og'izli kolbaga suvda erigan ammoniy digidrofosfat, keyin atsetonda erigan metakril kislota solindi. Unga dina-stark, sovutgichi va termometr ulandi. Keyin 43 101-106 ºC gacha qizdirildi. Reaksiya paytida 56-57 ºC da atseton, 100 ºC suv ajalib chiqdi. Reaksiya oxirida oq rangli kristall tuz hosil bo'ldi. Reaksiya unumi 88% ni tashkil qildi.

## MUHOKAMA VA NATIJALAR

Reaksiyalar quyidagi sxema bo'yicha sodir bo'ladi:

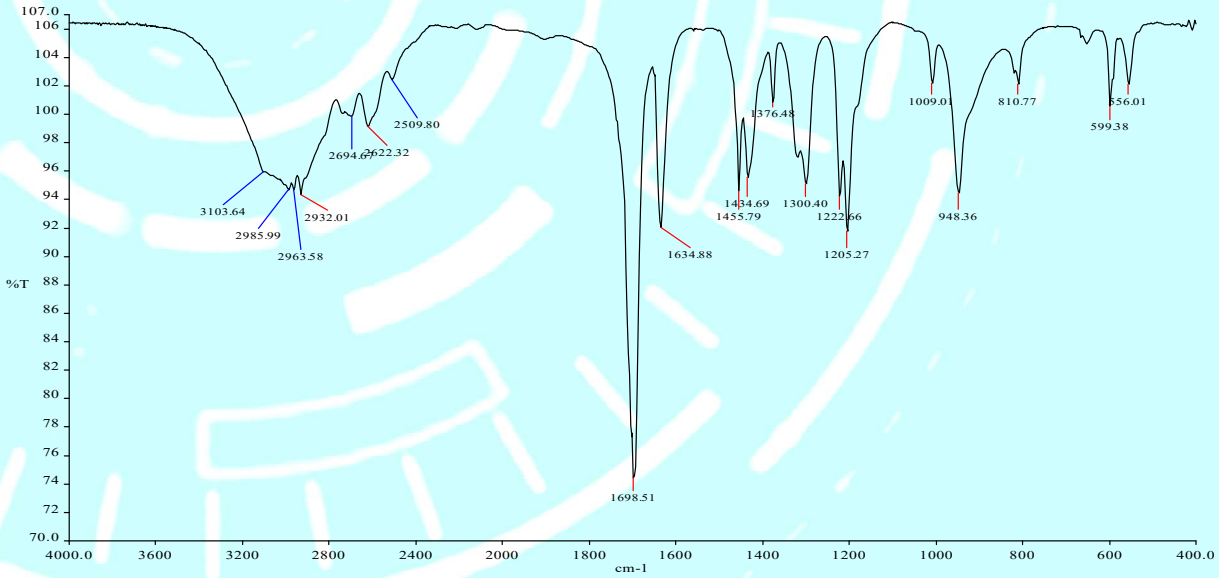


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$$CH_2=C(CH_3)\text{-}COOH + NH_4H_2PO_4 \longrightarrow CH_2=C(CH_3)\text{-}COO^-PO_2OHNH_4^+ + H_2O$$

Optimal reaktsiya sharoitlarini aniqlash uchun tajribalar 85, 95, 105, 110 va 115 °C haroratlarda o'tkazildi. Tajribalar синтез mahsulotining unumi harorat, erituvchi tabiati va vaqtga bog'liq ekanligini ko'rsatdi. Optimal rekasiya harorati 107 ºC tashkil qildi. Sintez qilingan mahsulot suv va N,N-dimetilformamid kabi erituvchilarda oson eriydigan, etanol va aseton kabi organik erituvchilarda qiyin eriydigan oq rangli kukunsimon moddadir.

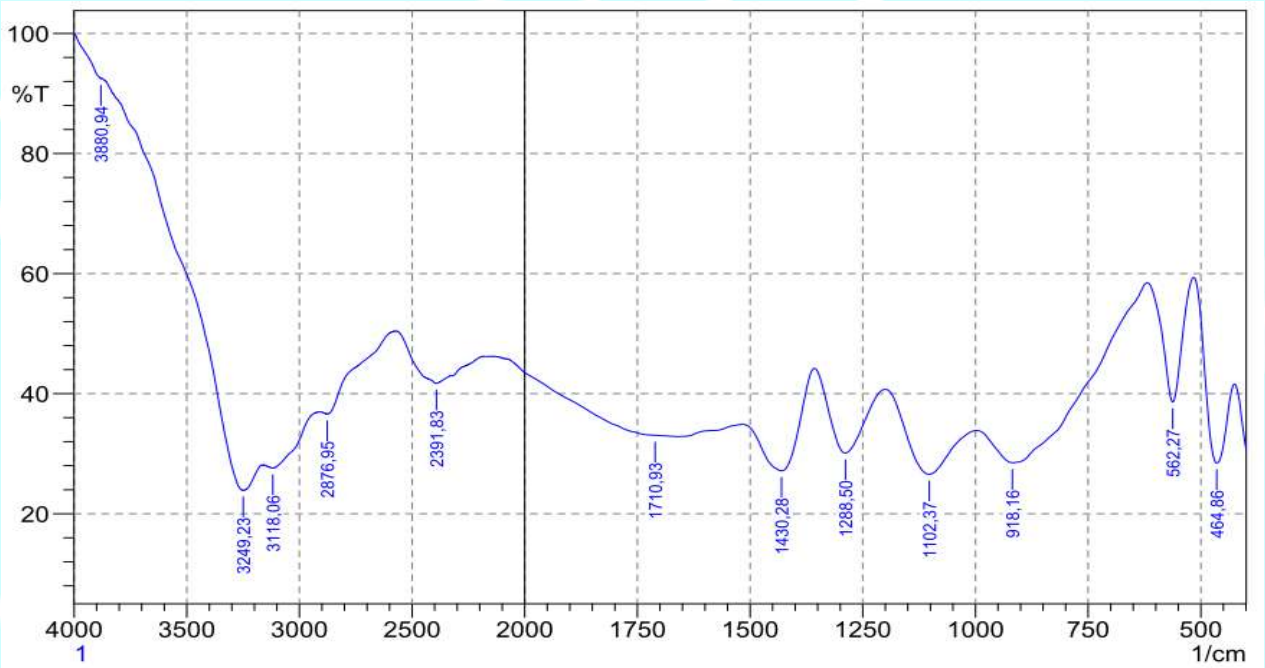
Sintez qilingan mahsulotning tuzilishini tasdiqlash uchun boshlang'ich reagentlar va reaksiya mahsulotining IQ-spektrlari olindi (1-rasm).




**1-rasm. Metakril kislotasining IQ spektri**

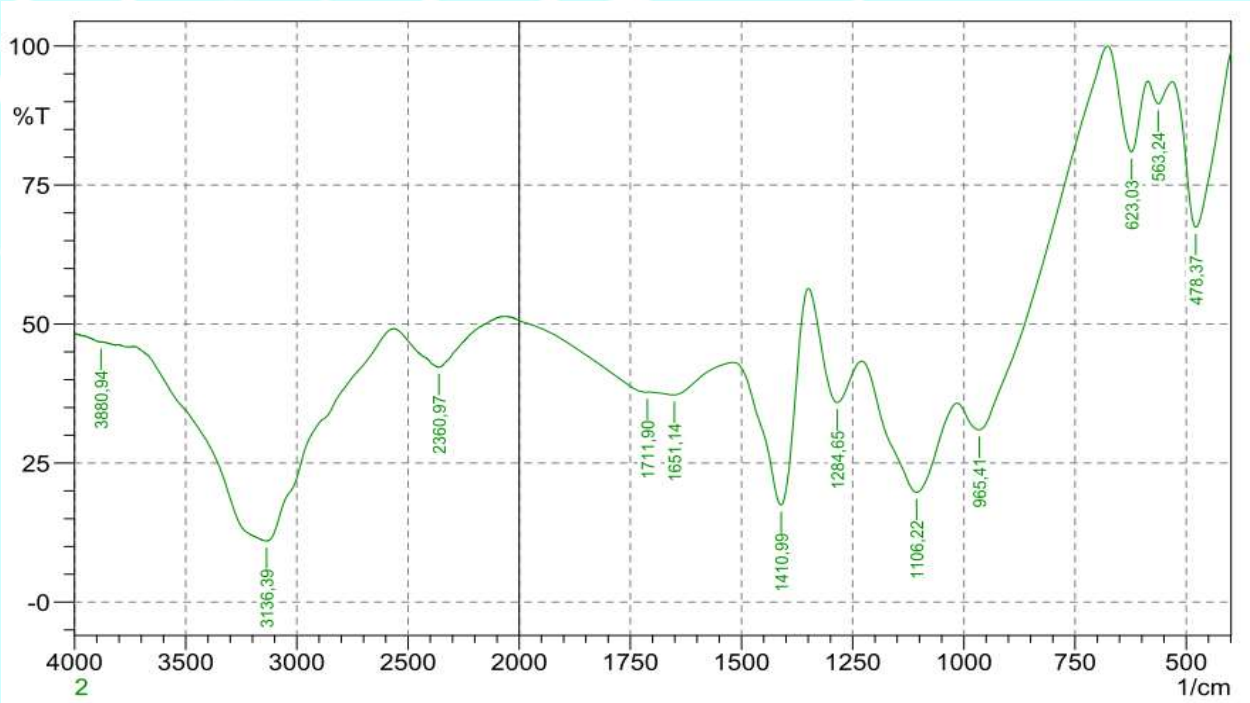
Metakril kislotaning IQ-spektrida 2985 $cm^{-1}$ sohada yutilish chizig'i kuzatildi, bu -COOH bog'ining valent tebranishlariga mos keladi, shuningdek -C=C-COOH bog'ining valent tebranishlariga xos bo'lgan yutilish 1698 $cm^{-1}$ sohada, -C=C- bog'ining valent tebranishlari 1434 $cm^{-1}$ sohada, -OH bog'ining valent tebranishlari 948 $cm^{-1}$ sohada kuzatildi.


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**2-rasm. Ammoniy digidrofosfatning IQ-spektri**

Ammoniy digidrofosfat tuzining IQ-spektrida $NH_4^+$ guruxining valent tebranishlariga xos bo'lgan yutilish chizig'i 3249 $cm^{-1}$ sohada kuzatildi. $H_2PO_4^-$ guruxining valent tebranishlari 1102 $cm^{-1}$ sohada, P=O bog'ining valent tebranishlari 1288 $cm^{-1}$ sohada, -OH bog'ining valent tebranishlari 918 $cm^{-1}$ sohada kuzatildi (2-rasm).




**3-rasm. Metakril kislota va ammoniy digidrofosfat asosida olingan mahsulotning IQ-spektri**

Sintez qilingan mahsulotning IQ spektrida $NH_4^+$ guruxining valent tebranishlariga xos bo'lgan yutilish chizig'i 3136 $cm^{-1}$ sohada kuzatildi. Qo'sh bog' bilan bog'langan murakkab efirning -C=C-COOR bog'ining valent tebranishlari


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1711 $cm^{-1}$ sohada, -C=C- bog‘ining valent tebranishlari esa 1611 $cm^{-1}$ sohada, P=O bog'ining valent tebranishlari 1284 $cm^{-1}$ sohada, $HPO_4^{-2}$ bog'ining valent tebranishlari 1106 $cm^{-1}$ sohada, -C-O-P- bog‘ining valent tebranishlari esa 965 $cm^{-1}$ sohada kuzatildi (3-rasm).

**XULOSA**

Shunday qilib, metakril kislota va ammoniy digidrofosfat asosida erituvchilar muhitida polifunksional monomer sintez qilish muqobil sharoiti aniqlangan. IQ-spektral usul yordamida dastlabki reagentlar va sintez mahsulotining strukturasi tadqiq qilingan.

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