Tereftal kislota diglikol efiri va oligomerlarning polikondensatsiyalanish reaksiyasi katalizi

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Annotatsiya: Jahon miqyosida polimer materiallarni qayta ishlash va qo'llash orqali kimyoviy va aralash tolalar, iplar, maxsus to'qimachilik mareriallari, poyabzal detallari, sintetik charm mahsulotlari ishlab chiqarish tobora kengayib bormoqda. Mamlakatimizning kimyo sanoati, to'qimachilik, yengil va poyabzal tarmog'i korxonalarining mavjud quvvatlarini yangilash, tayyorlanadigan mahsulotlar turini ko'paytirish hamda assortimentini kengaytirish borasida shuningdek, yuqori sifat ko'rsatkichlarini ta'minlash yo'nalishlarida muayyan natijalarga erishilmoqda. Polikondensatlanish reaksiyasi natijasida hosil bo'lgan polimerlarning elementar tarkibi quyi molekulyar moddalar ajralgani sababli reaksiya uchun olingan monomerlar tarkibidan farq qiladi. Bunday reaksiyaga kirisha oladigan monomerlar tarkibida ikki xil funksional guruh o'zaro reaksiyaga kirishib, molekula qoldiqlarini bir-biriga bog'laydi.

Kalit so'zlar: tereftal kislota, polikondensatsiya, katalitik kompleks, eterifikator, polikondensatsiya darajasi, semipolyar bog'lanish, katalitik kompleks

Catalysis of the polycondensation reaction of diglicol ether and terephthal acid oligomers

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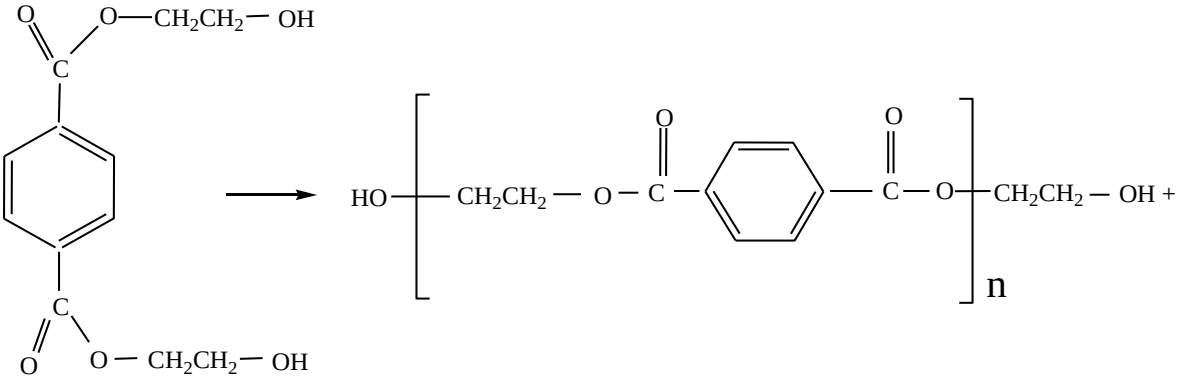
Abstract: Due to the processing and use of polymer materials, the production of chemical and mixed fibers, yarn, special textile materials, shoe parts, and artificial leather products is expanding throughout the world. Certain results are achieved in updating the existing capacities of chemical industry enterprises, textile, light and footwear enterprises in our country, increasing the types of products and expanding their range, as well as ensuring high quality indicators. The elemental composition of polymers formed as a result of a polycondensation reaction differs from the composition of monomers obtained as a result of the reaction due to the separation of low molecular weight substances. In monomers capable of such a reaction, two different functional groups interact and connect the residues of the molecule to each other.

Keywords: terephthalic acid, polycondensation, catalytic complex, esterifier, degree of polycondensation, semipolar bond, catalytic complex

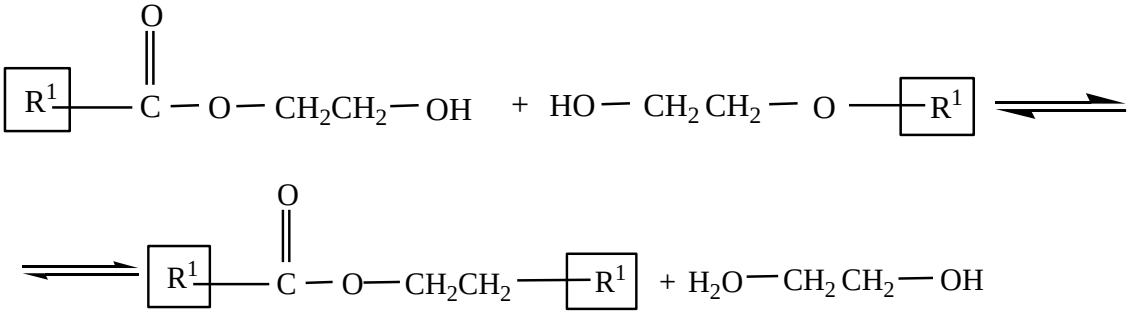
Tereftal kislota diglikol efiri va oligomerlarning polikondensasiyalanish jarayoni mohiyati bo‘yicha qayta eterifikasiyalash reaksiyasi bo‘lib hisoblanadi: oligomerning bitta molekulasi efir bo‘lib, ikkinchisi esa spirt bo‘lib xizmat qiladi.



polietilentereftalat

$$+ \quad (n\text{-}1) \quad HO{-}CH_2CH_2{-}OH$$

Reaksiya sodir bo‘lishi uchun dastlabki efirdagi karbonil guruhining kislorod atomini protonlash uchun katalizator zarur.



Protonli katalizatorlarni (kuchli kislotalarni) polikondensasiyalanish jarayoni sharoitida qo‘llab bo‘lmaydi, chunki ular juda tez faol bo‘lmagan birikmalarga aylanadi.

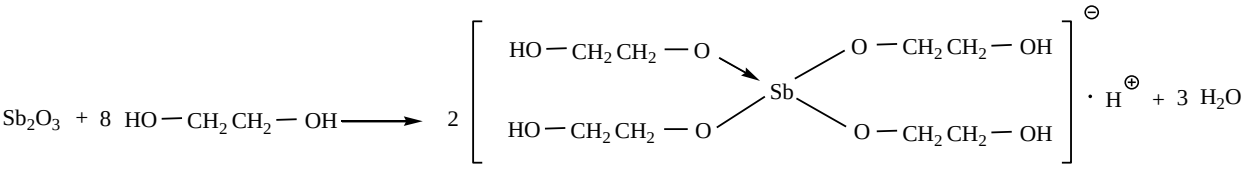
Eng maqbul variant esa vodorod kationini hosil qilish bilan dissosilanish qobiliyatiga ega bo‘lmagan aproton kislotalar hisoblanadi. Bu rol uchun surma(III)-oksid Sb_2O_3 tanlangan bo’lib, u kimyoviy mustahkam, kam zaharli va reaksiya sharoitida faol. Surma (III)-oksidi etilen glikol eritmasida kompleks holida qo‘llaniladi.

Quyida katalitik kompleksning tayyorlash mexanizmini batafsil ko‘rib chiqamiz.

Surma(III)-oksidi oq rangli mayin kristall modda bo‘lib, ko‘pincha organik erituvchilarda erimaydi. Uni katalizator sifatida bunday holda qo‘shib bo‘lmaydi. Eterifikatni old polikondensatorda bo‘lish vaqti davomida Sb_2O_3 harorat yuqori bo‘lishiga qaramasdan erishga ulgurmaydi va bundan kelib chiqadiki, polimerni erimagan zarrachalar bilan ifloslab o‘zining katalizatorlik rolini bajara olmaydi. Mana shu sodir bo‘lmasligi uchun Sb_2O_3 ni dastlab 110 - 160 ℃ gacha qizdirilgan etilenglikolda eritiladi. Natijada 0,5 - 1 % li eritma olinib, uni old polikondensatorga kelib tushayotgan eterifikator oqimiga meyorlagich orqali kiritib turiladi.

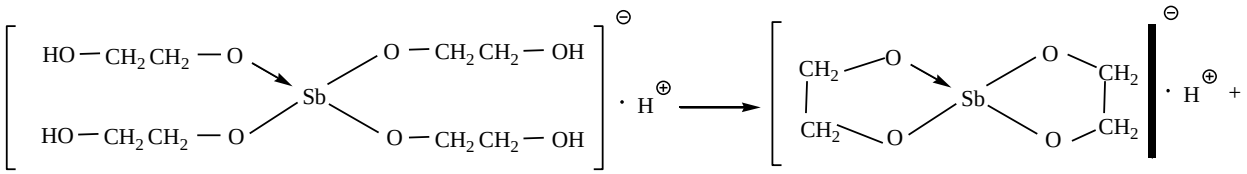
Eritmani tayyorlash jarayonida va bevosita polikondensasiyalanish reaksiyasida surma (III)-oksidi o‘zgarishlarga uchraydi.

Sb_2O_3 va etilenglikolni aralashtirib qizdirganda ular o‘zaro ta’sirlashib kompleks birikma 3 ni hosil qiladi. Bu holda gidroksil guruhlaridan birining vodorod atomi harakatchan bo‘lib qoladi va kompleks birikmaga kislotalik xossalarni bag‘ishlaydi (Brensted - Louri kislotasi).

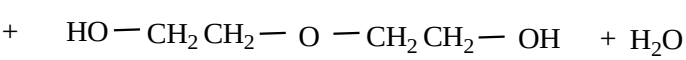


1 2 3

Kompleks 3 katalizator bo‘lib hisoblanadi, chunki u ancha kuchli kislota va tereftal kislota efirlarining karbonil guruhidagi kislorod atomini protonlashga qodir. Polikondensasiyalanish sharoitida 280 - 285 ℃ haroratda kompleks 3 termodinamik ancha barqaror shakl 4 ga aylanadi.



3 4



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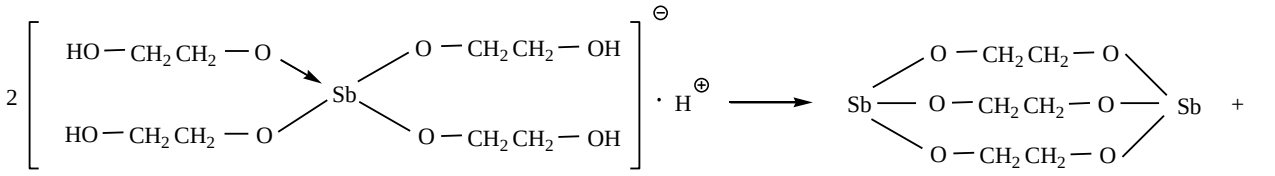
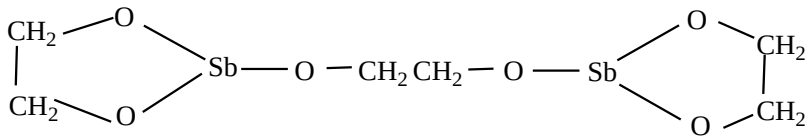
Katalitik kompleks 3 va 4 larning formulalari o‘zining tarkibida sxemada yo’nalish bilan belgilangan semipolyar bog‘lanish Sb→O ga ega. Haqiqatdan ham katalitik kompleks 3 va 4 larning molekulalarida barcha O - Sb bog‘lar teng va ham kovalent, ham semipolyar bog‘larning xossalariga ega.

Kompleks 3 ning etilenglikoldagi eritmasi sovutilganda undan $Sb_2(O - CH_2 - CH_2 - O)_3$ umumiy formulali oq rangli mahsulot 6 kristallanadi. Birikma 6 ning tarkibiga yana bitta qo'shimcha modda 7 ham bo'ladi.



3 6

+ 5 HO — CH_2CH_2 — OH



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Etilenglikolda eritilganda ikkala birikma 6 va 7 yana qaytadan katalitik kompleks 3 ni hosil qiladi, u polikondensasiyalanish reaksiyasi sharoitida barqaror shakl 4 ga o'tadi.

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