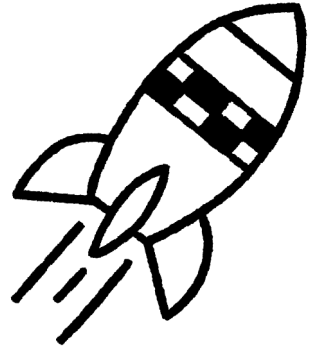


Qaab-dhismeedka polymers (Structure of polymers)

Sayniska

Cutub: Qalabka (Materials)



Natiijo

Waxaan siin karaa tusaalooyin polymers (polymers) ah oo aan sharxi karaa sida astaamaha polymers (polymers) ay ku xiran yihiin qaab-dhismeedkooda.

Erayada muhiimka ah

polymer (polymer)

Molekyuullo silsilad dheer leh oo la sameeyay iyadoo la isku xiro monomers (monomers).

forces of attraction (forces of attraction)

Xoog jiidasho oo walxaha isku dhoweya.

synthetic (synthetic)

Wax la soo saaray.

plasticiser (plasticiser)

Walax lagu daro polymer (polymer) si loo kordhiyo dabacsanaantiisa.

cross-link (cross-link)

Xidhiidh kiimikaad oo u dhexeeya atomooyinka silsiladaha kala duwan ee molecules polymer (polymer).

Qaab-dhismeedka polymer (polymer)



Polymers (Polymers)



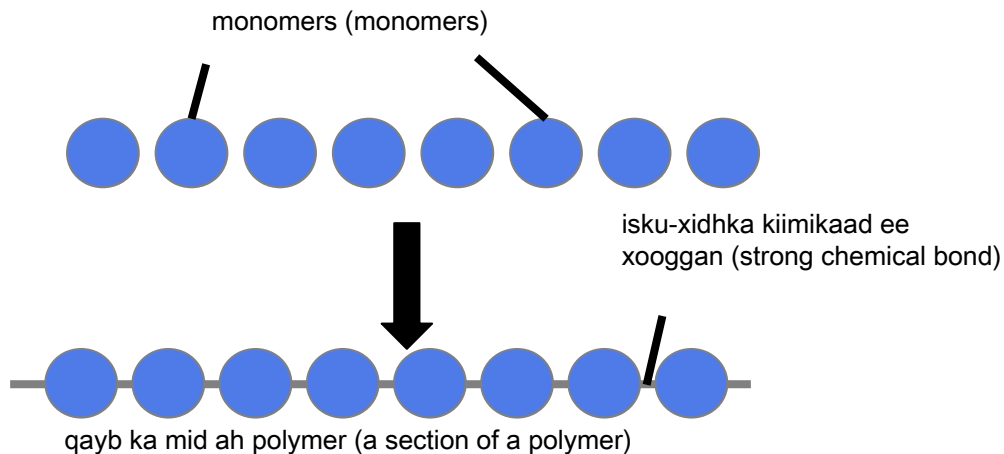
Beddelidda astaamaha polymers (polymers)

Polymers (Polymers) waxaa laga sameeyaa molekyuullo yaryar oo la yiraahdo **monomers (monomers)** kuwaas oo isku xirma si ay u sameeyaan silsilado aad u dheer oo atomo ah. **Polymer (polymer)** caadi ahaan wuxuu ka kooban yahay tobanaan kun oo atomo ah.

polymers (polymers)



badan qaybo



Imisa atom ayaa ku jira molecule polymer caadi ah?

a

<10

b

<100

c

<1000

d

>1000



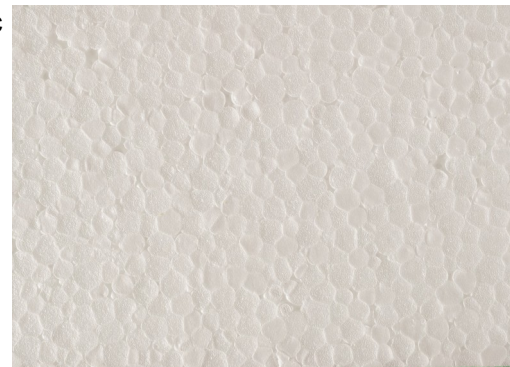
Polymers waxaa la samayn karaa si synthetic ah laakiin qaarkood waxay sidoo kale ku yimaadaan si dabiici ah.



dhalada poly(propene)

Poly(propene) iyo poly(styrene) waa tusaalooyin polymers synthetic ah.

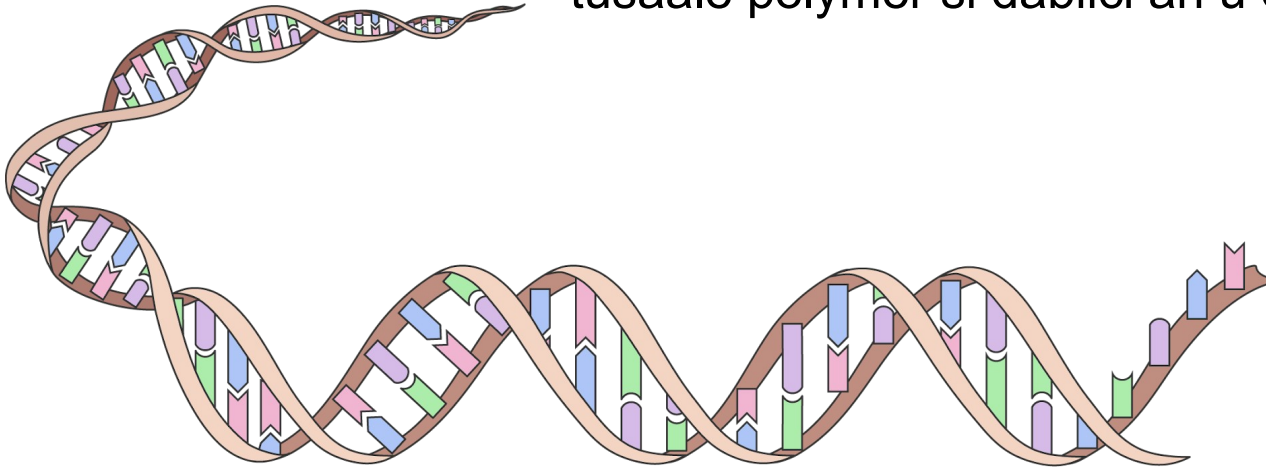
Poly(propene) waxaa laga sameeyaa monomer propene.



poly(styrene)

Poly(styrene) waxaa laga sameeyaa monomer styrene.

Deoxyribonucleic acid, DNA, waa tusaale polymer si dabiici ah u dhaca.



Polymers-ka dabiiciga ah waxay ka yimaadaan noolaha. Proteins, carbohydrates (tusaale ahaan starch iyo cellulose) dhamaantood waa polymers.

Tusaalooyinka polymers-ka dabiiciga ah waxaa ka mid ah:



cellulose

- laga helo gidaarada unugyada dhirta
- monomer glucose (monomer glucose)



silk

- faybar borotiin (protein fibre) oo uu sameeyo dixiriga (silkworm)
- monomers: amino acids



starch

- laga helo cuntooyinka sida baradhada
- monomer glucose (monomer glucose)



wool

- faybar borotiin (protein fibre) (keratin)
- monomers: amino acids

Waa kuwee shayyada laga sameeyay polymers synthetic?



bac poly(ethene) (poly(ethene) bag)

a ✓



koob poly(styrene) (poly(styrene) cup)

b ✓



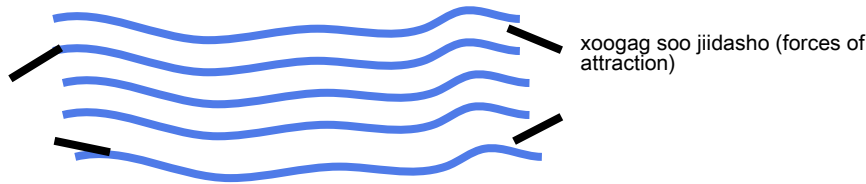
gacmo-gashi wool (wool gloves)

c

Balaastigga waxaa laga sameeyaa polymers tusaale: poly(ethene).

Polymers waa molecules aad u dheer.

Waxaa jira xoogag soo jiidasho (forces of attraction) oo u dhexeeya molecules-ka polymer-ka.



qaab dhismeedka balaastigga (structure of a plastic)

Heerkulka dhalaalka (melting point) ee polymers wuu ka sarreeyaa kan molecules-ka fudud.

Marka polymer-ku dhalaalo, molecules-ku way dhaqaaqaan. Sababtoo ah xoogagga soo jiidashada (forces of attraction) ee u dhexeeya molecules-ka ayaa jabay, ma aha bonds-ka u dhexeeya atoms-ka molecule-ka.



Waxaa jira noocyo badan oo polymers ah. Isla monomer-ka ayaa xitaa samayn kara polymers kala duwan:

- poly(ethene) cufnaan sare leh, HDPE
- poly(ethene) cufnaan hoose leh, LDPE

Heerkulka dhalaalida ee HDPE wuu ka sarreeyaa LDPE sababtoo ah xoogagga soo jiidashada (forces of attraction) ee u dhexeeya molekyuulada ayaa ka xoog badan maadaama molekyuuladu isku dhow yihiin.

Heerkulka dhalaalida ee HDPE waa 120 - 180 oC.





balastiig laga sameeyay LDPE

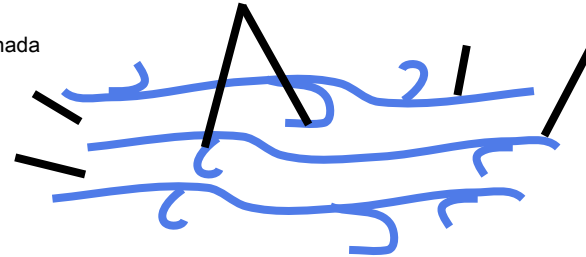
poly(ethene) cufnaan hoose leh, LDPE, wuxuu leeyahay heerkul dhalaalid ka hooseeya HDPE.

Tani waxay ugu wacan tahay silsiladaha polymer-ka oo leh laamo (branches) kuwaas oo keena xoogag soo jiidasho oo daciif ah.

Heerkulka dhalaalida ee LDPE waa qiyaastii 105 - 115oC.

xoogagga soo jiidashada
(forces of attraction)

molekyuulada polymer-
ka (polymer molecules)



Run mise been?

Polymer-ka cufnaanta hooseeya wuxuu leeyahay heerkul dhalaalid ka sarreeya polymer-ka cufnaanta sare leh.

T Run

F Been



Sabab u sheeg jawaabtaada

a Polymer-ka cufnaanta sare leh wuxuu leeyahay xoogag soo jiidasho (forces of attraction) oo badan oo u dhexeeya molekyuulada.



b Molekyuulka polymer-ka cufnaanta hooseeya wuxuu leeyahay bondiyo (bonds) ka xoog badan oo u dhexeeya atom-yada.

Maxay polymers (Polymers) u leeyihiin heerkulka dhalaalida (Melting Point) oo ka sarreeya monomers-ka?

Qodob kasta, dooro hal tiir si aad u muujiso waxa aad qabtid

a

Atamka ku jira polymers (Polymers) ayaa si xoog leh isugu xidhan.

b

Waxaa jira xoogag (Forces) soo jiidasho oo ka weyn oo u dhexeeya molecules-ka.

c

Waan hubaa inay sax tahay	Waxaan u malaynay aa inay sax tahay	Waxaan u malaynayaa inay khalad tahay	Waan hubaa inay khalad tahay

- 1) Maxay polymers (Polymers) u leeyihiin heerkulka dhalaalida (Melting Point) oo ka sarreeya monomers-ka?

Qodob kasta, dooro hal tiir si aad u muujiso waxa aad qabtid

- a** Atamka ku jira polymers (Polymers) ayaa si xoog leh isugu xidhan.
- b** Waxaa jira xoogag (Forces) soo jiidasho oo ka weyn oo u dhexeeya molecules-ka.
- c** Atam badan oo ku jira molecules-ka ayaa loo baahan yahay in la kala saaro.

I Waan hubaa inay sax tahay	I Waxaan u malaynayaa inay sax tahay	I Waxaan u malaynayaa inay khalad tahay	I Waan hubaa inay khalad tahay
			✓
✓			
			✓

2) Arday qaar ayaa samaynaya qaab (Model) molecule polymer (Polymer) ah. Waxay go'aansadeen inay isticmaalaan silsilad dheer oo kuul ah.



- a) Sheeg hal hab oo ay kuuluhu u yihiin matalaad wanaagsan oo ah unug polymer (polymer molecule).
- b) Sheeg saddex hab oo ay kuuluhu u ahayn matalaad sax ah oo ah unug polymer (polymer molecule).

3) Starch waa polymer dabiici ah (natural polymer) iyo nylon waa polymer synthetic ah. Waa maxay farqiga?

2) Arday qaar ayaa samaynaya moodal unug polymer (polymer molecule). Waxay go'aansadeen inay isticmaalaan silsilad dheer oo kuulo ah.

- a) Sheeg hal hab oo ay kuuluhu u yihiin matalaad wanaagsan oo ah unug polymer (polymer molecule).



Waxay muujinaysaa kuulo badan (monomers) oo isku xiran silsilad dheer.

- a) Sheeg saddex hab oo ay kuuluhu u ahayn matalaad sax ah oo ah unug polymer (polymer molecule).

Kuuluhu waxay ku xiran yihiin xadhig kaliya.

Atamku ma aha buluug (blue).

Waxay matalaysaa qayb yar oo polymer ah sababtoo ah polymer-yada waxay ka samaysan yihiin kumannaan atam.

Ma aha cabbir sax ah (not to scale).

3) Starch waa polymer dabiici ah (natural polymer) iyo nylon waa polymer synthetic ah. Waa maxay farqiga?

Polymer-yada dabiiciga ah waxay ka yimaadaan noolaha, tusaale: starch waxaa sameeya dhirta sida baradhada.

Wax soo saarka synthetic waa la soo saaraa. Nylon waa polymer la soo saaray (man-made).

Qaab-dhismeedka polymer (Structure of a polymer)



Polymer-yada (Polymers)



Beddelidda sifooyinka polymer-yada (Changing the properties of polymers)

Beddelidda sifooyinka polymer-yada (Changing the properties of polymers)

Polymer-yadu waa agab aad u kala duwan oo leh codsiyo badan sababtoo ah waa sahlan tahay in la beddelo sifooyinka. Tusaale: polymer polyvinyl chloride (PVC) wuxuu noqon karaa mid jilicsan ama adag.

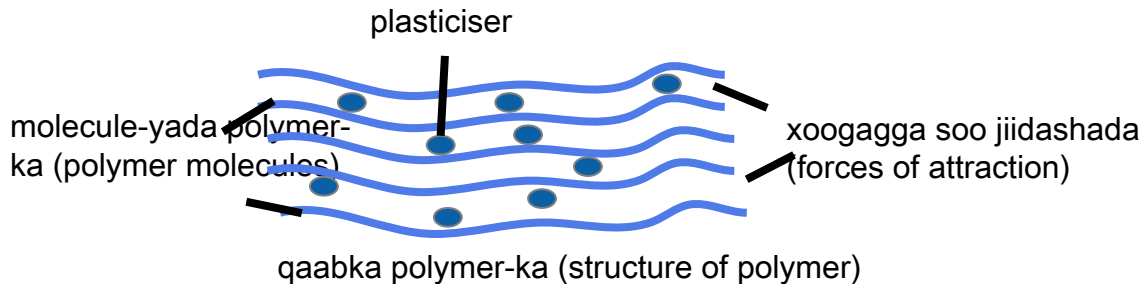


Furaha iftiinka (light switches) iyo godadka korontada (electrical sockets) waxaa laga sameeyaa PVC adag (rigid PVC).



Kabaha Wellington waxaa laga sameeyaa PVC jilicsan (flexible PVC).

Si loo kordhiyo jilicsanaanta (flexibility) polymer-yada sida PVC, waxaa lagu dari karaa plasticiser.



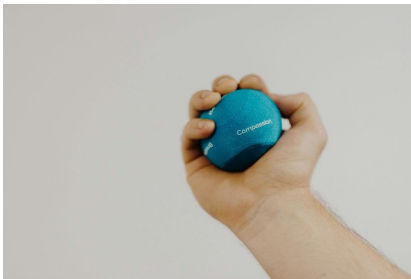
Plasticiser-ka lagu daro polymer-ka wuxuu dhexgalaa molecule-yada polymer-ka wuxuuna u oggolaadaa inay isku dhaqaaqaan si fudud. Wuxuu kala fidaa molecule-yada dhaadheer si xoogagga isku haya ay u yaraadaan.

Rubber-ku waa polymer dabiici ah (natural polymer) oo laga helo dheecaanka geedaha rubber-ka.

Rubber-ku wuxuu leeyahay adeegsi badan:



xariijinta rubber-ka
(rubber band)



kubadda rubber-ka
(rubber ball)



taayirada rubber-ka
(rubber tyre)

Wuxuu leeyahay astaamo laastiko ah (elastic properties) waxaana la kala jiidi karaa ka dibna wuu soo laabtaa.

Beddelka astaamaha polymer-yada (Changing the properties of polymers)

Plasticiser-yada waxaa lagu daraa polymer-ka si ay u noqdaan...

a

adag (harder)

b

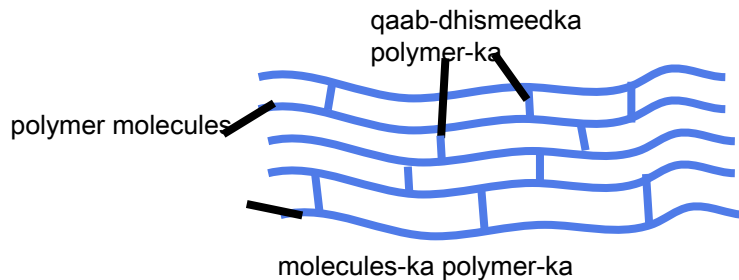
jilicsan (more flexible) ✓

c

adag (more rigid)

Si loo kordhiyo adkaanta polymer-ka oo loo yareeyo dabacsanaantiisa, iskutallaab (cross-links) ayaa lagu daraa qaab-dhismeedka.

Cross-link waa xidhiidh kiimiko oo xooggan oo u dhexeeya silsilado kala duwan oo atomo ah oo ku jira polymer-ka kaas oo:



- iskutallaab (cross-link)
- ka dhig polymer-ka mid adag oo aan dabacsanayn

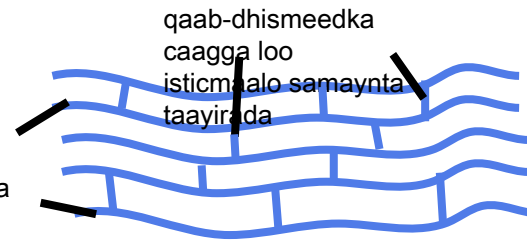
ka dhig mid adag in molecules-ka polymer-ku isku siibaan



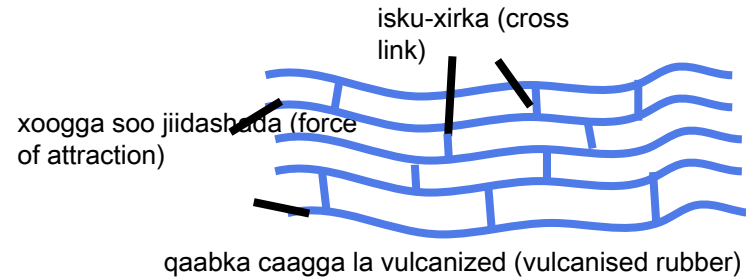
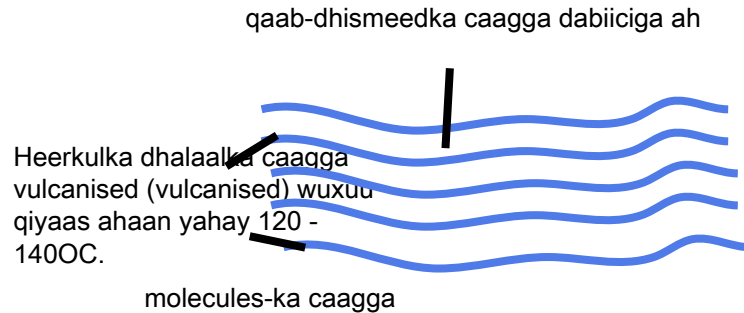
Beddelidda astaamaha
polymers (polymers)

taayir caag ah

Hab loo yaqaan
vulcanisation
(vulcanisation) ayaa
loo isticmaalaa in
lagu daro molecules-ka caagga
iskutallaabyo (cross-
links) inta u dhaxaysa
silsiladaha polymer-
ka.



Beddelidda astaamaha polymers (polymers)



Waxay u baahan tahay tamar badan in la kala saaro molecules-ka polymer-ka marka ay jiraan iskutallaabyo (cross-links), maxaa yeelay waxay ka xoog badan yihiin xoogagga soo jiidashada ee u dhexeeya molecules-ka caagga dabiiciga ah.

Run mise been?

Isku-xirka (cross links) wuxuu kordhiyaa dabacsanaanta polymer-ka.



Run



Been



Sabab u sheeg jawaabtaada

a

Waxay ku darsataa xidhiidhyo kiimiko oo xooggan oo u dhexeeya molecules-ka polymer-ka.



b

Waxay kala fogaaysaa silsiladaha polymer-ka, iyada oo ka dhigaysa mid fudud inay dhaqaaqaan.

1) Xabagta PVA waa mid dareere ah oo ay ku jirto polymer.

Isku darka milanka borax (borax solution) iyo xabagta PVA waxay ku darsataa isku-xirka (cross-links) polymer-ka.

- a) Saadaali sida sifooyinka xabagta PVA ay u beddeli doonaan marka borax lagu daro?
- b) Sheeg sababta aad u malaynayso inay tani dhacdo.

2) Sifooyinka polymer-ka waxaa lagu beddeli karaa iyadoo lagu daro isku-xirka (cross-links) ama plasticisers.

Sidee ku samayn kartaa polymer ka sii dabacsan?

1) Xabagta PVA waa mid dareere ah oo ay ku jirto polymer.

Isku darka milanka borax (borax solution) iyo xabagta PVA waxay ku darsataa isku-xirka (cross links) polymer-ka.

a) Saadaali sida sifooyinka xabagta PVA ay u beddeli doonaan marka borax lagu daro.

b) Sheeg sababta aad u malaynayso inay tani dhacdo.

PVA waa inay noqotaa mid aan dareere ahayn / aan dabacsanayn / sii kala bixi kara.

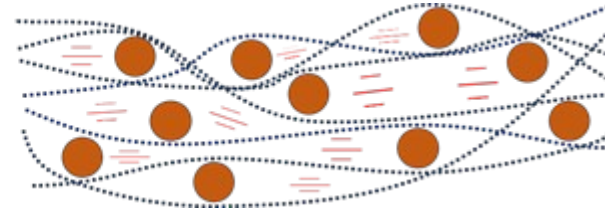
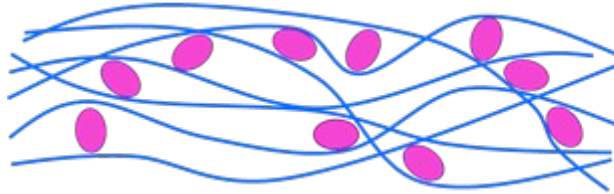
Isku-xirka (cross links) waa xidhiidhyo kiimiko oo xooggan oo u dhexeeya molecules-ka polymer-ka dhaadheer. Waxay ku adkaan doontaa molecules-ka polymer-ka inay iska siibtan / is dhaafaan.

2) Sifooyinka polymer-ka waxaa lagu beddeli karaa iyadoo lagu daro isku-xirka (cross-links) ama plasticisers. Sidee ku samayn kartaa polymer ka sii dabacsan?

3) Laba arday ayaa sawiro sawiray si ay u sharaxaan sida plasticiser u shaqeeyo.



Layla



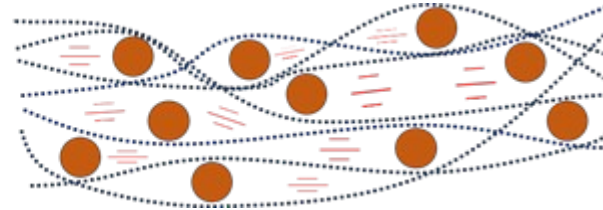
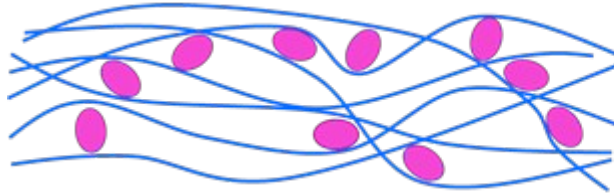
Saciid

- a) Waa maxay xariijmaha buluuga ah (blue lines) ay matalaan?
- b) Waa maxay oval-ka casaanka ah (pink ovals) ay matalaan?
- c) Waa maxay xariijmaha dhibcaha leh (dotted lines) ay matalaan?
- d) Waa maxay oval-ka oranji ah (orange ovals) ay matalaan?
- e) Waa maxay xariijmaha casaanka ah (red lines) ay matalaan?

3) Laba arday ayaa sawiro sawiray si ay u sharaxaan sida plasticiser u shaqeeyo.



Layla



Saciid

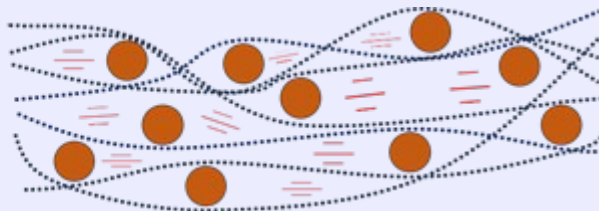
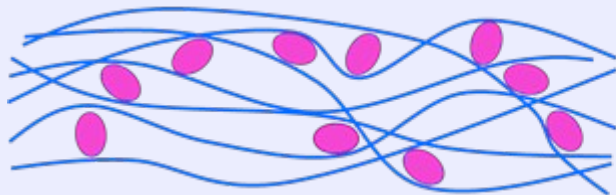
f) Yaa sawirkiisu ka caawinaya in si fiican loo sharaxo sababta plasticiser uga dhigo PVC polymers kuwa dabacsan? Sabab u sheeg.

3) Laba arday ayaa sawiro sawiray si ay u sharaxaan sida balaastigaystaha (plasticiser) u shaqeeyo.



Layla

- a) Waa maxay xarijmaha buluuga ah (blue lines) ay matalaan?
- b) Waa maxay oval-ka casanka ah (pink ovals) ay matalaan?
- c) Waa maxay xarijmaha dhigacata leh (dotted lines) ay matalaan?
- d) Waa maxay oval-ka oranj ah (orange ovals) ay matalaan?
- e) Waa maxay xarijmaha casanka ah (red lines) ay matalaan?



Saciid

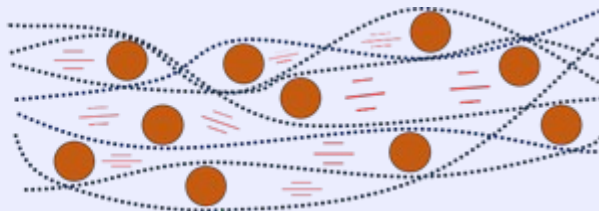
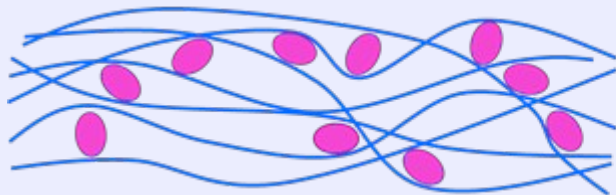
molekyuulasha polymer-ka (polymer molecules)

Xoogagga soo jiidashada ee u dhexeeya
molekyuulasha polymer-ka.

3) Laba arday ayaa sawiro sawiray si ay u sharaxaan sida balaastigaystaha (plasticiser) u shaqeeyo.



Layla



Saciid

f) Yaa sawirkiisu ka caawinayaa in si fiican loo sharaxo sababta balaastigaystaha (plasticiser) uga dhigo polymer-ka PVC mid jilicsan? Sabab u sheeg.

Sawirka Saciid. Labada sawirba waxay muujinayaan molekyuulasha polymer-ka iyo balaastigaystaha (plasticiser) laakiin sawirka Saciid wuxuu kaloo muujinayaa xoogagga soo jiidashada ee daciifka ah ee u dhexeeya molekyuulasha polymer-ka; sidaas darteed waa ka fiican yahay. Wuxuu bixiyaa faahfaahin dheeri ah oo ku saabsan waxa dhacaya.

Polymer-ka (polymers) waxaa laga sameeyaa molekyuul yaryar oo loo yaqaan monomers kuwaas oo isku xirma si ay u sameeyaan molekyuul dheer oo silsilad ah.

Polymer-ka (polymers) waxaa lagu samayn karaa si macmal ah, laakiin qaarkood sidoo kale waxay u jiraan si dabiici ah.

Qaar ka mid ah polymer-ka (polymers) waxay leeyihiin heerkul dhalaal sare sababtoo ah molekyuulashooda way adag tahay in la kala saaro.

Balaastigaystaha (plasticiser) lagu daro polymer-ka (polymer) wuxuu dhexgalaa molekyuulasha polymer-ka wuxuuna u oggolaadaa inay isku dhaqaaqaan si fudud.

Isku-xirnaanta (cross-links) ee u dhexeysa molekyuulasha polymer-ka waxay ka dhigi kartaa polymer-ka mid adag oo aan jilicsanayn.