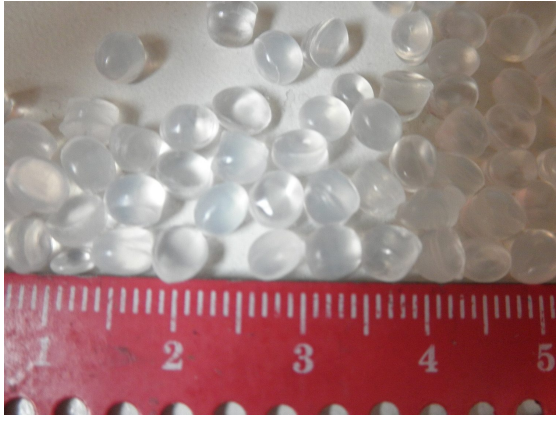
Polymerisation

A-Level Chemistry ▪ Topic 20

A-Level Chemistry

What we will cover

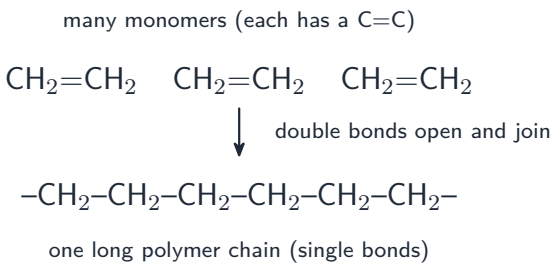
1. Addition polymerisation
2. Repeat units
3. Finding the monomer
4. The problem of disposal



poly(ethene) pellets

1 Polymerisation

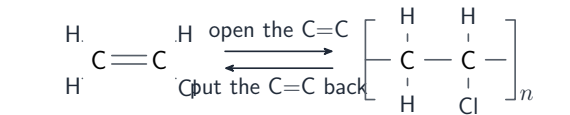
Addition polymerisation



In **addition polymerisation** 加成聚合, many **monomers** 单体 join into one long chain – with no other product.

> Each monomer must have a C=C; the double bond opens so they link end to end into the **polymer** 聚合物.

Repeat units



chloroethene (monomer) poly(chloroethene), PVC

The **repeat unit** 重复单元 is copied along the chain.

- ethene → **poly(ethene)** 聚乙烯
- chloroethene → **PVC** 聚氯乙烯

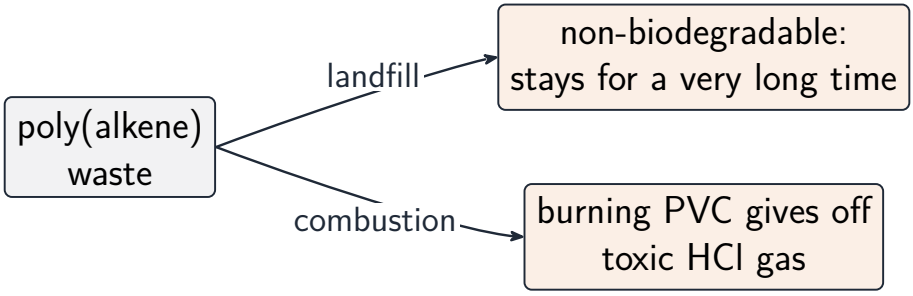
Change the C=C to a single bond; draw bonds out at each end.

The problem of disposal

Poly(alkene)s are hard to dispose of:

- **non-biodegradable** 不可生物降解 – microbes can't break them down
- **combustion** 燃烧 of PVC releases toxic HCl

The problem of disposal, continued



Poly(alkene) waste is hard to dispose of: it is non-biodegradable, and burning PVC releases toxic hydrogen chloride

Exam tips

- Draw the **repeat unit** in brackets with the two bonds crossing them and *n* outside; keep the backbone carbons.
- Deduce the **monomer from a polymer** (and vice versa) – a very common question.
- Addition polymers are **inert and non-biodegradable** – link to landfill, recycling and incineration issues.
- Do not confuse with condensation (no small molecule is lost in addition polymerisation).

2 Recap

Worked example – drawing a repeat unit

Draw the repeat unit of poly(propene) and explain why it is hard to dispose of.

- Propene is $CH_2{=}CHCH_3$. Break the π bond and join the monomers.
- Repeat unit: $-[CH_2 - CH(CH_3)]-$ with the bonds drawn through the brackets.
- The backbone is only strong, non-polar C–C and C–H bonds.
- Nothing in nature attacks them $\Rightarrow$ non-biodegradable. Burning PVC also gives toxic HCl.

An addition polymer has the same empirical formula as its monomer – nothing is lost. Draw it with the C=C opened and bonds through the brackets.

Topic 20 – key takeaways

1 Polymerisation

many C=C monomers join, no other product

2 Repeat unit

change C=C to a single bond, bonds out

3 Monomer

put the C=C back into one repeat unit

4 Disposal

non-biodegradable; PVC burning gives HCl

Check yourself

1. What bond must a monomer have for addition polymerisation?
2. Which polymer is made from chloroethene?
3. How do you find the monomer from a repeat unit?
4. Why is poly(ethene) hard to dispose of?

Answers **1.** a C=C double bond **2.** PVC / poly(chloroethene) **3.** put the C=C back **4.** it is non-biodegradable