

How is Hydrogen Produced?

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Hydrogen is the most abundant chemical element in the universe.

But it is almost always combined with other elements. Example: water (H_2O) = hydrogen (H) + oxygen (O)

To use pure hydrogen in a fuel cell or car engine, the element needs to be isolated.

The most common method is **steam reforming**. Steam (H_2O) reacts with methane (CH_4) to separate the carbon (C) atoms from the hydrogen (H) atoms. The reaction yields dihydrogen (H_2) + carbon dioxide (CO_2)

The same result is achieved with the charcoal **gasification** process, which consists in burning charcoal in a very high-temperature reactor.

Another method: **water electrolysis**. An electric current is used to decompose water (H_2O) into: dihydrogen (H_2)/dioxygen (O_2)

However, 95% of hydrogen is produced from fossil fuels or wood.

So we need to find alternatives for producing hydrogen, and ensure that these alternatives emit little-to-no greenhouse gas.

- **#1 Photosynthetic microorganisms**, which can produce hydrogen using sunlight.
- **#2 Photoelectrochemical cells**, electric components submerged in water and exposed to light to produce bubbles of dihydrogen and dioxygen.
- **#3 Thermochemical decomposition of water**. Heated to a high temperature, the water molecule decomposes and releases the dihydrogen.

Summary:

In nature, hydrogen is always combined with another element.

To use pure hydrogen, the element needs to be isolated.

3 methods:

Steam reforming with steam and methane (CH_4).

Charcoal gasification, which consists in burning charcoal.

Water electrolysis.

However, 95% of hydrogen is produced from fossil fuels or wood.

More sustainable alternatives do exist: photosynthetic microorganisms and photoelectrochemical cells.