The chemistry of the smell of the sea

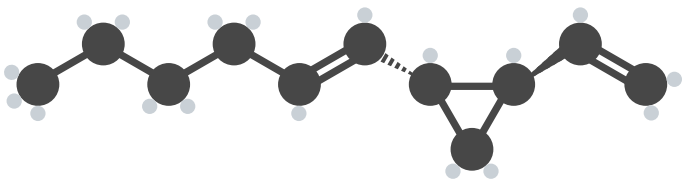
COMPOUND INTEREST

Where does the smell of the sea come from?

Much of the characteristic smell of the seaside stems from volatile organic compounds that contain sulfur. Some of these compounds are emitted by algae in the sea, as a result of enzymatic activity or bacterial action, while others can be emitted by decomposing seaweed on the beach itself.

KEY: Carbon · Oxygen · Sulfur · Hydrogen

Hydrogen sulfide



Dictyopterene A

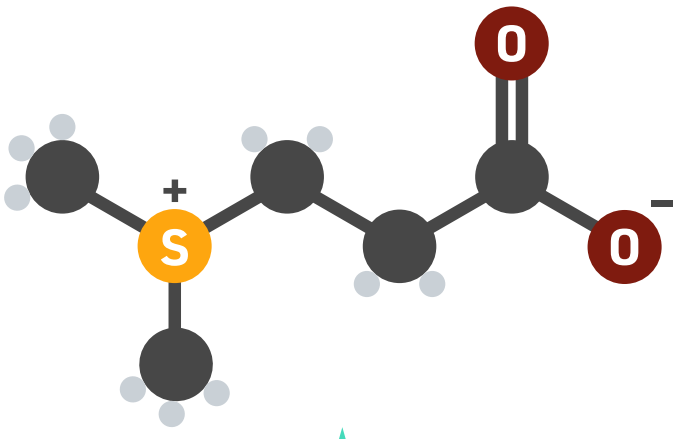
Seaweed death and sex

Bacteria break down sulfates in decomposing seaweed, producing hydrogen sulfide. This gas is toxic in high concentrations. However, as hydrogen sulfide is produced naturally in the body, humans have mechanisms to break it down, so we can tolerate low concentrations.

Seaweed also contributes to the smell of the sea through the release of dictyopterenes. Seaweed eggs release these pheromones to attract sperm.

Compounds from algae

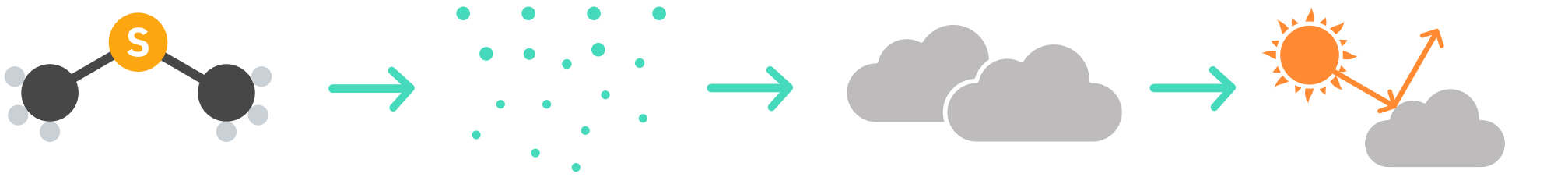
Dimethylsulfoniopropionate (DMSP) is found in algae cells and acts as an osmolyte (it helps maintains cell volume and water levels). Enzymes and bacteria break down DMSP, producing dimethylsulfide (DMS), a major component of the smell of the sea. Algae is also the source of bromophenols that are key flavour compounds in seafood.



DMSP

DMS and clouds

DMS also has a role in cloud formation. Less than 10% of the DMS formed in the ocean gets to the atmosphere. Chemical reactions in the air can break it down into aerosols (tiny particles of a solid or liquid suspended in air). Water vapour condenses around these particles, resulting in cloud formation. Other, non-DMS-derived aerosols also contribute, including dust and soot.



1 DMS released → 2 Aerosols form → 3 Clouds form → 4 Cooling effect