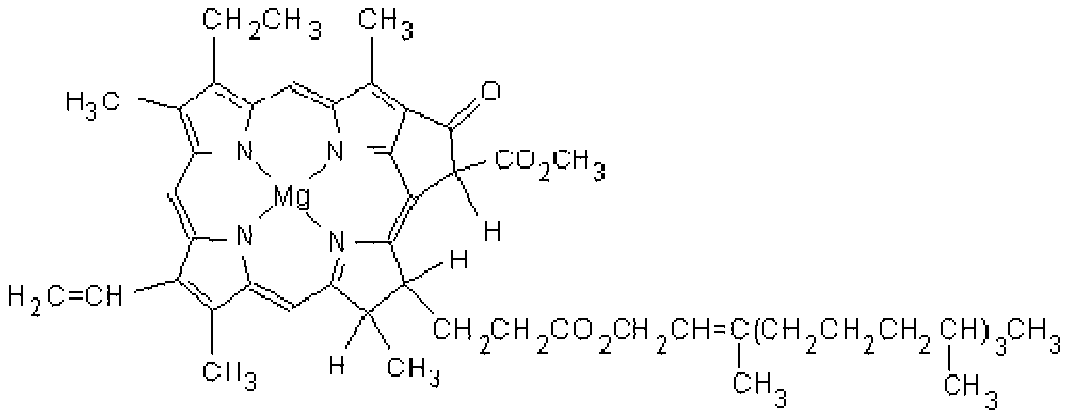
Nature’s green oxygen machine

Chlorophyll, the substance in green plants, contains no chlorine, says S.Ananathanarayanan.

‘Chloros’ is Greek for ‘yellowish green and both Chlorophyll and chlorine get their names because they have this colour.

Chlorophyll and photosynthesis

Chlorophyl is a complex molecule, consisting of a central magnesium atom surrounded by atoms of nitrogen, linked to a maze of hydrogen, oxygen and carbon atoms. The complex structure enables chlorophyll to play a role of a ‘go-between’ in helping the energy of sunlight free the hydrogen in water to combine with carbon dioxide in the air to produce hydrocarbons. When water is stripped of hydrogen, what is left is oxygen, which is given off!



And so, with the help of chlorophyll, the earth’s green cover is able to convert the energy of sunlight into leaf, fruit, trunk and root and at the same time regenerate oxygen that is used up in metabolism and in burning fossil fuels.

How does it work?

This reaction, in fact, is the opposite of what usually happens, which is that hydrocarbons burn, to produce carbon dioxide and water. And these end products are so stable that even supplying the right quantities of energy does not usually make them take the reverse direction. But when there is chlorophyll present, the energy differences are ‘smoothed out’. The chlorophyll supplies the carbon dioxide an extra negative charge which makes it ready to accept bonding with hydrogen, and then, being short of one negative charge, the chlorophyll takes up the negative from the oxygen in water, to set the hydrogen free to bond with carbon and sets the oxygen free.

And though chlorophyll can make this possible, the bottom line is that the reaction needs energy, the same energy the hydrocarbon can later release when it is burned as fuel. Photosynthesis thus takes place only in the presence of sunlight, which provides energy in the form of photons in the correct range of frequencies.

Some chlorophyll look-alikes

Heme in red blood corpuscles has a structure similar to chlorophyll, but with iron in the middle, in place of magnesium. Heme is bright red and this gives blood its colour. Like chlorophyll, heme picks up oxygen in the lungs, gills or other respiratory surfaces and releases it in the body tissues.

Another look-alike is ***vitamin B_{12}***, which has cobalt in the place of magnesium. It seems to act in a similar way to enable absorption of nutrition.

Is it antiseptic?

People often think chlorophyll has antiseptic or antibacterial properties. Toothpaste ads, for instance, speak of chlorophyll content in their products, to suggest that this would put an end to decay!

It is true that the oxygen produced by chlorophyll should inhibit those bacteria that need ‘anaerobic’ or oxygen-free conditions. And the agents that cause tooth decay are among these. But in the crevices between teeth, in the mouth, and through the night when most tooth decay takes place, there is no sunlight. Hence, the chlorophyll in toothpaste would produce no oxygen and bacteria would go freely about their business.