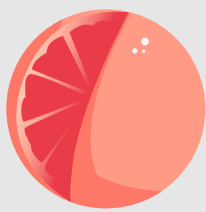
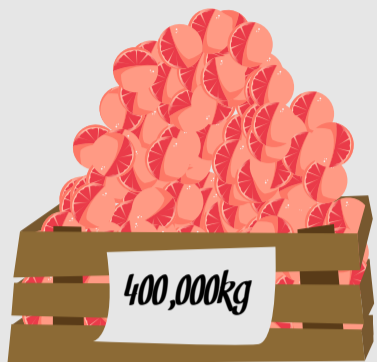


NOOTKATONE



Nootkatone is a flavour ingredient of grapefruit. It is used in drinks, desserts and confectionary.



Around 400,000kg of grapefruits are needed to produce just 1kg of **nootkatone**.

Since grapefruit production is limited, **nootkatone** is one of the most expensive flavour ingredients in the world.

But **nootkatone** can be produced in a different way



VALENCENE

is produced from oranges, which, unlike grapefruit, are always in plentiful supply.



\$550 per kg

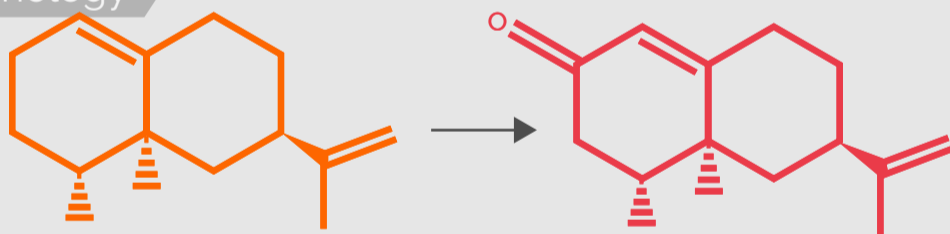
\$4000-7000 per kg

Valencene is vastly cheaper and more easily sourced, though the two molecules are actually very similar.

So how to get from **valencene** to **nootkatone**?

The old technology

Chemical conversion



This involves heavy metal catalysts and peroxides. It cannot be classed as 'natural' in the EU.



The new technology

VALENCENE

WATER

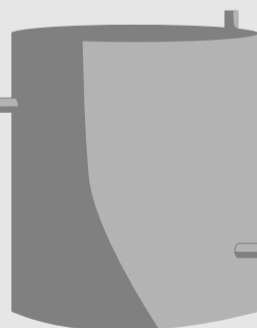
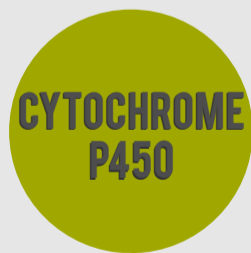
CYTOCHROME P450



+



+



NOOTKATONE



The process and ingredients are all natural.



Cytochrome p450 is an enzyme present in humans, plants and animals. A special form is produced by an engineered strain of E.coli.

Cytochrome p450 adds an oxygen atom and removes two hydrogen atoms, leaving **nootkatone**.

The final nootkatone is distilled, leaving the enzyme behind.

Producing cytochrome p450 involves synthetic biology.

This part of the process is similar to the production of an enzyme used in cheese-making.

