

Measuring Greenhouse Gases In Old Bottles Of Wine

1 In order to investigate the greenhouse gas effect in Europe, one has to measure the concentrations of CO₂ from fossil fuels at different places all over the continent. This could be done with 14C tests of air samples, but the same types of measurements can also be carried out on plants that have absorbed CO₂. To that end one would need plant material that is known to come from a specific region and also know which year it grew in.

5 Wine is the ideal research material, thought researchers from the Centre for Isotope Research (CIO) of the University of Groningen.

CO₂ in the atmosphere can come from various sources. Humans and animals breathe it out, it comes out of the earth when organic material decays, and it is also created by burning fossil fuels like coal, petrol and natural gas. CO₂ formed in this way contributes to the strengthening of the greenhouse effect, and thus to a warmer

10 climate. However, part of it is absorbed by plants that convert it with the help of sunlight into sugars.

Wine grape

The alcohol in wines is the result of the fermentation of plant sugars in the wine grape. The carbon atoms in the alcohol molecule can be directly traced back to the carbon atom in CO₂. By analysing the amount of carbon-14 (14C) in the alcohol, one can find out what the percentage of CO₂ from fossil fuels was in the atmosphere

15 when the grapes were ripening.

Radioactive decay

The scientific basis for this is the same as for 14C dating for age. Carbon-14 is a radioactive form of carbon that occurs everywhere in nature in minute traces. In dead material, this 14C slowly disappears due to radioactive decay. Fossil fuels are millions of years old so all of the 14C that they once contained has disappeared in the

20 meantime. CO₂ deriving from fossil fuels can thus be identified easily by the absence of 14C.

Regional map

Wine is the ideal agricultural product for conducting this type of research. Better quality bottles of wine state on the label the year that the grapes were harvested and the region they come from. With the help of colleagues in Europe, and also just via off-licences, the researchers obtained 160 bottles of wine from different

25 years and from different European countries and regions. 'On this basis we could create a wonderful regional map of the European use of fossil fuels for a number of years', says researcher Sanne Palstra of CIO. Most helpful was the contact with a wine-grower from the Pfalz in Germany, who contributed a series that resulted in measurements stretching back to 1975.

Supplement

30 The research revealed that wine alcohol can definitely be used to derive trends in the amount of fossil fuel CO₂ in the atmosphere in previous years. Palstra: 'Analysing the 14C in wine alcohol is an excellent supplement to the current air measurements. Before we can convert the measured amounts of CO₂ back into the amount of fossil fuels burned, however, we need information about air currents. That has been acquired with the help of a German colleague. Atmospheric transport can vary significantly from year to year, so detailed regional

35 information is very important.'

Popular

The research will be continued in cooperation with Wageningen University, because in addition to wine, other agricultural products or plants can also be used. However, it's doubtful whether the researchers will be as popular with them as they are now at their institute. They only needed 100 ml from each bottle for their wine

40 research and the opened bottles were shared with their colleagues, who toasted the research with them at home.



Old wine bottles.

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50 *was in the atmosphere when the grapes were ripening.*