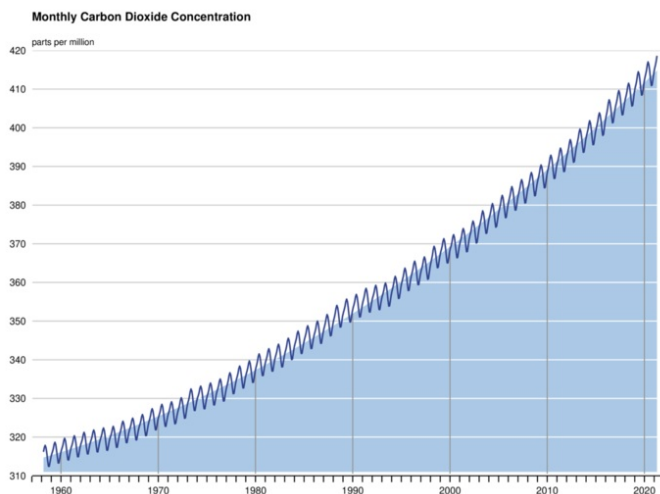


Reduction of greenhouse gases in wine production

The REDWine project and climate change

In the EU project REDWine, the CO₂ produced during wine fermentation is captured and used to produce algae biomass. Novis GmbH from Tübingen supplies the complete system for CO₂ utilisation. The aim of the project is to reduce the share of global warming caused by wine production in a way that is economical for producers.



Atmospheric CO₂ concentrations measured by the Mauna Loa Observatory from 1958 to 2020. The spikes, which occur annually, are due to the photosynthetic activities of the vegetation on land masses in the northern hemisphere.

© Scripps Institution of Oceanography

In June 2021, the President of the European Commission, Ursula von der Leyen, announced that the European Union is officially committed to reducing greenhouse gas emissions in the EU by at least 55 percent by 2030 and to establishing an economy without new climate burdens by 2050. That it is not enough just to sign declarations of intent, without also turning these goals into reality, was most recently made clear by the flooding disaster in Germany in July this year, which leaves no doubt about the effects of climate change. Despite some good approaches designed to reduce CO₂ emissions in recent years, CO₂ in the atmosphere continues to rise. It is now 415 ppm (parts per million), i.e. 48 percent more than pre-industrial levels. This human-induced increase in the CO₂ content of the atmosphere can be used to calculate the warming of the Earth's surface due to the greenhouse effect. This warming is sufficient to explain the observed increase in global temperature of over 1 °C in recent decades.¹⁾ The climate neutrality goal enshrined in the new EU Climate Law entails that everything possible must be done to reduce man-made CO₂ emissions.

Millions of tonnes of CO₂ from wine fermentation

The EU, with Italy, France and Spain, and a dozen other wine-producing countries, including Germany and Portugal, is by far the largest wine producer in the world. Together, the countries of the European Union produce about 175 million hectolitres of wine per year, about seven times more than the U.S., the next largest producer after the EU. The Bio-based Industries Joint Undertaking (BBI JU) - a public-private partnership between the European Commission and the Bio-based Industries Consortium, the association of bioeconomic industries in Europe - identifies the wine industry as one particularly affected by global warming: many traditional wine regions in Europe are facing increasingly poor environmental conditions for viticulture. At the same time, the wine industry is also a significant producer of greenhouse gases. Alcoholic fermentation produces 40 g of CO₂ for every bottle of wine produced. For the EU as a whole, this adds up to 1.5 million t of CO₂ released into the atmosphere each year through wine fermentation.

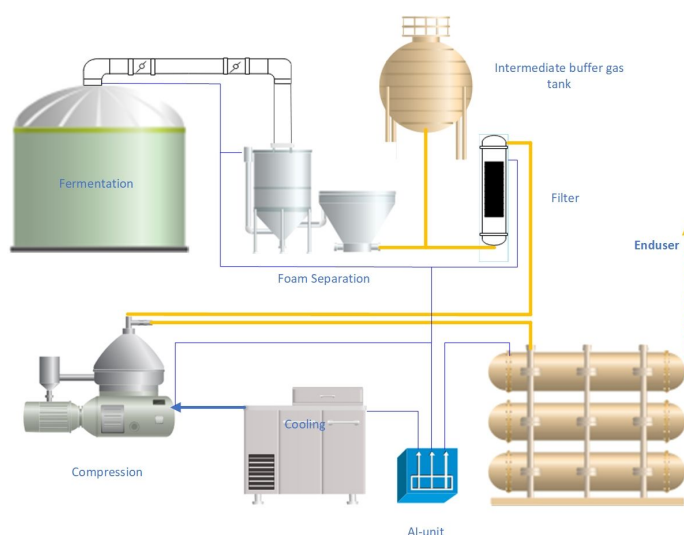
The REDWine project

Novis GmbH from Tübingen, a specialist in biotechnological research and biogas plants, joined the European cooperative REDWine project in early 2021. The project seeks to capture, compress and reuse the CO₂ produced during wine production: most of the CO₂ is used to feed algae that are processed into raw materials, for example in the cosmetics and food industries. REDWine is the second EU-funded project that the Tübingen-based company recently joined. Dr. Thomas Helle, CEO of Novis GmbH, is pleased to state: "Our projects at the European Commission are proving successful."

REDWine is receiving 7.5 million euros of funding via BBI JU (Bio-based Industries Joint Undertaking), the joint platform of the Bio-based Industries Consortium (BBI) and the EU within the framework of the European Horizon 2020 funding programme. The Portuguese viticulture association Avipe - Associacao de Viticultores do Concelho de Palmela is also a cooperation partner in the project. Novis GmbH supplies the complete system for CO₂ recycling. The gas produced in the fermentation tanks during the production of red wine is collected and analysed using a sensor array. This completely new sensor system is being developed by Tübingen-based JLM Innovation GmbH, a specialist in chemical sensor technology. The analysis is being monitored with the help of artificial intelligence (AI) developed by the Tübingen-based company 42aaS GmbH, and can give the wine producer indications if the fermentation has been thrown out of balance. The analysis data obtained in this way is a special feature, because the key parameters for wine fermentation are normally only measured at the beginning and end of the fermentation process, and often still in analogue form. With the novel sensor technology, data can be collected continuously, which contributes to improved product quality.



Fermentation tanks used for red wine production in Portugal.
© Novis GmbH



Process of CO₂ extraction from wine fermentation in the "REDWine" project.
© Novis GmbH

The gas produced during fermentation is purified and the CO₂ is compressed, liquefied and stored. A solar plant supplies the energy for the CO₂ liquefaction plant in an environmentally neutral way. Surpluses of liquid, cryogenic CO₂ can be used to cool the wine during fermentation. They thus end up back in the fermentation tank and are collected and liquefied again. However, most of the extracted CO₂ goes to a nearby algae production plant, where it is consumed by photosynthesis as the microalgae (Chlorella) grow. According to BBI JU, the wastewater generated during the cleaning of the fermentation tanks, which is rich in carbon, nitrogen and phosphorus, is also used to help the microalgae grow. The algae biomass produced is then processed into raw materials for industry (see also ["Biomass from algae and the wholesale market – a promising replacement for fossil raw materials"](#)). Helle says that, based on current findings the process is quite profitable because raw materials from algae biomass are particularly sought after in the cosmetics and food industries and attract high market prices.

A particularly pleasing outcome of the CO₂ recycling process using the REDWine procedure – not least in the eyes of wine drinkers – "is that the consumption of red wine helps minimise carbon dioxide," as Helle sums up. It is interesting to note that this process can also be transferred to beer production. Initial approaches show that the entire carbon dioxide requirement for bottling beer can be generated economically by using the CO₂ produced during beer fermentation in the brewery.

Pressure grows to take action against global warming

The overriding objective of the REDWine project, beyond the individual economic aspects, is to show how the contribution of wine production to global warming caused by CO₂ emissions can be reduced. The fact that measures to reduce greenhouse gas emissions are needed right now and can no longer be left for future generations to deal with is not only made clear by the growing number of environmental catastrophes, but is now also being imposed by the Supreme Courts. When the Federal Constitutional Court in Karlsruhe - following legal action taken by ten minors, among others - overturned the Federal Climate Protection Act in April 2021 because it did not take into account the restrictions on the civil rights of future generations caused by today's omissions, there was applause, but also much unrest. A lesser known case is yet to be brought before the European Court of Human Rights in Strasbourg: after devastating forest fires in Portugal killed well over a hundred people in 2017, young Portuguese people aged between 9 and 22 filed a lawsuit against the EU states for failing to take action against climate change, which was ultimately responsible for the fires. Similar legal actions are expected following the flood disaster in western Germany in July 2021. The growing pressure on decision-makers to take swift action to combat ongoing global warming will help make CO₂ mitigation measures like the REDWine project a success.

References:

1) Stefan Rahmstorf (29th July 2017). Der globale CO₂-Anstieg: die Fakten und die Bauernfängertricks. Spektrum.de SciLogs, KlimaLounge, Allgemein. Accessed on 21st June 2021, <https://scilogs.spektrum.de/klimalounge/der-globale-co2-anstieg-die-fakten-und-die-bauernfaengertricks/>

Article

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