

For a world with clean water



WASTEWATER TREATMENT AND REUSE

ENVIRONMENTALLY FRIENDLY SOLUTIONS FOR
THE INTERNATIONAL BEVERAGE INDUSTRY



CLEAN WATER IS A SCARCE RESOURCE

ATB WATER AS A SPECIALIST IN THE INDUSTRY

Around 71 percent of the Earth's surface is covered by water. However, only a small fraction of this is suitable for people to drink. Freshwater makes up just three percent of the world's water. The effects of climate change also mean that clean drinking water is becoming an increa-

singly precious resource. Beverage producers around the world have recognized this due to their reliance on water for producing alcoholic and soft drinks. Equally strong is the awareness of the value of being able to economically and ecologically treat wastewater.

As a specialist in modern wastewater technologies, ATB WATER has been assisting beverage companies around the world to develop and implement bespoke wastewater treatment solutions for more than 20 years. We have gained valuable experiences from our work that we are happy to share with you in this whitepaper. In the following pages you will find out how we support beverage producers with modern wastewater treatment solutions and provide them with new perspectives in this exciting sector – and we hope together with you in the future.



(Source: FAZ: Tea is the world's most popular drink)

AN OVERVIEW OF THE INTERNATIONAL BEVERAGE INDUSTRY

It's quite clear – water is drunk all over the world. It is the basis for countless drinks that have been developed over millennia. Without water there would be no tradition of tea in Britain, American Cola or German beer. But which drinks are internationally the most popular today? An initial overview:



5.7 MILLION

tons of tea are produced annually. Tea is the undisputed number one most popular non-alcoholic drink.



1 BILLION

bottles of Cola are produced annually. The leading soft drink brand globally is Coca Cola. In Mexico, Cola is the most popular drink overall. The reason for this: A lack of clean water.



45%

According to data from the WHO, around 45 percent of global alcohol consumption are spirits. In South East Asia vodka, whisky and liquor that are most popular.



36%

With a 36 percent market share, beer is the second most popular alcoholic beverage.



8,6%

... followed by wine at 8,6 percent.



Well-known brands and a strong middle class

The market is shaped by the three largest beverage producers: The softdrinks company PepsiCo, the brewer Anheuser-Busch and the Coca-Cola Company. Aside from these and a handful of other giants in the sector, there are countless small and medium sized beverage producers all over the world. Despite the diversity of drinking cultures found internationally, they share many things in common. Italian wine is appreciated just as much in China as German beer in Brazil or French mineral water in Japan. Time to take a closer look at the different types of drinks.

(Source: WHO: World Health Statistics Report)



THE GLOBAL MARKET FOR MINERAL WATER AND NON-ALCOHOLIC DRINKS

As we all know, clean water is an increasingly scarce resource. So no wonder that more and more people are drinking bottled mineral water. In 2007, around 212 trillion litres of mineral water had been sold. Ten years later this figure reached 391 trillion litres. Bottled water is most popular in China, India, Thailand and the Middle East. Besides mineral water, either still or carbonated, non-alcoholic beers, energy drinks and isotonic sports drinks are becoming increasingly popular. You find the highest per capita revenues for these in the USA, Norway and Belgium. Sales of 133 litres per capita puts Germany on place 10 in the Top Ten, but it is catching up rapidly.

COUNTRY COMPARISON OF PER CAPITA SPENDING ON SOFT DRINKS



Sale of spirits, beer and wine are also growing. In 1990, the average per capita consumption globally was 5.9 litres. Today, this value is 6.5 litres of alcohol annually. Alcohol has a very long history.

(Source: Statista.com: Per capita consumption of bottled water / Per capita consumption of beer by country in 2018)



ALCOHOLIC DRINKS

A RESULT OF THE NEOLITHIC REVOLUTION

Approx. 12,000 years ago, a hunter put down his bow and swapped it for a plough and scythe. Day after day he worked on his field in all kinds of weather to grow his crops. The yield? A handful of grains that were hardly enough for survival. It remains disputed, why exactly humans began to settle. One hypothesis: One again alcohol is the reason – a product of the fermentation of overripe crops. A kind of by-product that made a difficult

existence easier to bear. Ever since that time, brewers, vintners and distillers have become respectable professions that form the backbone of the industry up to now.

« **A clear thing: Vodka, Whisky, Schnapps etc.** »

Spirits remain especially popular. From aperitifs and digestifs to high-quality whisky, matured for many years in oak casks, spirits are part of drinking culture in almost every country on Earth.

«Give me aquavit! – William Shakespeare »

Even cultures that consume just a bit alcohol have produced world-renowned alcoholic beverages. Raki from Turkey or Japanese Rice Liqueur are just two examples. The top ten of the world's most popular spirit brands:

- | | |
|----------------------------|----------------------------------|
| 1. Smirnoff (Vodka) | 6. Captain Morgan (Rum) |
| 2. Bacardi (Rum) | 7. Cuervo Tequila |
| 3. Johnnie Walker (Whisky) | 8. Baileys (Whisky liqueur) |
| 4. Absolut (Vodka) | 9. Jägermeister (herbal liqueur) |
| 5. Jack Daniels (Whisky) | 10. Ballantines (Whisky) |

Whisky, vodka and aquavit are not just enjoyed after a meal or with good cigar, however, they are part of the global party scene for a long time. Here they form the basis of various mixed drinks or cocktails. A trend that also applies to other types of alcohol, beer for example.

(Source: Statista.de: Revenues for the German beverage industry 2019)



BEER IS A BASIC FOODSTUFF

ALL OVER THE WORLD

At least that is how it is seen by millions of people around the world. By the way – the barley juice has not been created in Germany, but in ancient Egypt. The recipe has reached Germany by 4000 years old hieroglyphs – so indeed long before the Bavarian purity law came into being. Nowadays, each year, around 177 billion litres of beer are drunk globally. The leader is China, consuming more than 42 billion litres each year. What about per capita consumption? Europe remains at the top of the charts – as this top 5 shows:

- | | |
|-------------------------------|-------------------------|
| 1. Czech Republic: 191 litres | 4. Romania: 98.9 litres |
| 2. Austria: 107.6 litres | 5. Poland: 98.2 litres |
| 3. Germany: 101.1 litres | |

The first non-European country is Namibia on place eighth, where each person drinks 81,3 litres on average per year. Overall beer consumption in Africa is rising sharply. Brands such as Heineken have recognized the continent as an exciting market for sales a long time ago. However, German beers are still popular exports.

„Even water can be turned into a fine tippel when it is mixed with malt and hops.“ (German adage)

76,000,000 hectolitres of beer were sold in 2019 in Germany, thus Germany is the market leader, far ahead of Great Britain, Poland and Spain.

1,539 German breweries produce more than 6,000 different beers.

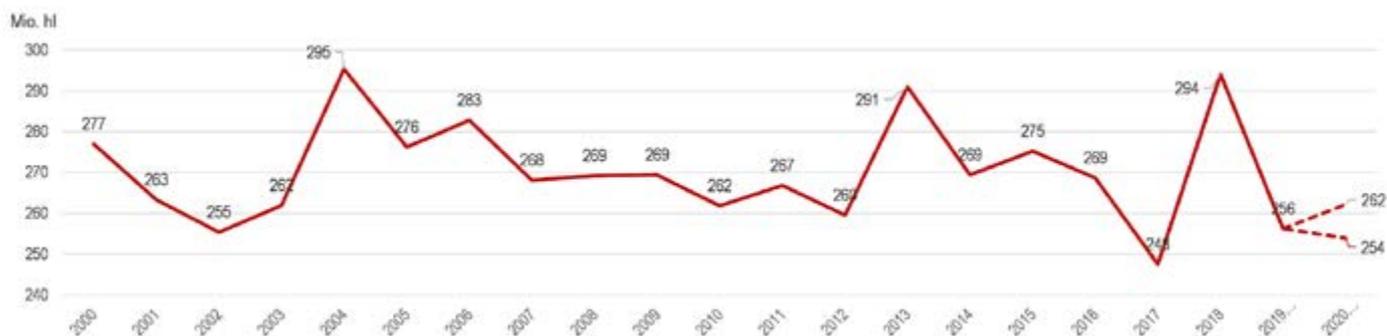
16.5 years would be needed to try them all if you would have one German beer per day.

(Source: Statista.de: Revenues for the German beverage industry 2019 / The brewing industry in Germany 2020)

WINE PRODUCERS ARE PARTICULARLY AFFECTED BY CLIMATE CHANGE

For centuries, wine has stood for culture, pleasure and enjoying life. Products such as Burgunder, Port, Chardonnay and Riesling are consumed and appreciated all over the world. Whilst demand continues to grow, the international wine production has only increased minimally. There are two key reasons for this: Climate change and the Corona pandemic. Countries such as the USA, Australia and Argentina have seen entire crops destroyed by poor weather conditions and large scale fires. In South Africa, also an important wine exporter, droughts have led to a reduction in production. Compared to 2019, only one percent more wine was produced in 2020 for a total of 262 million hectolitres of wine.

Global wine production (excluding juice), 2000-2020



(Source: OIV status report)



Wine is a reflection of the region in which it grows

It's not just the wine itself that is enjoyable. The landscapes in which the grapes are grown have their own appeal. For this reason European wineries have discovered wine tourism and created entirely new sources of income for themselves. A development that we will now take a closer look at alongside other trends in the beverage industry. "In wine lies truth – and for that everyone everywhere raises a glass." – Friedrich Hegel

A sector that is reinventing itself: Key trends in the global beverage industry

If you don't move forwards, you go backwards. This old piece of wisdom is especially true for the dynamic beverage industry. Drinking customs are changing faster and thanks to globalisation we are even well informed about trends in far away countries. What and how we drink is increasingly seen as a lifestyle statement. Hipster culture with its craft beer breweries is just one example of a development that has spread around the world. Beer and other drinks should again be seen as "true workmanship" and stand out for their unadulterated flavour.

A DESIRE TO SLOW DOWN AND FOR RELAXED ENJOYMENT

As our world is driven forward ever faster by globalisation and digitalisation, many people desire a few moments to slow down the pace and relax. A good craft beer takes time, and more and more beverage producers are becoming aware of just how important tradition still is to many people. Retro style advertising campaigns are just one example of how the industry advertises to consumers. So beer for example, should be produced in its own region and ideally by a brewery that has been family-run for many generations. This has to do with trust. At a time where we hear of one new food scandal after another, trust has become a sort of guarantee.

51 percent of European beer consumers believe that it is ok paying more for craft beer.

17 percent of craft beer products introduced globally come from the USA.

By the way: Craft beer breweries also produce non-alcoholic beers and soft drinks. Since the craft beer scene is populated largely by brewers with less experience, ATB WATER support these companies with an environmentally friendly wastewater treatment solution. How we do this will be explained in detail later on.

« Focus on sustainability »

Record summer temperatures and environmental catastrophes such as forest fires are not just some abstract danger. For many people they are a hard reality. The demands on sustainability in beverage production are constantly growing. And beverage manufacturers are coming to the relevant conclusions. Environmentally friendly drinks packaging, electricity production using solar cells and sustainable logistics are areas with which the industry has been intensively engaging for quite some time already. In some cases, existing production and logistics infrastructure is being turned entirely inside out and made more eco-friendly. Environmentally friendly wastewater disposal and reuse are also on the agenda of many small and large beverage producers. One factor pushing such development is wine tourism. Wine tourism is currently experiencing a strong boom and making many wineries give consideration to environmentally friendly solutions.

« Wine tourism: A real economic factor »

Good wine depends on the quality of the grapes and the soil in which the vines grow. Enjoyment of wine is a spe-

cial event that can be celebrated stylishly. It's no wonder that wine tourism is booming. When you go on holiday or are travelling, you like to have new experiences, leave behind the daily grind and enjoy life.

All this and more is offered by wine tourism. It's not the wine alone that attracts people. The landscape in which the grapes are cultivated and the picturesque vineyards contribute to the atmosphere. Traditional winegrowing regions such as those in Italy and France understood the economic value of wine tourism long ago and developed it constantly. Other countries with good wine-growing regions are now catching up and discovering wine tourism for themselves.

Ideas such as "eco wine tourism" have appeared where issues of sustainability, biodiversity and environmental protection play key roles. However, this trend entails new challenges for wineries, breweries and distilleries, as the gastronomic offer create domestic wastewater that must be treated alongside the wastewater from the production process.



(Source: Statista.de: Craft Beer in Germany 2020 / Mintel Germany)



Joël Rochard
Owner of a winery

“ I’m used to having to remind people that “every winery is a special case” when it comes to wastewater and the environment. ”

SUSTAINABLE AND ECOLOGICAL WINERIES

INTERVIEW WITH JOËL ROCHARD

Joël Rochard owns a small winery in the Champagne region of France. He is a connoisseur and renowned expert in the field of winegrowing and production as well as for the overall conception of renovation and construction of wineries. He is a member of the International Organisation of Vine and Wine (OIV), working as an expert for the environmental group. He is also an editor for “Oenologist Magazine” More information about his work can be found on his homepage: www.joel-rochard.com/en/water-management.

« How do most French wineries handle wastewater treatment? »

It is first worth mentioning that, compared to other food processing industries, wastewater from wineries is associated with a very large spike in output during the grape harvest and processing (mid August to the end of October, depending on the region). Vineyards in France are highly diversified, which has resulting in the various different treatment technologies being developed. Directly spraying onto agricultural areas to take advantage of the natural filtration properties of the soil is practiced in high limestone areas, particularly Champagne and Cognac. Wastewater is treated along with domestic wastewater if the municipal wastewater treatment plant can cope with the high output during the peak period. This can sometimes be achieved by installing buffer tanks to store the increased wastewater during the harvest and processing seasons. Bespoke treatment solutions are increasingly based on extensive aerobic systems (aerated storage), intermediate sequential batch reactors or intensive “activated sludge”. The latest systems generally include a supplementary treatment stage

using phytoremediation (reed soil filtration). Methanation is being increasingly used more heavily contaminated wastewater from distilleries. In particular, there is a large collecting plant in Cognac (Revico Cooperative, www.revico.fr).

« What is the situation in other countries? »

The wide range of treatment equipment seen in France can be seen throughout the world. A few countries prefer treat wastewater using domestic wastewater treatment plants, such as in Germany and Switzerland. Others require that it is treated separately, most often using extensive or intensive aerobic plants. While Europe and North Americas use a wide range of different treatment plants, numerous countries, particularly those in the former Soviet Union, are relatively poorly equipped.

« Why is it so important for wine producers to have a well planned wastewater treatment process? »

Optimised wastewater treatment must be adapted to the relevant context. I’m used to having to remind people that “every winery is a special case” when it comes to waste-



water and the environment. It's also worth noting that "the easiest type of wastewater to deal with is that which is not created in the first place". This kind of approach required optimal management of water and liquid by-products. This step, combined with the possible separation of the systems, is often one of the largest challenges for implementation. Furthermore, the availability of water in certain regions can be a problem. This is particularly the case in areas of the Americas and the Mediterranean, leading businesses to consider reusing wastewater, particularly for watering their crops and sometimes for internal use in the winery. In this context, the use of phytoremediation (using reed soil filtration) for significantly improving hygiene, potentially in combination with membrane technologies, can be bit by bit integrated into the perspectives for further developing cleaning techniques.

« What are the advantages of biological plants, particularly SBR systems, for wineries? »

Aside from the large production units, the world of wine production is large still a small scale business. The harvest and processing time in wineries is also very intensive and monitoring the treatment systems is rarely a top priority, requiring systems that are easy to manage. The SBR system is a good compromise between traditional techniques that require large volume storage and intensive processes that require technical expertise and complex monitoring.

« Aside from wine tourism, what trends are currently shaping the future of the sector? (individual countries/regions, but also globally) »

Like all sectors, the world of wine production is more and more looking at the issue of sustainability. Wine is also a cultural product where the buyer has high expectations, as well as the visitor. This is why I have developed the "eco-oenotourism" concept. This gives wineries guidance and orientation on ecological practices, particularly in regards to biodiversity in the vineyards and

sustainable wine production. The eco-design concept of wineries to which I provide advice and training focuses on combining the limited use of fossil fuels using bioclimatic architectures, reducing water consumption and ecological management of wastewater by limited energy consumption, visual, odour and noise pollution.

« Why are you collaborating with ATB WATER? »

I believe that ATB WATER's excellent specialist knowledge in the sector, for the food industry in particular, and their ability to implement SBR systems in a wide variety of different situations puts them in an excellent position to deal with the sheer variety found in wineries. The presence of ATB in many countries can also help contribute to development throughout the global wine sector.

« What advice would you give to wineries that are currently considering modifications and new builds? Particularly with regards to water/wastewater management? »

Wineries are built to last for a long time. It is important to think ahead to the future when thinking about challenges associated with energy and water consumption through the development of the bioclimatic architecture and from the use of technologies that make cleaning easier. With regards to wastewater, it believe it is important to integrate sustainability criteria into treatment systems that go beyond what local regulations require. This makes it possible to combine ecological systems, most often based on phytoremediation (soil filtration), with various conventional treatments. There is sometimes also an opportunity to create wetlands in the area around the winery. Doing so can strengthen the environmental image for visitors taking part of wine tourism. In all cases it is essential to avoid problems associated with the installation of a treatment system as people living locally are increasingly intolerant of annoyance of any kind.

WHAT KINDS OF WASTEWATER ARE PRODUCED BY THE BEVERAGE INDUSTRY?

The production, processing and filling processes associated with various beverages generate wastewater. This wastewater can have high levels of biological and chemical contamination. It can also contain a high concentration of easily degraded organic compounds. Water from breweries for example, has a temperature between 25 and 35 degrees, a high nutrition content and balanced pH value. These are excellent conditions for bacteria to grow. During the brewing process itself, biological substances such as yeast, starch and sugar compounds are discharged into the wastewater. Later on, the process of cleaning the vat and lines produces further wastewater that contains significant amounts of chemical cleaning agents. Wastewater from wine-growing has high levels of biological contamination. The high fruit acid content and acidic pH value means that untreated wastewater can accelerate the corrosion of some materials, putting further strain drainage pipes on that carry this water away. However, it is not regulated uniformly how this wastewater has to be treated.

« Wastewater disposal: There is no globally applied standard of regulation »

Internationally there exists a wide variety of regulations and laws regarding to how different types of wastewater are to be handled. In Germany, for example, wastewater regulations set out threshold values for feeding to a wastewater treatment plant via the sewage network (indirect feed) or for directly operating a wastewater treatment plant with treated water being subsequently fed out into the immediate environment (direct feed). Wastewater treatment plants are also subject to an approval process. If threshold values are not maintained, the beverage producer is liable for any damages or environmental contamination that may arise.

« Coming full circle: Decentralized wastewater disposal and reuse »

Breweries, wineries and other beverage producers are often found outside of built-up areas. There is not enough space in a large city for vineyards, furthermore some landscape would lose its romantic atmosphere if rows of grapes would be surrounded by factories and skyscrapers. The success of small villages that depend on the tourism is certainly due to the excellent wine in their region. Despite all the wonderful romanticism and love for untouched landscapes, there is a problem. Breweries and wine producers located far from the beaten path are rarely connected to public sewage systems. Wastewater from the brewing or wine pressing process must be disposed of in a decentralized way. The good news: There is a solution to this very problem.

« Decentralized wastewater disposal for the global beverage industry »

First of all: Most wastewater from the beverage industry is biodegradable. As one of the leading specialists for decentralized and semi-centralized wastewater treatment using biological methods, ATB WATER supports many breweries, wineries, distilleries and other beverage producers in the treatment of their wastewater. We use several different approaches including the SBR process (Sequencing Batch Reactor) for sequential biological cleaning.





« What is the SBR-process? »

The focus is on a separate primary sedimentation for the mechanical retention of coarse materials as well as a biological activation and secondary sedimentation tank – also called an SBR-reactor. The inflowing wastewater is treated in several cycles via the SBR- treatment plant. Our AQUAMAX® SBR treatment plant, for example, is particularly suitable for breweries and wine press houses whose wastewater is subject to various load fluctuations – because if the wine is processed in autumn, naturally more wastewater is produced than in the following winter.

- » Are you not interested in reusing wastewater? Also not a problem. The SBR-process can be used to treat wastewater for disposal into the local environment and thus helping maintain ground water levels.
- » The system is highly intuitive. Once installed, the operator has control over many of the plant’s functions. Specialist Know-how is required only for regular maintenance and any repairs that may be needed.
- » Each customer receives his custom-made solution. For example the Belgian brewery „Eifel Domaine“.

« What are the advantages of the SBR-process? »

- » The SBR-process is the ideal solution for the beverage industry and has been used successfully in the food industry for many years. The benefits of the SBR-wastewater treatment plant at first view:
 - » The SBR-process is a purely biological process that meets all key criteria for organic certification and achieving sustainability goals.
 - » The system requires minimal space compared to other biological processes and is therefore ideal for smaller breweries and wine growing areas.
 - » The batch-based treatment of wastewater is easily adaptable to the daily, monthly and seasonal demand.
 - » The SBR-process treats wastewater such that it can then be reused for watering vineyards and potentially also used as fertilizer. This reduces costs and protects the environment.
 - » Depending on circumstances, this wastewater may also be reused in production processes.

« Ecological and efficient: Wastewater treatment for a Belgian brewery »

Located in rural Büllingen, the brewery has no connection to a municipal sewage system. In areas like this, each private residence and business is required to setup their own wastewater treatment system. One of these businesses is the small Brewery "Eifel Domaine" that produces top-fermented craft beers. The beer is brewed to a Belgian recipe using water from the Ardennes. The brewery also produces special beers according to customer recipes. The company is located on the edge of a nature conservation area and is therefore subject to very strict wastewater regulations. An additional challenge: The amount of wastewater produces varies highly depending on the season. The organic contamination of the wastewater can vary from day to day. As this is a small brewery, the available space for installing a wastewater treatment plant is minimal at just 10 x 4 metres. Beer tastings are also held in the brewery. It is therefore essential that the wastewater treatment system does not give off any unpleasant odours. So finally a challenging project – that we gladly took on.



OUR SOLUTION

A CUSTOM-MADE PROCESS

The Belgian brewery was looking for a solution that would tackle all of these challenges. After intensive discussions and a personal consultation with the experts from ATB WATER, we together decided on the installation of an SBR-wastewater treatment plant. This decision was based on:

- » the SBR-plant would allow the use of a buffer tank that could absorb the hydraulic effects of the brewing process.
- » the system has a flexible structure and the tank sizes were suitable for even the minimal space of 40 square metres.
- » the duration and frequency of cleaning cycles can be adjusted if required.
- » the wastewater produced can be disinfected if desired.
- » Just three weeks passed on between placing the order, installation and setup. This ensured the system could be put into operation quickly.
- » After start-up, the wastewater concentrations were extremely below the thresholds required by the local environmental authorities.



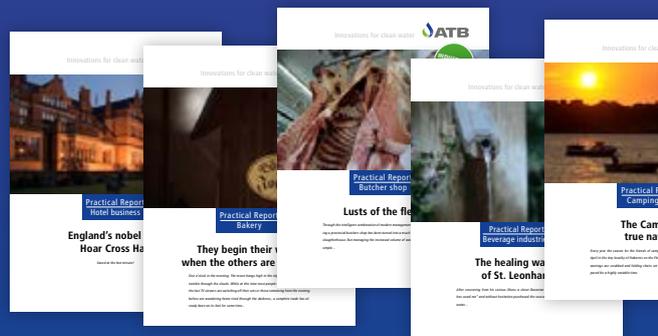
This project demonstrated once again the efficiency of SBR-wastewater treatment plants and their benefits in the beverage industry. Due to the high degree of flexibility, this process can be adapted to facilities of any size. Training for personnel in how it works and is operated is no trouble at all. It's no wonder that we could support many other breweries, wineries and distilleries using the SBR-process in countries throughout the EU in order to ensure optimal wastewater treatment.

ATB WATER: TAKE ADVANTAGE OF OUR CONSULTING SERVICES FOR YOUR WASTEWATER TREATMENT AND REUSE

As a specialist for innovative wastewater technologies and decentralized wastewater treatment, we are a competent partner for businesses in the beverage industry.

We take our time to properly advise you. We want to learn about the specific challenges you are facing in your company and work together to find the best solutions for your wastewater treatment and reuse. As our customer, you are just as important to us as our efforts to handle our planet's most important resource as carefully as possible. We do everything we can to ensure clean water for the world. Protecting our water means protecting the environment.

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