

Vinegar



Vin e gar

Vinegar

Process Technology

VOGELBUSCH VINEGAR PLANTS

Know-how and technology licensing

Vinegar is an important acidifier and preservative commonly used in the food processing industry and in cooking for salad dressings, vegetable pickling and sauces. It has also traditionally been used for medical and cleaning purposes.

Vinegar is made by harnessing vinegar bacteria's ability to convert the alcohol in feedstocks into acetic acid.

Vogelbusch has decades of experience in the design of industrial vinegar production plants with reference installations all over the world. They are known for their outstanding performance and reliability thanks to the most efficient aeration system available on the market today. Behind the company's comprehensive services is an exceptionally strong base of know-how which is the result of a wealth of experience with a full range of raw material sources and fermentation processes.

DESIGN FOCUS

The semi-continuous Vogelbusch vinegar fermentation process has been developed to provide optimal, cost-effective technological solutions which result in consistent product quality, addressing bioengineering issues such as oxygen transfer, mash circulation, cooling requirements and foam formation.

Benefits of Vogelbusch technology and design

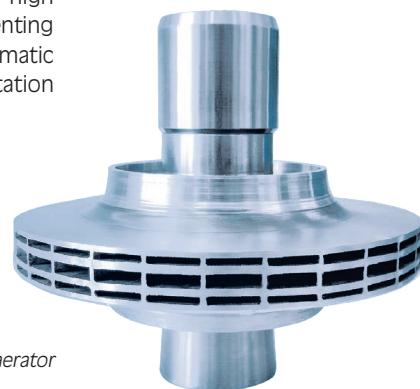
- | Exceptionally efficient aeration system
- | Interruption-free performance over long periods
- | Low labor requirements with fully automated fermentation
- | High flexibility in terms of raw materials and product specifications
- | Integration potential with alcohol plant

YOUR ADVANTAGE

IP-8 SELF PRIMING AERATION

The major benefit of the Vogelbusch vinegar fermentation system is the highly efficient IP-8 aeration system. Easy to operate and with very low energy consumption, it maintains the optimal conditions for the growth of vinegar bacteria in the fermentation tank.

The rotating self-priming turbine produces tiny, uniformly-sized air bubbles, generating the high oxygen transfer rates necessary for high vinegar production rates. Its design minimizes shear forces, preventing mechanical damage to the vinegar bacteria and therefore problematic foam development. As a result, the Vogelbusch vinegar fermentation system does not require a mechanical defoaming device.



Vogelbusch IP-8 aerator

SERVICES TAILORED TO YOUR NEEDS

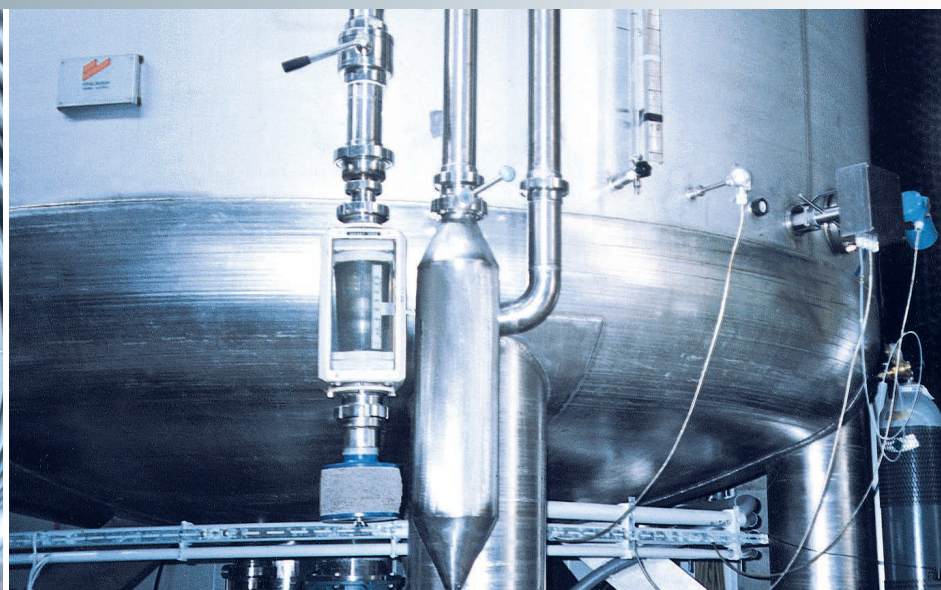
Our services are customized to our clients' requirements. Design packages and equipment can cover just the key components (fermenter and process control system) or the complete process line, including measuring & control and laboratory equipment.

Our standard design package consists of the basic engineering of the process plant including

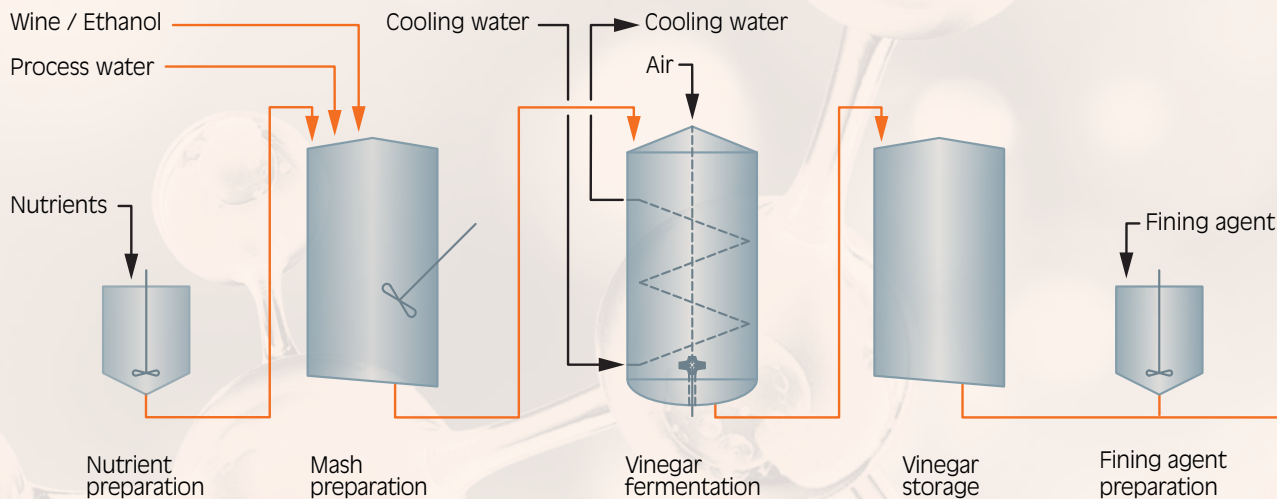
- | Technology and process design
- | Supply of key equipment
- | Implementation support and operator training

Our full service includes the turnkey installation of the complete production plant.

We can also carry out the integration of the vinegar unit into other facilities, e.g. alcohol production.



THE VOGELBUSCH VINEGAR PROCESS



The Vogelbusch vinegar process employs submerged fermentation in which acetic acid (vinegar) bacteria homogeneously scatter in the fermenting mash and no carrier material is used. For optimal bacteria growth, specific nutrients are added to the mash and a self-priming turbine supplies the oxygen necessary for the aerobic fermentation.

MASH PREPARATION

The fermentation substrate (wine or alcohol diluted with process water) is mixed with vinegar containing acetic acid bacteria in the injection tank. Nutrients (a mix of glucose and Bremono[®]) and some vinegar are blended in the nutrient vessel, then added to the injection tank and mixed to dilute.

This mash preparation is carried out in batches once or twice a week in one of the injection tanks while the other is used as feed tank for the fermentation.

BREMONO[®]

Nutrient for vinegar fermentations

Bremono[®] is a blend of vitamins, minerals and other nutritive substances for vinegar bacteria that is formulated according to the raw material type. This nutrient mix has been developed by Vogelbusch to promote optimal propagation of the vinegar bacteria in submerged fermentation. The nutrient is added to the mash together with glucose. The standard packaging for Bremono[®] is 25kg drums.

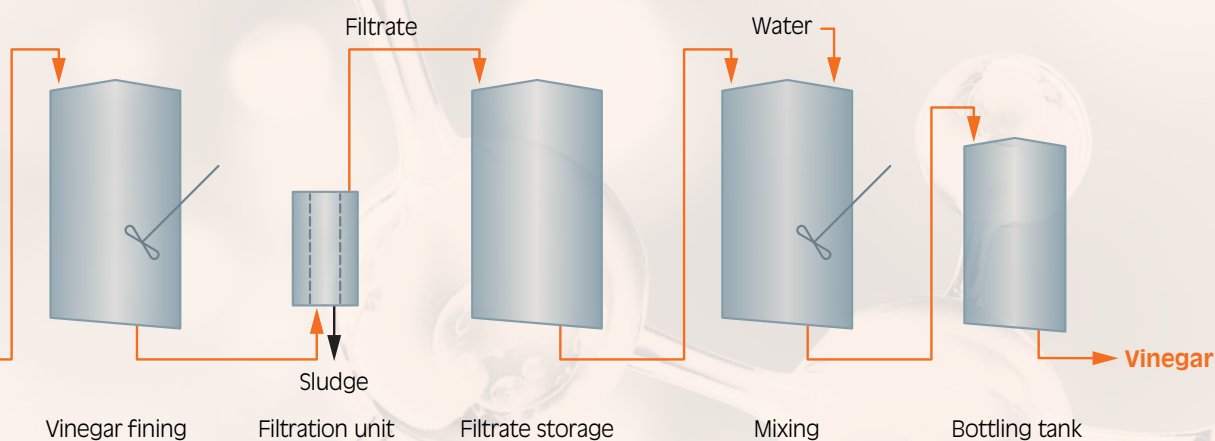
VINEGAR FERMENTATION

The fermentation is semi-continuous. The alcoholic mash is aerated in the fermenter until the vinegar concentration reaches its maximum and the alcohol decreases to around 0.3 vol%. About a third of the fermenter content is then pumped into the ejection tank.

The fermenter is refilled with fresh mash from the injection tank for the next fermentation batch. A batch cycle lasts about a day, but is dependent on the alcohol content of the raw material.

FINING AND FILTRATION

The raw vinegar is allowed to mature in the ejection tanks for several weeks while impurities which cause turbidity (such as bacteria, coagulated proteins, precipitated salts) settle to the bottom of the tanks. If further fining is required the vinegar is sent to a fining tank for precipitation.



To remove any remaining solids, the mature vinegar passes through a micro-filter module into the filtrate tank before it is fed to the mixing tank. Here it is diluted to the desired concentration with process water, pumped into the bottling tank and finally filtered over a de-germination filter before bottling or bulk filling.

PRODUCT TYPES

The Vogelbusch vinegar fermentation process is suited to any kind of alcohol-containing raw material. Neutral alcohol (for white vinegar) and fruit wine (e.g. grape, apple or date) are commonly used. Vogelbusch can also provide alcohol production equipment and services if required.

Standard product concentration is between 5 and 14% acetic acid. Final concentration depends on the initial alcohol content of the raw material – at the top end of this range the limits are determined by the natural acid tolerance of the vinegar bacteria – and on economic considerations.

For domestic use, the vinegar is diluted to a concentration of 5%.

AVERAGE CONSUMPTION FIGURES

For the production of 10,000 liters of 10% vinegar (10g acetic acid/100ml)

RAW MATERIAL

		ALCOHOL	FRUIT WINE
Ethanol content	%	100	10
Quantity	l	1,075	10,500
Bremoferm® (nutrient)	kg	5	3
Glucose	kg	10	-
Electricity	kWh	450	450
Process water	m ³	9	-
Cooling water 23/27°C	m ³	840	840

Other consumables also include filter aids (e.g. cartridges) to be used according to the specifications of the filter type and a fining agent if required.



STANDARD PLANT SIZES

Vogelbusch offers four standardized plant sizes. The production capacity can be enhanced by the addition of further units.

FERMENTER TYPE		V300	V600	V1200	V2400
Fermenter volume	m ³	18	36	72	144
Production capacity ¹⁾	l	4000	8000	15000	30000
Cooling water connection load 23°C	m ³ /h	20	40	80	160
TANKS					
1 Nutrient tank	m ³	1	1	2	2
2 Injection tanks	m ³	30	60	120	120
2 Injection tanks ²⁾	m ³	4	10	20	40
4 Ejection tanks	m ³	30	60	120	120
2 Fining tanks ²⁾	m ³	30	60	120	120
1 Filtrate tank	m ³	30	60	120	120
1 Mixing tank ²⁾	m ³	30	60	120	120
1 Bottling tank	m ³	10	20	40	80
BUILDING DIMENSIONS					
Average required area	m ²	300	400	600	800
Minimum required height	m	7.6	7.7	9.5	10.5

¹⁾ Calculated in liters of 10% vinegar per day

²⁾ Optional

PROCESS AUTOMATION

The vinegar fermenter is fully automated, reducing the need for supervision to a minimum. The process is directly controlled by an inline alcohol measurement system (GS2E gas analyzer). As soon as the desired residual alcohol content is reached, the raw vinegar is automatically ejected and fresh mash is fed in. The system is highly flexible in order to meet the demands of a range of raw materials and changing ethanol and vinegar concentrations.

An emergency power supply with automatic start ensures interruption-free fermentation in case of power failure.

GS2E GAS ANALYZER

The Vogelbusch ethanol sensors for process automation ensure reliable online detection of the current ethanol concentration during vinegar fermentation. The system monitors the ethanol content in real time without sampling and analysis and determines when fermentation is complete.

It is designed to be installed on-site near the fermenter. A semiconductor sensor element which is in contact with the ethanol-enriched air passing a probe detects the ethanol.

The ethanol concentration is displayed on the instrument and converted to a standard current signal and two limit relay contacts which can be used as an input signal for any PCS or for visualization/documentation.

GS2E gas analyzer features

- | Easy installation and integration with existing equipment
- | Suitable for any type of fermenter and control system
- | Standard industrial design of all components





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