



The ham and sausage delicacies of the Schwarzwaldhaus GmbH are made using the traditional cold smoking method over natural Black Forest fir wood.

Photo: Schutzverband der Schwarzwälder Schinkenhersteller

Planning exhaust air treatment

A new construction of a Black Forest Ham production plant was planned with modern smoke filters

The odorous exhaust air from a smokehouse is enriched with a multitude of organic substances consisting of fatty, tarry or oily compounds. Therefore, new smokehouse productions are already in the planning phase subjected to an approval procedure in accordance with the Federal Immission Control Act (Bundes-Immissionsschutzgesetz – BImSchG). When planning a new plant, it is therefore important not only to find the best method for achieving the desired quality of the smoked goods, but also to observe the emission restrictions of the legislator at the same time. Exhaust air technology in modern meat product manufacturing has a high potential for energy savings and CO₂ avoidance.

By Friederike Schmedding

The German company Schwarzwaldhaus GmbH relied on a modern smoke filter system from a specialist when planning the new production plant for their Black Forest ham. Black Forest ham is a raw cured ham without bone, which receives its special flavor by the curing and gentle

smoking over fire and spruce wood. The company, a tradition-conscious and growing butcher's shop in the third generation from Gengenbach in Baden, Germany, attaches great importance to authentic Black Forest ham. Black Forest ham is a designation of origin and not a generic name. According to EU regulations, the protected ham may only be produced by companies located in the geographical Black Forest that adhere to the production specification with its strictly defined production steps.

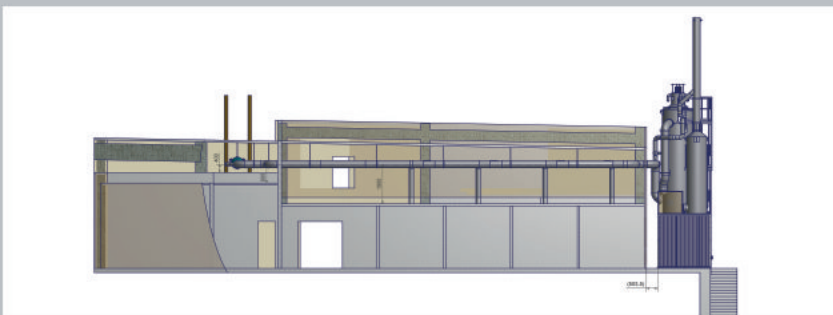
Ecology just from the start

Due to the growing international demand for high-quality Black Forest ham, the premises of the old butcher's shop became too small for the company. Several tons of the speciality, which is long since exported to England, France, Austria and Poland, as well as a range of sausage products, leave the factory every week. Furthermore, the requirements for the old smokehouse had become ever stricter, emphasizes Managing Director Frank Spinner, who also wanted a modern smoke filter system for the new ham production facility. Spinner commissioned the filter specialist KMA Umwelttechnik

GmbH from Koenigswinter, Germany to design, install and implement a hybrid filter system consisting of an electrostatic filter and an exhaust air scrubber (Fig. 1). In addition to compliance with the applicable BImSchG regulations, management focused on maintaining the individual taste and the energy-efficient operation of the exhaust air technology as well as on reducing odor emissions.

During the smoking process, intensive fresh smoke is continuously blown into the smoke chambers. However, in order to meet the German TA Luft requirements the smokehouse has to comply with the specified clean gas value of a maximum mass concentration for total carbon of 50 mg/Nm³. At the same time, the energy consumption of the filter system must be as low as possible. This places increased demands on the exhaust air purification. The multi-stage KMA purification system works with two filter modules to simultaneously separate solids (tar) and odors. By means of an electrostatic particle separator, the modern smoke filter system

Layout

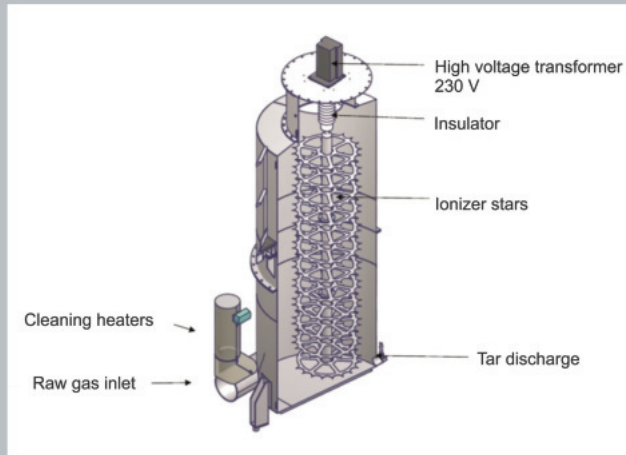


Source: KMA

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Fig. 1: During the planning phase, technical drawings are used to define the connections for the smoke extraction points, the connection of the pipelines and other on-site measures.

Installation



Source: KMA

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Fig. 2: The filter system consists of an electrostatic filter tube, which generates practically no pressure losses due to the unhindered flow of the exhaust air.



Fig. 3: The central air filter system has a smoke filter capacity of 3,000 m³/h and disposes the exhaust air of cold as well as hot smoke plants.

allows for a highly effective separation of aerosols (e.g. grease mist, oil smoke or smoke fumes) as well as for the elimination of odors thanks to a gas and odor separator (VOC separation).

The multi-stage method is efficient

For several reasons, exhaust air technology is of essential importance in the planning of modern meat product manufacturing plants. On the one hand, the design and on-site connections of the facility, including the necessary piping, can better be integrated into the construction plan at an early stage. In addition, the early examination of the exhaust air purification process results in high potentials of energy-saving and CO₂ avoidance for reducing operating costs and increasing sustainability.

The energy-efficient process of the modern smoke gas filter system is regarded as particularly sustainable, as by using the more energy-efficient electrostatic filter and gas scrubber hybrid filter system, smokehouse plants can reduce their energy consumption by more than 80% compared to a conventional afterburning system. Due to the applicable TA Luft regulations, afterburning plants must be operated at a temperature over 750 °C, in order to sufficiently separate emissions and smells from the smokehouse exhaust gases. The related energy input results in immense operating costs and secondary emissions (CO₂, CO) for the smokehouse plant.

The KMA process is divided into two steps – first the smoke is separated via electrostatic charging and is then washed to filter the remaining gases and odors. The exhaust air from the smokehouses is led into collecting pipes and transported to the central multi-stage exhaust air filter system.

In the first step, the exhaust air for particle separation reaches the core of the air cleaning system – the Airmaxx electrostatic tube filter (Fig. 2). The smoke gas loaded with particles enters the vertical stainless-steel tube from below and flows centrally along the arranged high-voltage electrode. This ionization electrode generates a strong electric field while maintaining a very low energy consumption. The electrostatic charge inside the tube causes the pollutants flowing past to migrate to the earthed stainless-steel walls of the separator tube and to settle there. The process copies natural events and resembles the cleaning effect of a thunderstorm: dust and other particles are charged by ionization and then precipitated. For this method of smoke separation the energy input is extremely low: only a few hundred watts are required per 1,000 m³ of smoke.

This way, a wide variety of pollutants can be removed from the exhaust air in a highly effective manner without sticking to the filter medium, as the separated tar droplets and residues flow off along the inner walls of the electrostatic tube filter. The filter tube has a liquid collector at the bottom with an outlet to the depot container. An integrated hot-air clean-

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ing program automatically cleans the inner walls of the smoke filter system. This built-in automatic self-cleaning system allows for a central programming from time to time (usually once a week). The constant efficiency of the exhaust air purification system makes the exchange of the filter cells redundant.

In the second step, the smokehouse exhaust gases flow through an exhaust air scrubber, which filters odors, gases and vapors from the exhaust air according to the absorption principle. The gas scrubber is designed as a pH-controlled packed gas scrubber with a highly effective countercurrent column. This means that a wash liquor flows inside the stainless-steel tube in counterflow to the incoming smokehouse exhaust gases and removes gaseous air pollutants and aromas from the exhaust air stream. An automatic regulation of the exhaust air scrubber adapts the washing liquor and fresh water demand to the respective operating situation.

Tailor-made project planning

The project planning of an exhaust air purification system is integrated into the conception of the meat production facility at an early stage by experienced construction planners. The process engineering, the design of the hybrid filter system and the necessary piping depend on the customer's production facility, the smokehouses to be connected and the planned exhaust air volume.

At the beginning of the project planning the number and the type of the smokehouses are taken as a basis. In the following, the flows of exhaust air to be removed are determined, the exhaust air properties (temperature, pollutant concentration etc.) are checked and limit values for the clean air quality are determined. A process diagram is used to define the design of the multi-stage filter system to ensure the best possible connection to the production facilities.



Fig. 4: The new ham production of Schwarzwaldhaus GmbH covers 3,115 m² with four cold smoking and three hot smoking systems.

Based on this data, KMA determines the appropriate filter modules with the necessary smoke filter capacity tailored to the customer's production. The hybrid filter system is available under the brand name Airmaxx in various sizes from 50 m³/h (for small climate smoke systems) to 10,000 m³/h (to connect entire facilities) or, as a central filter, even up to 30,000 m³/h depending on the exhaust air volume. To calculate the maximum exhaust air volume, the so-called simultaneity factor of the smokehouse has to be considered. For exhaust air technology, the simultaneity factor measures the maximum output of an exhaust air filter system or the maximum volume of exhaust air that can be disposed of simultaneously from the smoke chambers. Schwarzwaldhaus GmbH produces in a total of seven smokehouses, ham and sausage products with a simultaneity factor of 85%. This means that up to a maximum of six smoke chambers at the same time emit smoke, which has then to be filtered. In total, a maximum exhaust air volume of 3,000 m³/h with an average temperature of about 40 °C is filtered. For the project at hand, a central exhaust air filter system with a smoke filter capacity of 3,000 m³/h was selected for Schwarzwaldhaus GmbH (Fig. 3). The filter system centrally disposes of the exhaust air of the four cold and three hot smoke systems connected to it.

Once the required filter capacity and module size of the hybrid filter system have been defined, the installation location of the exhaust air filter system has to be considered and the on-site piping has to be drawn in the construction plans. Due to the compact design of the new filters, the smoke gas filter system can usually be installed right next to the smokehouses. However, it is also possible to install it on the roof or, as it is the case with the Schwarzwaldhaus GmbH, as a container solution outdoors next to the production hall. The connection between the smoke chambers and the smoke gas filter system is ensured by means of a simple pipe connection.

The hybrid filter system of the new ham production of Schwarzwaldhaus GmbH has been running for about two years and delivers convincing results (Fig. 4), says Managing Director Spinner. The exhaust air filter system works with low operating costs and requires minimal maintenance. Butchery producers from the surrounding area have already adopted this solution for their business as well.



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