Primary Smoke Products by Red Arrow

Only the best of smoke!

Process and Manufacturing -- Cleansmoke Technology -- Sustainability -- Food Safety -- Workmanship Safety -- Homestory
More than 50 years ago, Red Arrow invented a way to make conventional smoking more efficient and safe by condensing smoke. Simultaneously, people and the environment are protected sustainably with this process. One of the main reasons is that tar and ash are filtered from the smoke during the cleaning process. What remains are primary smoke products that contain the smoky taste so prized by us, without accepting any compromise.

This allows beef, chicken, pork and fish to be smoked with the same result as with conventional smokers. Furthermore, these purified primary smoke products also provide a universe of new sensory variations for enthusiastic amateur chefs and professional chefs alike in the kitchen.

CleanSmoke Technology not only gives sausages, hams and fish a nice smoke taste, it also creates an appealing smoke color with a better surface texture. These improvements create better slicing properties as well as better microbiological surface stability.

Recently the EU commission’s committee for environmental questions, public health and food safety (ENVI) determined that primary smoke products are healthy and harmless. However, the consumers have reservations. Only a fair insight into each individual process can provide safety here.

This small information brochure shows you how primary smoke products can be extracted through pure condensation and how people and the environment can benefit sustainably from this. Because of the filtration of unwanted and potentially harmful compounds such as tar and ash, primary smoke products captured through condensation are safe for consumption.

Welcome to a new and fascinating world of clean smoking.

Yours sincerely,

Uwe Vogel
Managing Director
Red Arrow Handels-GmbH
High quality through a gentle smoking process

Smoking is one of the oldest methods of preserving meat and fish. Hams have probably been smoked for more than 9000 years to enable people to keep them for longer. Nowadays, food is almost exclusively smoked to give them colour, taste and a longer shelf life. Smoking is usually carried out with sawdust from various different hardwoods such as beech, hickory, applewood, maple and oak.

The primary smoke products are not created in open fires, but rather through heating untreated sawdust under controlled conditions: Afterwards, the condensation of the smoke gas continues and leads to the primary smoke product.

In order to protect people and the environment sustainably, Red Arrow developed a patented process more than 50 years ago, with which the smoke is filtered/refined and the primary smoke product extracted.

Since then butchers as well as meat and fish processors have been smoking with purified primary smoke products as an alternative to conventional smoking methods.

With conventional smokers, ash, tar and polycyclic aromatic hydrocarbons (PAHs) as well as other compounds, arise in addition to the smoke taste and will settle on the beef, chicken, pork and fish. The tar and ash added here do not contain any smoke taste but are potentially harmful to health, as well as the PAHs. On average, this is 32% ash and 16% tar.

Red Arrow filters out the tar, ash and PAHs early in the primary smoke product extraction process, so that the meat in the smokehouse cannot get into contact with them at all.

The purified primary smoke product is added back into a stable smoke with the help of the CleanSmoke technology in the meat processing companies.

In technological terms there is no difference between conventional smoking processes and smoking with the CleanSmoke method on the basis of purified primary smoke products.

The smoking with CleanSmoke has proven itself to be a reliable and a safe technology. It is used even more often, primarily with cold, warm and hot smokers. With the SmartSmoke smoke generation process, smoke generated outside of the smokehouse is fed into the smoking system with the help of smoke tubes. The exhaust air from the smokehouse is returned to the SmartSmoke smoke generator via a smoke tube so that a closed smoke system is formed.
**Red Arrow production process**

The process starts in the forests/woods in which the natural hardwoods for the construction industry are chopped down ... and ends with the purified, environmentally friendly primary smoke product for future-oriented smoking.
Smoking based on purified primary smoke products meets these changing demands. Red Arrow has developed a particularly safe and environmentally friendly smoking process to take advantage of the numerous benefits of this technology when smoking uncooked sausages, raw hams and other typical cold-smoked products. One of the most significant advantages of this smoking technology is to produce healthier and safe food as well as the lower consumption of energy and water, reduced emissions (air, water, waste) and significantly better working conditions in the smokehouse area.

Simultaneous smoking with different primary smoke products

The smoking of raw cured products should not only lend a pleasant smoky taste to the sausages, hams or fish, but should also create an appealing smoked colour, harden the surface slightly for improved cutting characteristics and also guarantee a microbiological surface stability. The growth of yeast and mould cultures should be inhibited by the smoking. The CleanSmoke smoking process meets these requirements: If required SmartSmoke smoke generators can simultaneously create smoke from two different primary smoke products, which, for example, can have a mould inhibiting effect on the one hand and have special sensory characteristics on the other. This also has a direct effect on the product quality, as the foodstuff is not only adapted to the various different requirements for taste notes, appearance or bite, but is also significantly longer lasting.

Now more than ever, consumers are focussed on the quality of food. Of course, one part of this is ensuring that the product has as few harmful substances as possible. A huge advantage for CleanSmoke is that the smoke is almost completely free of harmful substances. In contrast to the classical smoke it has hardly any tar, ash or polycyclic aromatic hydrocarbons (PAHs). In conventional smoking processes these can be deposited on the foodstuff. However, with such high quality products as salami for example, these should have as few harmful substances as possible.
The lack of harmful substances in the smoke and the preservative effect of the smoking also make the CleanSmoke smoking process interesting for use with popular cold-smoked foodstuffs. For example, chemical preservatives such as potassium sorbate can be omitted with uncooked sausage and raw hams by smoking processes utilising purified primary smoke products.

A whole range of additional factors must be considered for the product quality of salami or hams: So, for example the complete smoking process, from drying and pre-curing through the actual smoking and on to the post-curing are just as important as the product’s ingredients. With the CleanSmoke smoking process, the smoke is generated outside the smokehouse and fed into it through smoke pipes and air ducts. The smokehouse air ducts ensure a uniform distribution of the smoke. The exhaust air from the smokehouse is returned to the smoke generator and thus remains environmentally-friendly in a closed circuit.

Depending on the food to be smoked, the smoking is generally carried out at a temperature between 15 and 25 degrees Celsius. The temperature, which can vary during the smoking process, is critical with this smoking system, as it has an enormous influence on the so-called starter cultures which are responsible for the desired pH value in salami, for example. And, the dehydration prior to the smoking is critical for the taste, texture and sustainability of a salami, for example. The complete smoking process can last from a few hours to several weeks.

**Environmentally friendly and safe**

It is not only the consumers that benefit from smoking with CleanSmoke, but also the environment. Since the smoking process with SmartSmoke smoke generators is a central element in a closed circuit, the CO₂ emissions are reduced by up to 80 percent. Further, since the smoke generated from purified primary smoke products is free from tar and ash, the amount of cleaning agents and water can also be reduced by up to 70 percent. The tar in particular, which occurs in large quantities in conventional processes and which is highly inflammable, adheres very strongly to conventional smoking systems and must be removed with particularly aggressive cleaning agents.

In contrast, smoking systems that are operated with CleanSmoke smoke have significantly lower cleaning requirements with less aggressive cleaning agents. This reduces costs and ensures that the burden on the waste water system is also reduced. In addition, there is a much reduced risk of fire or explosion, lower air burden and less aggressive cleaning agents employed when using CleanSmoke smoking processes, providing a significantly safer working environment.

Thanks to its numerous advantages when compared to conventional smoking methods, CleanSmoke has been promoted by the Executive Agency for Competitiveness and Innovation (EACI), in order to provide a general access to this unique technology for food manufacturers in the European Union.
The environment gets protected

If wood burns, chars or smoulders, substances that burden the environment always emerge. Smoking with smoke generated from primary smoke products should always be the preferred method for reasons of environmental protection alone. Smoking by using the CleanSmoke technology requires not only the use of less wood. It is significantly more energy efficient as well, and that again means less CO₂ emissions. Due to the low overall emissions, systems based purified primary smoke products are not subject to the EU pollution control act.

The EU directive 96/91/EC regarding the integrated avoidance and reduction of environmental pollution requires all manufacturers to employ processing technologies that offer the best possible protection for the environment (air, water and ground). The manufacturing process itself, where freshly developed wood smoke is processed to yield purified primary smoke products, as well as their use in the production of food, is implemented with the goal of keeping the burden on the environment as low as possible.

Better CO₂ balance for purified primary smoke products

Approximately 8,267 lb (3.75 kg) of sawdust are required per ton of smoked food (smoked ham for example) using conventional smoking (friction smoke or smoulder smoke) – but only 1,322 lb (0.6 kg) of primary smoke product. In a large-scale process, Red Arrow extracts 2,204 lb (1 kg) of primary smoke product from 6.613 lb (3 kg) of sawdust, a resource-conserving by-product of the construction industry. The primary smoke product used to smoke a ton of foodstuff can therefore be produced from around 4.188 lb (1.9 kg) of sawdust. The CO₂ emissions are also half as much for the approx. 50% less smoking material – namely, instead of a good 13.26 lb (6 kg), only a little over 6.613 lb (3 kg).

While the wood for conventional smoking often has short transport paths, the manufacturing of purified primary smoke products is carried out in the USA. For the transport until to the end consumer in Europe there is a resultant CO₂ balance of 1,212 lb (0.55 kg) per ton of foodstuffs, for conventional smoking materials with an average distance of 300 km around 0.44 lb (0.2 kg) CO₂.
Due to creation, transportation and disposal of the purified primary smoke product, we have in total 11.462 lb (5.2 kg) CO₂ per ton of smoked food. However, with friction generation, this is over 28.66 lb (13 kg) CO₂ and with smouldering smoke generation almost 70.55 lb (32 kg) CO₂.

Primary smoke products save up to 83% of CO₂ emissions due to a lesser amount of wood used, a lower energy consumption and unnecessary after-burning of the smoke gases.

**Less waste and less hazardous substances through purified primary smoke products**

With conventional smoke generation half of the materials used end up as waste for disposal. Around 1.1 lb (0.5 kg) of CO₂ is created per ton of smoked food due to cleaning, waste disposal and transport of the smoking materials. With the manufacturing of primary smoke products on the other hand, less than one percent of the materials employed end up as waste. Tar and charcoal, which are not used in primary smoke products, are used for energy generation and improve the CO₂ balance by around 0.66 lb (0.3 kg) CO₂. In total only 0.22 lb (0.1 kg) CO₂ arises per ton of smoked food with the purified primary smoke product for cleaning, disposal and transportation. When using smouldering smoke in contrast to the generation of friction smoke and smoke condensate, re-burning of the smoke gases is mandated. To do so around 10 m³ of natural gas is required per ton of smoked food. This represents almost 55.115 lb (25 kg) of CO₂ emissions.

Also, the problem with the exhaust air hazardous substances is avoided completely with the CleanSmoke technology. While it is practically impossible to use freshly generated smoke to smoke food in a closed system, because the tar and ash present an explosive mixture, these substances are missing with the purified primary smoke product. With this manufacturing process the tar and ash are already removed. In addition, there is neither an open fire nor embers when using the primary smoke product to generate the smoke. Since there is no combustion, neither nitrogen oxides (NOx) nor carbon monoxide (CO) are created. In addition, measurements have shown that the NOx limit values for thermal and catalytic after-burning systems could not be met by any of the after-burners tested.

The space requirement for the storage of the smoking material is significantly reduced. An IBC container (base size: one pallet) with 1,000 litres of purified primary smoke product replaces around 10 pallets of sawdust. This brings additional advantages with transport and thus for costs. These also work out lower for this reason - because the primary smoke product is not inflammable and so fire protection devices such as sprinklers etc. do not need to be installed in the smokehouse. Last but not least, smoke generators also require significantly less space, enabling a more flexible placement in the smoking compartments.
In chemical terms, the smoke is a mix of countless compounds, from which around 800 have currently been identified. The quantity of atmospheric oxygen, the humidity of the wood and the smoke temperature are critical for the proportion of desired and undesired compounds in the smoke. In fact, even if the sawdust used in a smoulder smoking process is untreated and only a small amount of hazardous substances are emitted, depending on the type of wood, there is still a residual health risk. This cannot be excluded in the event of having direct contact with the smoke – regardless of where it arises.

The situation is completely different with smokers using smoke freshly generated from purified primary smoke products. So, the explanatory memorandum for the EU directive 2065/2003 expressly endorses the use of smoke flavourings as these are considered to be less of a health concern than the conventional smoking processes due to their fractioning and cleaning out of undesired substances.
Conventional smoking systems are no harmless working environments. Smoke gases, which arise from smouldering sawdust, can have a health endangering effect for people. Alongside the general emissions burden in the vicinity of the smokehouses, there is also an increased risk of fire in the smoke compartments with smouldering processes. Alone in 2008, there were seven cases of fires with damages totalling 316 million Euros. Sadly there was also one fatality.

In order to make conventional smokers safer and to prevent explosive mixtures, high levels of investment are required. The system operators must identify the hazards presented by the operation of the system with the help of specialists and determine protective measures as well as verifying the results and measures in an explosion protection document.

No poisins in primary smoke products

The manufacturing of purified primary smoke products is a highly developed process whereby conventional smoke is initially generated from sawdust under controlled conditions. A Primary smoke product distinguishes from freshly developed smoke only through the separation out of the potentially health endangering tar components. The filtered smoke created by this contains only the desired components for conservation, taste forming and smoke colour intensity.

The filtered tar and ash components are generally used for other purposes, such as energy generation or road building for example.

The desired components of the smoke include: phenols, acids and carbonyl compounds, amongst others. The phenols predominantly determine the smoke taste and odour. The carbonyls are predominantly responsible for the smoke colouring. The phenols and the carbonyl compounds also provide the conservative characteristics.

Improved health and safer working conditions

No health endangering substances such as carbon monoxide and polycyclic aromatic hydrocarbons (PAHs), with whom employees may come into contact with.

- No use of sawdust and therefore
- No health risk due to inhaling wood dust
**No fire and explosion hazard with primary smoke product**

In contrast, working with the CleanSmoke technology based on purified primary smoke products is a great deal for being safer and presents no risk at all to health. Here the smoke is created without combustion or smouldering. That means that no smoke enters the work area and the workers are therefore not exposed to it.

A further advantage of smoke generation from primary smoke products is that the smoke has no explosive constituents such as tar, ash and combustion gases - they will already have been removed from the smoke with the creation of the primary smoke product. The preventative checks on the smoking system mandated by the explosion protection ordinance are thus no longer applicable and smoking through the night is also possible without supervision. This relieves personnel from the night shifts.

**Simple handling of purified primary smoke product**

Primary smoke products can be stored very simply, as it is non-flammable and thus fire protection systems such as fire protection doors and sprinkler systems are not required for the storage room. The simpler handling of the smoking material also contributes to healthier working conditions. The primary smoke product is fed through pipes into the corresponding storage tanks on the smoke generator via a central filling system. This improves not only the hygiene in the smoking compartment, but the physical work is also lighter as the loading of the smoke generator with firewood is no longer necessary. In contrast to conventional smokers, the risky cleaning of the smoke compartment can be omitted when using the CleanSmoke technology. The hard to remove fractions such as tar and ash are not even present in the primary smoke product.
DIE RÄUCHEREI, a company founded in 1988, based in Klein Meckelsen, Germany, is specialised in the preparation of fish and a supplier to both, the catering trade and food retailers as well as airlines and cruise ships. The business has relied exclusively on the smoking process based on purified primary smoke products for the production of their specialities since 1997.

A manufacturer of the 21st century
Visitors to the company DIE RÄUCHEREI in Klein Meckelsen would hardly suspect with their first glance that international fish specialities and seafood are turned into exquisite delicacies there. In fact the historic building which is both headquarters for the company and the production base, dates back to the middle of the 19th century, and was internally renovated to make it one of the most modern fish processing operations in Germany.

The smoking technology is based on the manufacturing of smoke from purified primary smoke products: The founder and proprietor Hans-Joachim Kunkel changed the production over completely to this smoking technology early on in the company’s life. A purified primary smoke product provided by Red Arrow, the market leader in the area of this smoking technology, is used here. A stable smoke is generated on-site in Kunkel’s smokehouse smoking system with the help of the Tarrber Smoke Master technology. Because the primary smoke product has been cleaned during its extraction, the smoke created later is almost completely free of tar, ash and polycyclic aromatic hydrocarbons (PAHs).

A modern interpretation of a process millennia old

“The process thus offers me the opportunity to create smoked fish products without introducing any harmful substances to the fish. And this is particularly important for us as we use very high quality raw foods - and why should one reduce the quality during the preparation of the food?” says Hans-Joachim Kunkel explaining one of the benefits. “With this smoking process the basic, millennia old principle of smoking is retained but at the same time is implemented with a modern interpretation.”

But how did he become aware of the process? “In 1995, Red Arrow presented it at the IFFA in Frankfurt, the leading trade fair for the food industry” he recalls. “I wanted to take the opportunity to get a better idea of this - or more precisely to confirm that this process was not practical.” but it did not work out this way: The smoking expert sampled a few products there and then - and was impressed. As early as May 1997, DIE RÄUCHEREI received the approval as the first company in the seafood industry, to use the CleanSmoke process and the production system was converted in close cooperation with Red Arrow. „We procured a total of three new smoking systems“, explains Kunkel, who initially insisted on leaving one old smoke generator on site. „In fact we never used it since and so eventually we dismantled it, too.“
Exceptional taste experiences

During the conversion process Red Arrow developed a special smoke for DIE RÄUCHEREI based on hardwood - and this is still used today as the core smoke. Alongside this it is also possible to use special smoke notes for individual specialties - and Kunkel and his team of 70 colleagues have recorded a complete range of these in previous years. Alongside the classical, smoked fish products, from smoked salmon to smoked eel, today DIE RÄUCHEREI offers numerous unusual creations. One such creation is „Black forest tuna“, which is very similar to a high quality (centre-cut) ham and which can also be used in the same way. The „Butter mackerel Lardo“ and the chorizo-styled „Andaluza salmon fillet“ are also part of the current range. Whilst some ideas are brought to life on-site, DIE RÄUCHEREI also works on other innovations with renowned, top chefs. For example, the chef and seasoning expert Ingo Holland has developed a shrimp for an airline menu, which is confited in fine oil together with a vanilla pod.

DIE RÄUCHEREI prepares a total of 500 to 600 tons of fish per year. „As a small artisan company, we place less emphasis on the quantity and are more focussed on quality over quantity“, says Kunkel. „You could say we are a 21st century manufacturer.“ He delivers his products not only to the catering trade and food retailers, but also primarily to companies from the transport logistics sector: To airlines, including Lufthansa, American Airlines and United Airlines, and to cruise ships such as the MS Europa, the MS Mein Schiff and the MS Discovery. „During the conversion phase we explained the new production process and its advantages in detail to our customers“, recalls Hans-Joachim Kunkel. This clarification proved worthwhile: He was able to take all of his customers with him - and has won many more since then. „The ability of our smoking process to tailor numerous different taste notes to the desires and requirements of our customers is certainly an advantage."

DIE RÄUCHEREI – A pioneer

No wonder he has never regretted the conversion to the modern process. „Quite the contrary, we have benefitted from this in many ways“, summarises Kunkel. The CO2 emissions of the company have thus been reduced by 80 percent. And because the system no longer needs to be cleaned with caustic soda, the quality of the waste water has improved. In addition there has been an improvement in operational safety as fire is no longer used in the process. „In my opinion there is no argument against the smoking process based on purified primary smoke products but many that speak in its favour. So, I am absolutely convinced that more and more of these systems will be employed and in the future many other manufacturers and consumers will be impressed by them“, says Hans-Joachim Kunkel.