

Elite
discovers

Disinfecting with light

Disinfection measures help keep infectious diseases and epizootics out of the herd. One option of sterilising surfaces is UV-C radiation. A field report.



Hygiene and biosecurity are the most important factors when it comes to keeping most infectious diseases out of calf igloos, dairy and cattle houses. For some reportable animal diseases, legislators require farmers to clean and disinfect the affected barns before moving in the next group. The surfaces can be sterilised either by chemical or physical methods. The latter include UV-C radiation (ultraviolet radiation-C) which kills and inactivates microorganisms and viruses.

We talked to German vet Theresa Scheu about UV-C disinfection measures that were taken at the livestock farm Hofgut Neumühle in the federal state of Rhineland-Palatinate after an outbreak of salmonellosis in the farm's 400-head dairy herd.

In this particular incident, one cow became clinically conspicuous as she developed a high temperature and bloody diarrhoea. After the faecal analysis showed the presence of salmonella typhimurium var. copenhagen, all contact animals were immediately sampled and eventually also the entire herd. The animals that tested positive were housed separately from the animals that tested negative. The isolation areas were cleaned and disinfected once a week in line with Cattle Salmonellosis Ordinance, Article 6 requirements.

Special measures in the calf barn

In a herd outbreak of salmonellosis, it is of utmost importance to protect the newborn calves from infection, because salmonella can cause severe diarrhoea which involves a high risk of losing animals. In addition, after going through a salmonella infection, calves may become permanent excretors of the pathogen. As a result, there is a risk that the infection will linger in the barn for an unduly long time and flare up again and again.

Foto: Manufacturer photo

UV-C radiation damages the genetic material of microorganisms and viruses.
UV-C disinfection is efficient and environmentally friendly.

For this reason, the estate introduced special hygiene measures for the newborn calves (individual igloos). The measures require the staff to put on special gear (wellington boots, washable apron, disposable gloves) before they enter the calf area. In addition, drinking buckets, straw and feed were prepared outside of the calf area and handed over to someone "on the inside" who would feed the calves.

Following consultations with the Veterinary Office, it was not possible to move out all calves during the three-month sanitizing process, so some calves had to stay in the igloos for up to six weeks. To reduce the proliferation of potential pathogens and prevent a contamination of the stalls with salmonella, the igloos, too, were disinfected regularly even though they were occupied. The method was UV-C irradiation.

This was carried out in the following way: the calf was led out of the igloo by the halter, the straw mattress was removed and the igloo was given a rough cleaning. Then the mobile UV-C equipment – the Eco-Protector UV-C from Urban GmbH & Co. KG – was brought in. The mobile protector sterilises floors and igloos. It consists of four UV-C mercury low-pressure

light tubes with an output of 15W each. For the disinfection process, you roll the unit to the entrance of the igloo and turn on the light. Each igloo is irradiated with UV-C light for five minutes. This way, up to 15 igloos were disinfected one after the other at the Neumühle Estate. ►

User protection

UV-C radiation damages the genetic material and as such kills bacteria and viruses. Most of the UV-C disinfection equipment that is currently available uses wavelengths of about 254nm, the mutagenetic efficacy of which has been confirmed by various studies. UV-C radiation must be used with caution! The radiating light must never be directed at people or animals and neither people nor animals must look directly into the light source. An acute and generally known reaction to UV-C exposure is inflammation of eyes and skin. The technology damages the DNA and as such it damages the cells, which as a result are at risk of degenerating to cancer cells in the long term.
Source: Federal Office for Radiation Protection

1 | Key parameters for effective disinfection by UV-C irradiation

		Distance (m) between the target and the Ecoprotector (target is in front of the unit at 0°)		Distance between target and Ecoprotector (60° angle)	
	Distance between target and Ecoprotector	1 m	2 m	1 m	2 m
	Required light dose to achieve LD 90 mJ/cm²	Irradiation time (sec) until LD 90 is reached		Irradiation time (sec) until LD 90 is reached	
BACTERIA					
E. coli	2.8	5	16	6	23
Salmonella enteritidis	2.2	4	12	4	18
Streptococcus faecalis	10	16	56	20	83
Streptococcus pneumoniae	46.8	77	260	94	390
Mycobacterium avium ssp. paratuberculosis	6	10	33	12	50
Mycoplasma ssp.	0.9	1	5	2	8
VIRUSES					
Bovine viral diarrhoea virus	9.9	16	55	20	83
Rotaviruses	10.9	18	61	22	91
FUNGI					
Trichophyton ssp.	56	92	311	112	467
PROTOZOA					
Cryptosporidium parvum	1.7	3	9	3	14

Irradiation times vary depending on the pathogen and the distance between the light source and target until the lethal dose (LD) 90 is reached, which means 90% of the pathogens are killed.

Source: Urban



Veterinarian
Theresa
Scheu,
Neumühle
Estate,
Rhineland-
Palatinate

UV-C disinfection has many advantages

UV-C irradiation offers several advantages over liquids:

- it cuts out the first step in the sterilising process, which is applying the sterilising foam with a lance and a back-pack sprayer. This in turn eliminates potential user errors when preparing the solution.

- Irradiation also requires only a rough pre-clean of the igloo. There is no need for a pressure wash.

- In addition, there are no issues with so-called cold tem-

- **In human medicine, UV-C radiation has been used for a long time for the disinfection of surfaces, water and air. The required irradiation time varies depending on the pathogen.**

- **Specialised mobile equipment can be used for surface disinfection on livestock farms.**

- **Unlike other disinfection methods, UV-C radiation offers user advantages that outweigh other aspects.**

- The UV-C unit is low-risk and easy to use and dry. An irradiation session takes five minutes per igloo. This time can be used to prepare the next igloo for UV disinfection.

The discussed UV-C unit is also suitable for disinfecting larger areas and therefore also for sterilising barn floors, for example, thereby presenting an alternative to the application of quicklime (calcium oxide, high hazard potential). Irradiating a large surface takes more time though than irradiating igloos. The above table lists the key parameters that have meanwhile been measured for the irradiation of housing areas. The individual dose depends on the pathogen and the exposure time increases as the distance between the target surface and the UV-C lamp and also the obliqueness of the angle of incidence increases.

The UV-C method was also evaluated in respect of its cost effectiveness, which was explored by two students in their bachelor theses at the universities of Osnabrück and Weihenstephan-Triesdorf. These were the findings: Even though the process of disinfection itself is very time consuming, it does save time that would otherwise be spent caring for sick animals, because the number of actual clinical diseases dropped. To suit, vet costs dropped, too. These two benefits as well as the user benefits mentioned above must be balanced against the purchase price of such equipment.

perature errors, because for reliable efficacy, many disinfectants require a minimum outdoor or surface temperature of 10° Celsius.

- Also, irradiation involves a lower health risk for users than other surface disinfecting methods (liquids, quicklime).

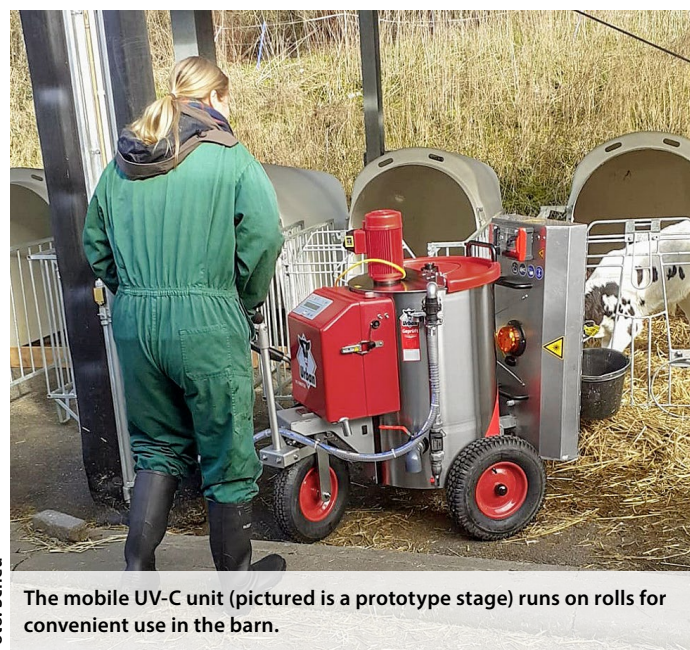


Foto: Scheu

The mobile UV-C unit (pictured is a prototype stage) runs on rolls for convenient use in the barn.

The new disinfection standard

At the Neumühle Estate, the measures described ensured that none of the newborn calves tested positive in the period during which the salmonella disinfection was carried out. Also, animal health did not deteriorate despite the high occupancy - on the contrary, it even improved in some animals. Especially diarrheal diseases decreased noticeably. Therefore, now that they have overcome the salmonellosis, the farm uses the EcoProtector UV-C as the regular method of disinfecting the calf area.

We conclude: a commendable procedure

UV-C radiation has been used for disinfection in human medicine for quite some time and thanks to its efficacy and ease of use, it also offers advantages for livestock farms for dealing with animal epidemics and for their day-to-day operations. Therefore, it is desirable that this technology establishes itself as an additional option in hygiene management and biosecurity on livestock farms. For this, the technology should be approved to the standards of the German veterinary society DVG as a valid disinfection measure.

In the interest of user protection and efficacy, it is recommendable to use bespoke UV-C technology that is specifically developed for livestock farming applications and that has been tested and certified by the manufacturer.

-ks- (Translated into English by trans-agrar)