

UV Disinfection in the Dairy Industry

By: Damian Corbet*

In an increasingly regulated and safety-conscious market, the dairy industry has to meet ever more stringent standards of quality. Microbial growth in dairy products due to contaminated water supplies can cause discoloration, off flavors and shortened shelf-life, as well as increasing the risk of infection to consumers. The threat of contamination is further increased as manufacturers respond to consumer demand for reductions in chemical additives and preservatives. Effective microbial disinfection of process water is therefore essential.

A non-chemical method of disinfection which is gaining increasing acceptance is ultraviolet (UV) disinfection. UV kills all known food spoilage organisms, including bacteria, viruses, yeasts and moulds. It is a low maintenance, environmentally friendly technology which eliminates the need for chemical treatment while ensuring high levels of disinfection.

Benefits of UV Disinfection

UV disinfection has many advantages over alternative methods. Unlike chemical biocides, UV does not introduce toxins or residues into process water and does not alter the chemical composition, taste, odor or pH of the fluid being disinfected. This feature is especially important in the dairy industry where the chemical dosing of incoming process water can cause off-

flavors and alter the chemical properties of the product.

UV treatment can be used for primary water disinfection or as a back-up for other water purification methods such as carbon filtration, reverse osmosis or pasteurisation. As UV has no residual effect, the best position for a treatment system is immediately prior

to the point of use. This ensures that all incoming microbiological contaminants are deactivated and therefore a minimal chance of post-treatment contamination. Many users install UV systems after filter beds and storage tank outlet valves to reduce the likelihood of contamination from these sources.

How Does UV Disinfection Work?

UV is the part of the electromagnetic spectrum between visible light and X-rays. The specific portion of the UV spectrum between 200-315 nm has a strong germicidal effect, with peak effectiveness at 265nm. At these wavelengths UV kills microorganisms by pen-



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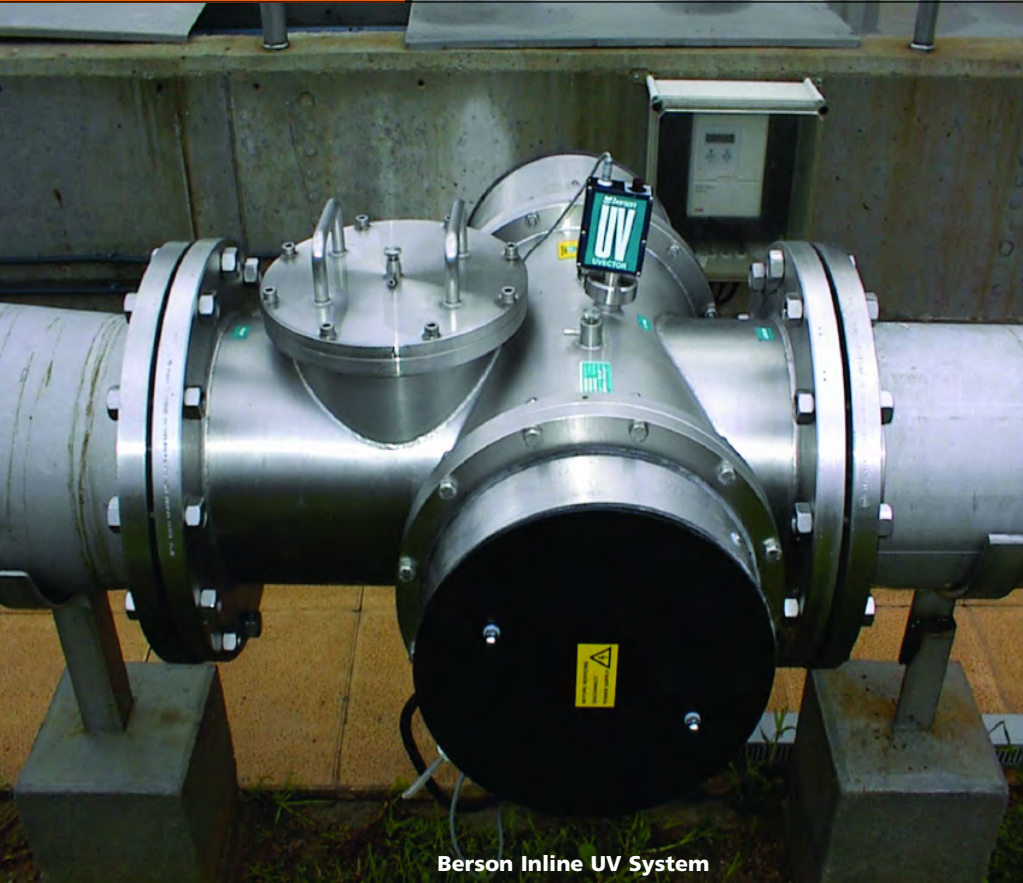


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Berson Inline UV System

without chemicals or pasteurisation. It also allows the re-use of process water, saving money and improving productivity without risking the quality of the product.

- Pre-treatment Disinfection

Reverse osmosis and carbon filtration are often used to treat water. These can be both harmed by, and contribute to, microbial contamination. Carbon filters in particular can be a breeding ground for bacteria. UV can protect against this bio-fouling.

- CIP (Clean-in-Place) and Wash Water

Even water used to clean surfaces or used in CIP operations can be a source of contamination. UV is an approved method of disinfecting this water without the use of chemicals.

- Cooling Media and Chiller Disinfection

Some dairy products are subject to contamination after heat treatment or cooking. UV provides an excellent way to protect foods from contamination by contact-cooling fluids.

- Liquid Sweeteners

Sucrose-based sweeteners can be a prime breeding ground for microorganisms. UV systems are available specifically for treating these syrups.

- Packaging & Surface Disinfection

Surface disinfection systems are used to reduce microbial counts on all kinds of packaging, including tubs, bottles, cans, lids and foils for yoghurt, milk, butter and other dairy products. By irradiating the surfaces with UV prior to filling, food spoilage organisms are eliminated, extending the shelf life of the product and reducing the risk of contamination.

etrating cell membranes and damaging their DNA - making them unable to reproduce and effectively killing them.

Recent tests at a cheese processing plant in the Netherlands, for example, showed a 3 log (99.9%) reduction of thermophilic bacteria and a 5 log (99.999%) reduction of bacteriophages* with UV.

A typical UV disinfection system consists of a UV lamp housed in a protective quartz sleeve, which is mounted within a cylindrical stainless steel chamber. The liquid to be treated enters at one end and passes along the entire length of the chamber before exiting at the other end. Virtually any liquid can be effectively treated with UV, including raw mains water, filtered process water, milk, viscous sugar syrups and effluent.

There are two main types of UV technology, based on the type of UV lamps used: low pressure (LP) and medium pressure (MP). LP lamps have a monochromatic UV output (limited to a single wavelength at 254nm), whereas MP lamps have a polychromatic UV output (with an output between 185-400nm).

For several reasons, UV systems based on MP lamps are better suited to the dairy industry. Firstly, only one MP

lamp is required to produce the same UV output as many LP lamps - this has obvious cost implications for replacement lamps, not to mention considerations of space.

LP lamps are also highly temperature dependant, with variations in the temperature of the incoming liquid adversely affecting their UV output; MP lamps, on the other hand, operate effectively at all temperatures. Cleaning also needs to be taken into account: when fluids containing high solid concentrations are being treated, deposits can build up on the quartz sleeves surrounding the UV lamps, reducing their efficiency.

To overcome this problem MP systems utilize a mechanical wiper which passes back and forth along the length of the quartz sleeve, keeping it clean. LP lamps cannot use these wipers, relying instead on chemical cleaning - a costly and time-consuming process.

UV Applications in the Dairy Industry

- Direct Contact Water or Ingredient

Water used as an ingredient in dairy products or coming in direct contact with product can be a source of contamination. UV can disinfect this water



Berson Inline UV Chamber Cut Away

• Wastewater

Effluent from dairy processing facilities can be treated without the use of environmentally hazardous chemicals. This ensures all discharges meet with local environmental regulations. As already mentioned, because process water can be treated and re-used with UV, this also leads to a significant reduction in the amount of wastewater produced.

Conclusion

Meeting the increasingly rigorous hygiene standards required in the pro-

duction of dairy products is a real challenge for manufacturers. If improvements need to be made to plant and equipment, they need to bring quick returns on the investment and measurable improvements in product quality.

For those manufacturers seeking to improve the quality of the end product, medium pressure UV is an economic, realistic option. It is already a well established method of disinfecting drinking water throughout the world. It is also widely used for high purity applications such as brewing and pharmaceutical processing, where water of

the highest quality is required.

UV disinfection systems are easy to install, with minimum disruption to the plant. They need very little maintenance, the only requirement being the replacement of the UV lamps every 9-12 months, depending on use. This is a simple operation that takes only a few minutes and can be carried out by general maintenance staff. ■

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تحتاج صناعة منتجات الحليب إلى ملاقات متطلبات كثيرة خاصة بالنوعية، خاصة وأن الأسواق أصبحت أكثر تنظيماً ووعياً لمسائل الأمان. إن نمو البكتيريا في مشتقات الحليب بسبب استعمال مياه ملوثة قد يؤدي إلى تغيير المذاق وتقصير مدة الصلاحية بالإضافة إلى زيادة خطر انتقال الأمراض إلى المستهلكين. بالإضافة إلى ذلك فإن خطر الإصابة بالأمراض يزيد عندما يتجاوب المصنعون مع طلب المستهلكين للتقليل من استعمال المضافات والحافظات الكيميائية، من هنا أهمية عملية تعقيم الماء. إن إحدى أهم عمليات التعقيم التي تلقى تقبلاً متزايداً هي باستعمال الأشعة فوق البنفسجية. تقوم هذه الأشعة بقتل كل الكائنات المجهرية المعروفة التي قد تسبب فساد المأكولات بما فيها البكتيريا والفطريات. يذكر أيضاً بأن هذه التكنولوجيا الجديدة لا تحتاج إلى صيانة معقدة كما أنها غير مضرّة للبيئة. مما ينفي الحاجة إلى المعالجة الكيميائية مع المحافظة على نسبة عالية من التعقيم. إن فوائد عملية التعقيم باستعمال الأشعة فوق البنفسجية عديدة، فهي لا تخلف سموماً أو ترسبات في الماء المستعملة في عملية التصنيع كما أنها لا تؤثر على التركيبة الكيميائية أو المذاق أو الرائحة أو نسبة الحموضة الخاصة بالوسائل التي يتم تعقيمه. إن هذه المميزات مهمة جداً في مجال تصنيع مشتقات الحليب حيث من الممكن أن تؤثر المواد الكيميائية الموجودة في المياه المستعملة على نوعية المنتجات النهائية. إن أفضل موقع لنظام معالجة المياه هو مباشرة قبل نقطة الاستعمال مما يضمن خلو الماء من الملوثات والكائنات المجهرية ويقلل من نسبة إمكانية التلوث ما بعد عملية المعالجة. من الممكن أيضاً تركيب أنظمة المعالجة ما فوق البنفسجية بعد نقاط الترشيح أو خزانات المياه للتخفيف من نسبة التلوث في هذه المصادر.

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