UV systems: **getting a perfect match**

Ultraviolet irradiation offers a good solution for liquid disinfection in the food and beverage industry. However, to get the best out of a UV system, it needs to be designed for the duty. *Diane White* offers advice on specifying the right solution for an application.

To ensure that a design meets the application requirements it is important to provide the UV supplier with enough information to allow it to not only select the right size of reactor but also to consider what other features may need to be built in to make the system complete.

The first thing to define is the flow rate of the liquid to be treated. That sounds easy enough but it is necessary to provide not only the maximum, average and minimum flows but also the pattern of use. For example, if the normal average flow is 5m^3/hr for six hours per shift but the maximum is 10m^3/hr for two hours it may be better to use two 5m^3/hr units with one normally off line and just brought into service for the maximum flow.

It is important to specify whether the flow is continuous, and whether a standby stream is needed to cover for maintenance or breakdown? The minimum flow is important because some large UV reactors need a minimum flow to keep them cool. Equally important is whether the flow is intermittent. If the flow stops it may be necessary to switch the reactor off, but then, when it restarts it will need some warm-up time before it can guarantee to deliver the full germicidal dose and this may necessitate a run to waste or a recycle line.

Liquid characteristics

The next thing to consider is the liquid characteristics – most UV systems treat water but UV is also used to treat syrups, juices and similar solutions. The supplier will need to know the density, viscosity and temperature of the liquid including any maximum and minimum variations. For disinfection to occur the radiation has to pass through the liquid and the critical parameter here is the UV transmittance (UVT). This measures how much of the radiation power is lost by absorption or scattering of the rays in a 1cm path length through the liquid. It is usually measured in percentage so a liquid with UVT of 80% means that 20% of the UV lamp intensity will be lost in a 1cm path. Knowing this will allow the supplier to rate the reactor to compensate for this loss. Other useful characteristics are turbidity (a measure of colloidal particles that scatter light), colour and UV254 absorbance both of which indicate how much light is absorbed by the liquid. There are quite a few different units used for these measurements so make sure that you tell the supplier what they are.

Finally the UV dose (or fluence). A single pass through a standard UV system delivering a UV dose of 40 mJ/cm^2 will typically achieve better than a 4 Log reduction (99.99%) of most bacteria and protozoans like Cryptosporidium. Some yeasts and moulds, however, require much higher doses so, if possible, let your supplier know what species are (or could be) present.

For UV to be effective it has to be delivered uniformly to all parts of the reactor so make sure that there is a UV monitor built in to the reactor to check that the required dose is being received. A single monitor can only check a single point in the reactor. Being certain that the applied dose is reaching all areas of the reactor depends on the reactor design. Reactor performance can be validated by type testing using independent third-party bioassay with live, surrogate microorganisms (typically bacteriophage T1 and MS2) against standardised test methods – the internationally accepted protocol is that of the US EPA so ask for a validation certificate to this effect. ■

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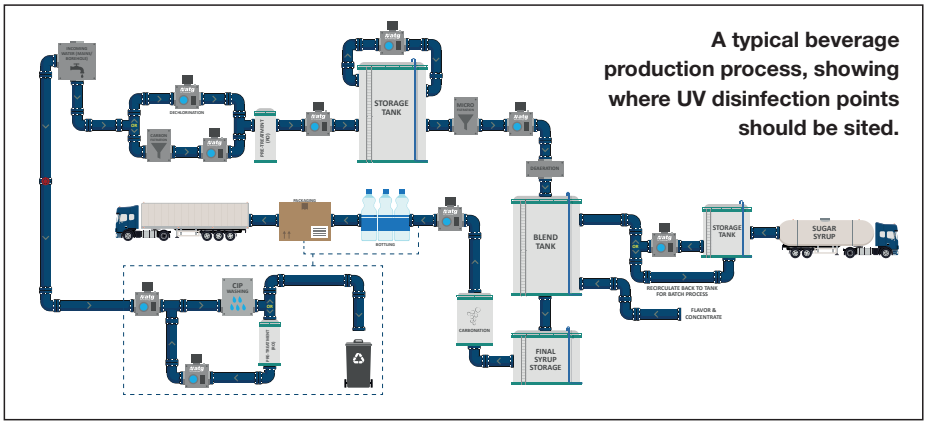

A typical beverage production process, showing where UV disinfection points should be sited.