Optimized hygiene in the beverage filling process

QUALITY MANAGEMENT | The company Teutoburger Christinenbrunnen GmbH & Co. in Bielefeld has realized and implemented new options in the area of the filling hygiene in a short term. In June 2008 a filling line in the plant Bielefeld was upgraded, so that during the running production the required hygiene status is kept during the whole filling time. With this technology beverages can be filled in their native form without adding any preservatives.

FILLING IS THE LAST PROCESS STEP during the preparation of beverages and also the first step of the packaging. This step determines how long original quality and thus the minimum shelf life can be kept. The longer the period until the expiry date is, the better are the possibilities for the distribution.

Aseptic filling processes always played an important role for filling germ-free beverages into germ-free containments or bottles without the hazard of recontamination. But even in not completely aseptic filling lines highest standards of quality and hygiene must be obeyed if the requested expiry dates should be kept without adding preservatives or using thermal treatment.

Market tendencies
The market decides the distribution channels. One demand is a long minimum shelf life, even without adding preservative substances.

Also the large variety of closing systems and containments is a challenge issued by the market. In the beverage industry the containments are usually made of glassware, PET, tinplate/aluminium or inside coated cardboard boxes. The producers of beverages are under permanent pressure by the key accounters. The beverages should be pure, fresh, tasty and natural when they are delivered.

At the same time it is demanded that no preservatives are added or thermal treatment was performed. This generates highest requirements for the quality control. Besides the unavoidable and exact monitoring of the hygiene status, also preventive technologies must be applied, which prohibit the recontamination of the product over the long distribution paths.

Potential problems
The quality of the manufacturing process up to the filling process should be ensured by well known procedures.

Keeping the containments germ-free until the filling and afterwards until the closing is a critical point. It is only possible if the industrial sanitation is consequently applied to the whole filling line. The bottling machine with all its functional parts is a unit of high complexity with many peripheral parts which must be cleaned and disinfected regularly. Clean-up of filler and filler table, automatically or manually performed, has top priority in the industrial hygiene of the beverage production. Normally applied chemicals are not suitable for a continuous disinfection during full operation. With the conventional operating technology, the filler is emptied and flushed, disinfected, flushed again and afterwards re-filled. Very often only the flushing is routinely executed. This approach causes frequently problems and discussions. Due to the required quality standard an hourly repeat of the whole procedure would be necessary.

The desired and needed success is limited by the fact that after a short time the same micro biological situation like before is re-established due to foaming of the beverages, bursting bottles, interruptions by re-adjustments etc. Furthermore the complete cleaning procedure is very time consuming and cost intensive and reduces the plant

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Fig. 1
Sprinkling system: Rinser
productivity, making it quite unpopular with the cost accounting.

**Filling plant disinfection by Innowatech Anolyte®**

The membrane cell electrolysis technology with the Innowatech Aquadron® systems allows significant changes in the food and beverage plant disinfection, especially in the area of the filling tables.

The basis of the technology is the PLC controlled membrane cell electrolysis with the help of which the disinfectant Anolyte® can be generated from a high pure aqueous common salt solution.

The disinfectant differs in its physical properties (colour, specific weight, density, viscosity, melting and freezing point) not much from pure water, as it contains only a low concentration of free chlorine. Anolyte® is transparent and clear without blur. It has a slight smell of chlorine.

The active chemical substance in the Anolyte® is hypochlorous acid (HOCl) which is in a balance with its salt sodium hypochlorite (NaOCl). Anolyte® has a neutral pH (6.5 - 7.5), where the more active acid form dominates.

The used concentration is depending on the application area between 0.1 and 4 percent. It does not influence or change the original water pH.

During production and application no chlorine gas (Cl₂) or associated hydrochloric acid and no ozone (O₃) is produced. The concentration of chlorate (ClO₃⁻) is less than 10 mg/l.

Undiluted as well as in the application concentration Anolyte® is non-toxic for humans:
- No generation of trihalogen methanes (THM), as the pre-substances are already eliminated during the synthesis;
- good compatibility with all used materials;
- no wear of stainless steel or elastomer seals.

Innowatech Aquadron® systems running in the production for more than 6 years meanwhile have proofed these statements.

**Optimizing the hygiene at the filling plant for Christinen Brunnen**

If an aseptic filling station is available, it will be easier to get the product safe and clean into the dedicated containments. However, an assortment of chemicals is used both for the aseptic filling and for the traditional custom filling. These chemicals normally have also a microbiological function. If they are used for longer periods and in higher concentration, high wear and corrosion must be taken into account.

If preservatives are added to the products they have to be listed on the package. In the European Union the declaration is duty. For this reason the management of the Gehring-Bunte Getränkeindustrie GmbH & Co. decided to use Anolyte® in their plants. Compared to the custom filling the advantage is that sanitation is performed in the area of the filler table and surrounding through the whole filling time. Thus interruptions of the production by in between cleanings and disinfection can be avoided. The productivity of the plant becomes higher and additionally the water consumption can be reduced.

To reach such a high hygiene state a special nozzle system was developed. The nozzles in the plant are positioned in a way that they are able to permanently sprinkle the transport conveyer belts, bottle inlet/outlet starwheels (PET-Rinser) – centring bells, bottle in- and out-feed, filling valves, container caps, closer and other trouble zones in the filling area (fig. 1).

The implementation of the system can be adapted to the problematic zones of each individual site. The inclusion of the CIP plant is already planned. It will replace the hot water disinfection completely.

Practice has shown, that Anolyte® in the applied form and concentration will not be found in the product later on. This was proofed by organoleptic tests. Neither taste or smell nor the colour of the product will be influenced by Anolyte®. Also in multi vitamin beverages no reduction of vitamin concentrations or flavour could be found.

With the help of Anolyte® the hygiene in the filling area is improved significantly. Problems existing before at critical points of the filling system could be solved.

Table 1 shows the results of microbiological tests at a PET-Filling plant (fig. 2) at the Teutoburger Christinenbrunnen GmbH & Co. in Bielefeld. The microbiological improvement of the existing state and the successive reduction of the preservatives up to the operation without preservatives was the target of the management at the Gehring-Bunte Getränkeindustrie GmbH & Co.

The success was obvious after short time. The results of the smear tests improved
significantly and the preservatives for the cold de-germination were redundant or could be lowered in the case of delicate beverages. This created substantial cost savings which allowed a short term return of investment.

**Summary**
The Innowatech Aquadron® systems in their layout are designed in a way that the needed amount of Anolyte® is always available. Maximum consumption times are supplied from a buffer tank of appropriate size, which is part of the system (fig. 3).

The on-site produced Anolyte® is used for the disinfection of the facilities, instruments, tanks, tube systems, storage tanks etc. It is used in diluted solutions adapted to the different applications. Previous used disinfectants are often completely redundant.

The Aquadron® systems and the active agent Anolyte® have already proven reliable for years.

Furthermore they offer the following advantages:
- Safe and complete antisepsis of all beverage vermin, bacteria and yeast;
- short exposure times < 5 Min. for full impact;
- no re-contamination by water residues in containments;
- no sensoric or physical and chemical product changes;
- stainless steel and elastomers remain unaffected;
- handling and storage of dangerous chemicals or substances becomes redundant;
- due to the neutral application pH no waste water pollution;
- enhancement of CSB and AOX values;
- low operation and maintenance costs, for the operation only common salt and electricity is needed;
- reduced water consumption due to less cleaning and disinfection flushing;
- easy handling and operation by intuitive user interface;
- minimised storage and logistic costs;
- problem-free uncomplicated integration into existing systems;
- short installation and start-up time;
- Innowatech Anolyte® is conforming to EU and German drinking water ordinance.

**Acknowledgement**
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