Published in dmz 1/2006

Iced Coffee

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Solutions for the stabilising problems of iced coffee-milk-beverages

In the past coffee beverages mostly were represented on the market as instant variations which were brewed at home in different flavour varieties. Producers of these instant coffees are mainly traditional coffee manufacturers.

Combined with the trend to use more convenience and prepared foods iced coffee beverages show an increasing demand – in addition to the above instant variations – and are offered as latte macchiato, cappuccino and espresso flavour. While the German market focuses on indulgence and coffein kick as the main pillars of its marketing strategy, products on other markets show also additional benefits through the packaging such as US- coffee beverages in „self-heating-cans“, in which the beverages are heated due to a chemical reaction.

Iced coffee beverages are no longer only produced by coffee suppliers but also by the milk processing industry because a considerable percentage of the beverages comprises milk. As milk components whole milk, low-fat milk, skim milk and also milk powders are used. Fat and protein content of the final product are adjusted individually.

As coffee components for these iced coffee beverages freshly brewed coffee is utilised but also coffee extracts in liquid form as well as freeze-dried and spray-dried raw materials. The conventional dosage for these raw materials ranges from 5-6% for coffee extract, 1-2% for soluble coffee and roughly 75% for brewed coffee. All these semi-finished products contain chlorogenic acid of the coffee bean which induces the acid ambience of coffee.

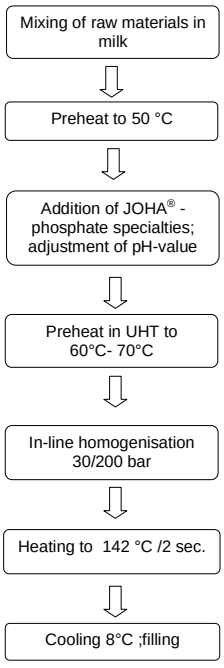

Fig. 1: process conditions of UHT treatment

According to the desired flavour sugar, cocoa, aroma, sweetener, salt and water can be part of the recipe.

For the preservation of these iced coffee beverages different heating procedures are realised. Besides a short-term heating for exclusive cooled storage, shelf life products for storage at room temperature can be produced with UHT-heating with subsequent aseptic filling as well as with a retort process.

During the production of iced coffee beverages the acid system coffee and the milk components clash together resulting in a shift of the ionic equilibrium which supports the protein denaturation during the following heat treatment. With plate and tube heat exchangers this leads to burning and causes shorter production times of the facilities. With the sterilisation of coffee beverages in cans the quality of the whole batch can be diminished because of protein coagulation.

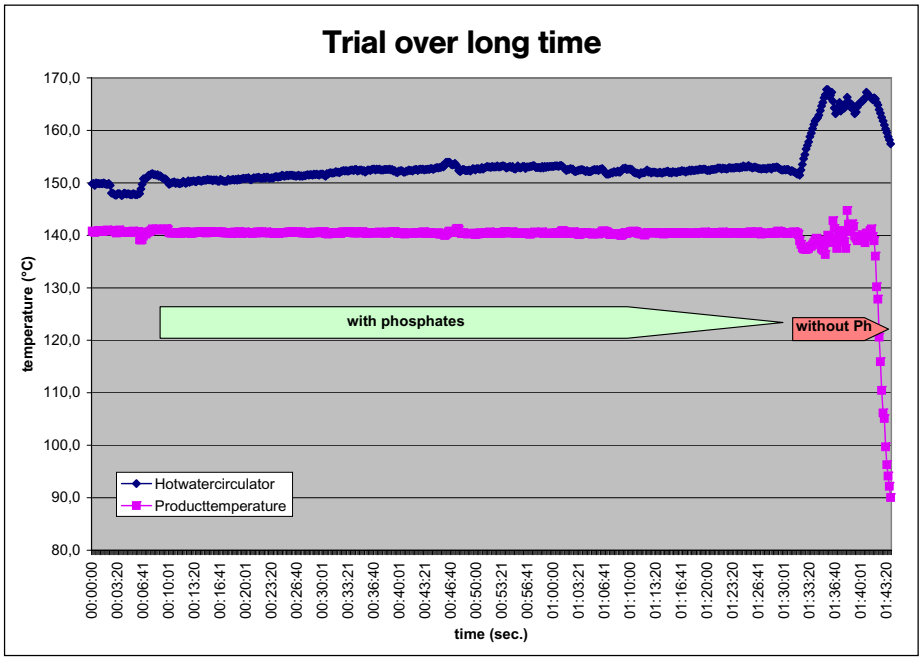

Fig. 2: process course UHT-heating with and without phosphate

As a consequence of this protein damage the final product is devalued optically and with respect to taste in both heating procedures. The sensory negative impact is engendered by a burnt off-flavour. A higher sedimentation during storage is the reason for an optical negative evaluation. The sediment consists of denaturated protein and insoluble carbohydrates.

JOHA® -phosphate specialties prevent that. They have a stabilising influence on the pH-value and connected with this, on the buffering of the system. Furthermore they ensure protection of the protein at high heat treatment by complex building impact on polyvalent cations like calcium and magnesium. Additional variabilities in quality of the raw material milk can be equalised with phosphates even before the heat treatment. Consequently a standardised end product can be guaranteed.

On the basis of a selected recipe with a protein content of 3,3% the influence of JOHA® -phosphate specialties on protein denaturation, sedimentation, sensory profile and pH-value-shift was examined. For each of the above-mentioned heating procedures a sample without phosphate was heated as control sample.

In figure1 the process for UHT-heating is shown. During this heat treatment no irregularities were found for the samples with JOHA® - specialties, whereas obvious protein denaturation and combined with this burning in the utilised tube heat exchanger were found for the control sample.

In figure 2 temperatures of the hot water circulator and the product are plotted versus time.It can clearly be seen that the temperature of the hot water circulator increased when adding the coffee beverage with JOHA®-phosphate after 6 minutes.When the heating system had leveled off, the heating went on calmly and continuously.

Immediately after addition of the control sample (without phosphate) the temperature of the hot water circulator suddenly increased: due to protein denaturation and burning on the product side (fig.3), the heat transfer between product and hot water deteriorated For reaching the target product temperature,however, the hot water circulator heated up, the temperature increased. In the end the target temperature of 142°C on the product side wasn´t reached any more.

With the broadly based functionality of the JOHA®-specialties a stabilisation of the protein during heating processes is achieved:

On the one hand the typical acid of the coffee is buffered to a pH-value which is acceptable for the process, on the other hand the proteins are protected against coagulation by the complexing of calcium ions.

The protection of the proteins with phosphates could also be guaranteed at the sterilisation of coffee beverages in cans. Figure 4 shows clearly the denaturation of proteins in the control sample, while the sample with JOHA®-specialties resulted in a homogeneous, impeccable product. The addition of phosphate clearly ensured a stabilisation of the system without increasing the viscosity.

Fig. 3: denaturated protein of control sample without phosphate in UHT facility, pilot plant BK Giulini GmbH, Ladenburg

Fig. 4: sterilisation of a coffee beverage in cans

The amount of sediment was measured by means of a centrifuge. The samples with JOHA®-specialties had an average sediment of 1,5%, whereas the control sample showed a sediment of 16,2%. Besides influencing protein denaturation and sedimentation, phosphates can also emphasise the sensory impression of a coffee beverage (table 1).

	JOHA® B 30	JOHA® B 50	JOHA® KM 2
Ingredients/declaration	E339, E452, E340	E340, E452	E339, E452, E331
solubility	++[1)]	++	++
pH (1%)	11,5 – 12,1	11,1 – 11,7	11,0 – 11,6
P_2O_5 – content [%]	48,5 – 50,5	43,5 – 45,5	39,4 – 41,4
sensory impression	milky	coffee dominated	Neutral/balanced
sediment [%]	1,5 ± 0,3	1,5 ± 0,3	1,5 ± 0,3
[1)] good solubility			

Table 1: Survey about JOHA®-specialties for stabilisation of coffee beverages

With the UHT-heating respectively sterilisation of protein-containing coffee beverages the exertion of JOHA®-specialties is absolutely essential. They ensure protein protection and re-establishment of the ion equilibrium, which results in a calm production process Optimising individual process conditions of customers and adjusting recipes accordingly is offered within the scope of technical service for JOHA®-specialties.

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