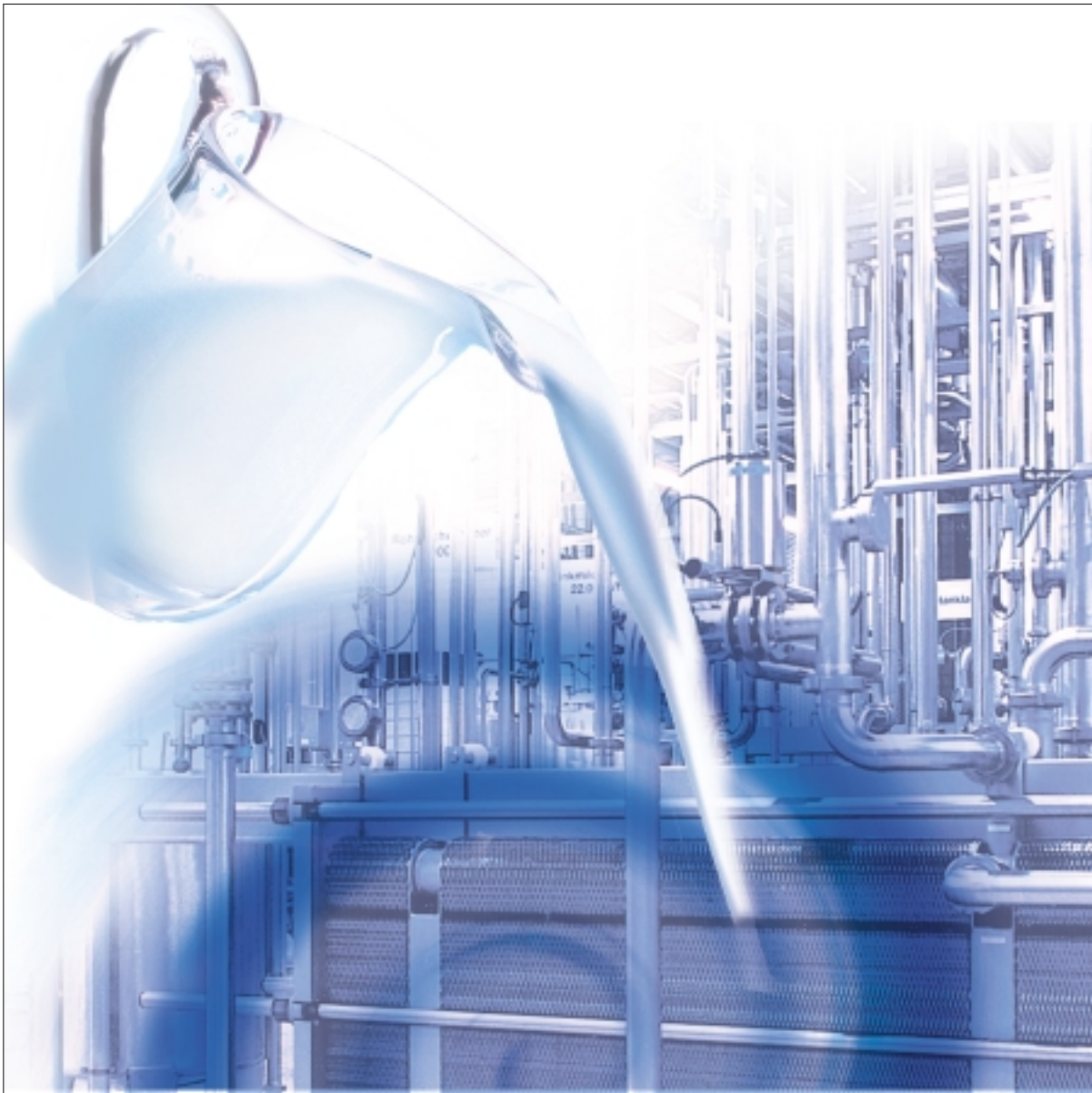


Extended Shelf Life Milk

Solutions with Indirect Heating Applications



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Besides technological aspects of producing ESL-Milk, economic efficiency is becoming more and more important. With this article we would like to draw your attention to the "Solutions with Indirect Heating Applications" and their economic benefits.

GEA Ahlborn and GEA Finnah cover, within the Liquid Processing Division (the global technology group specialising in Process Engineering), the whole spectrum of known ESL technologies such as:

1. High Temperature Heating (plants for direct and indirect heating, modified UHT-plants or modules for pasteurisers),
2. Micro Filtration (with combined heat treatment),
3. Bacteria Removal (via Separator).

In addition to these germ reduction methods, the downstream packaging technology (low germ and aseptic) and storage are important factors.

Today dairies mainly use direct heating systems which require high investment and running costs. However, market analyses revealed that consumers are not prepared to pay higher prices.

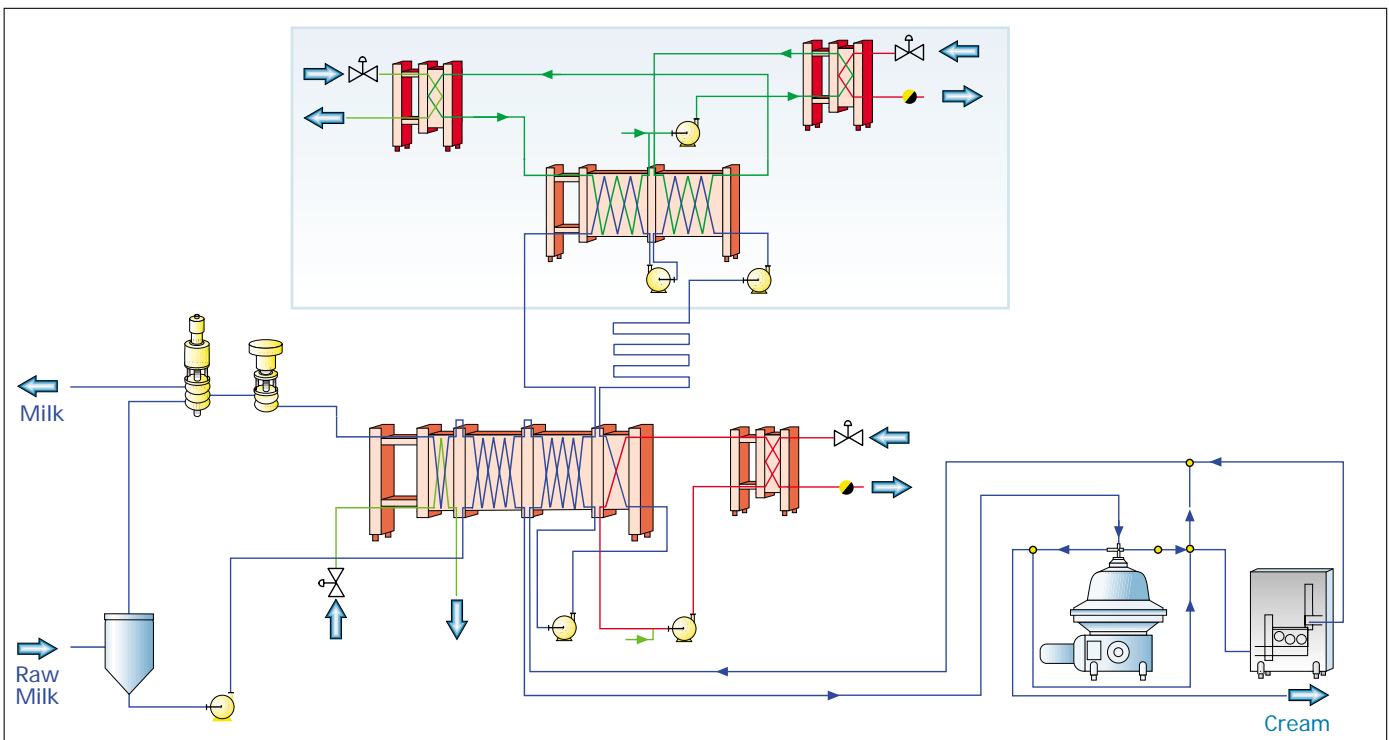
These circumstances have compelled us to find low cost solutions and in return GEA has developed two systems:

1. a modified pasteurizer
2. an indirect UHT-treatment plant with product/product heat recovery.

Modified Pasteurizer

The high-temperature heater for the production of ESL milk, developed by GEA Ahlborn, is integrated as an additional module into the existing pasteurizer which is used for the production of consumer milk.

- In this module the milk is heated to the desired high temperature and is subsequently cooled down rapidly.
- When the pasteurizer is modified in this way it has, between its heating and exchange section, an additional heating and cooling section (indirect heating).
- Substantial interventions on the pasteurizer system are not necessary.
- The heater is designed for a heating temperature of approx. 125° C at increased flow velocity. This is for minimum temperature load without defined temperature holding times, heat recovery takes place via the water circuit.
- High rate of heat recovery (the same as with the pasteurizer).
- The process is patented.
- Storage and filling operations are similar to those of direct heating systems.



Flow Diagramm (Modified Pasteurizer)

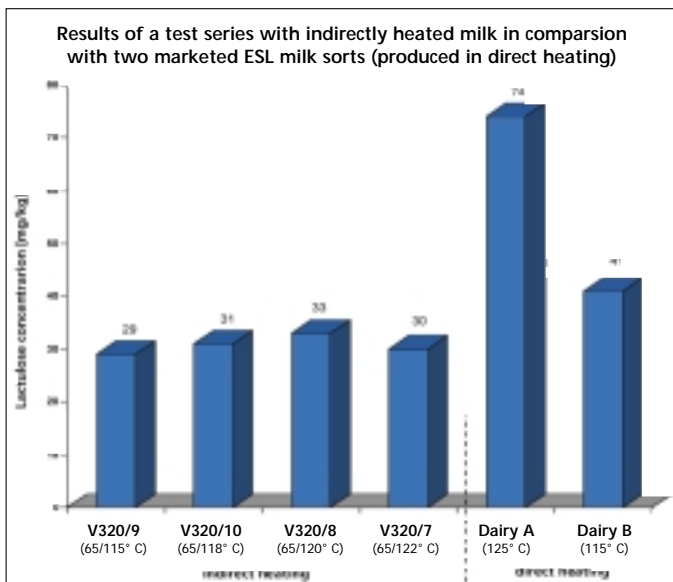
The results are comparable to direct heating systems:

- Shelf life is approx. 21 days (10° C storage temperature). Experience so far has shown that directly and indirectly heated milk cannot be distinguished by shelf life and taste.
- Good results in sensoric taste testing. Within the 2nd Ahlemer Seminary (College for Dairy Technology) on 5 June 1999, sensoric taste tests of ESL-milk (pasteurized milk and UHT milk) were carried out. In taste, the indirectly heated milk was slightly ahead the directly heated milk.
- Lactulose below 40 mg/kg:

The diagram (see picture 2) shows the results of a test series with indirectly heated milk and in comparison with two marketed ESL milk sorts (produced in direct heating).

- Operation time was 4-5 h, but at a higher flow rate

The disadvantage of a limited running time can be compensated by a higher flow rate in comparison to the filling line. This requires the installation of a sterile tank between the pasteurizer and filler.



Picture 2

Main advantages of the modified Pasterurizer:

- In contrast to modified UHT plants raw milk is used on the modified pasteurizer. That means the milk is heated once resulting in lower production costs of approx. 0.5 cents/kg milk.
- The investment costs are less in comparison to other ESL technologies.

Indirect UHT-Treatment with Product / Product Heat Recovery

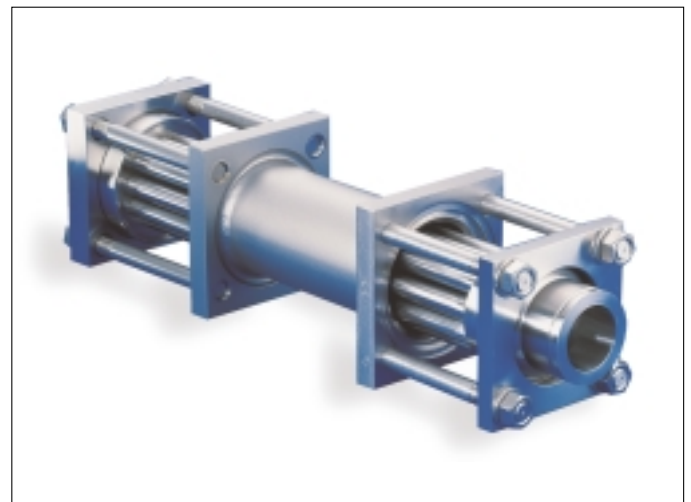
This technology is based on the UHT process. This is interesting for an ESL production, especially if the UHT plant is already existing with the associated production conditions and sales structures.

In this connection the use of a Tubular Heat Exchanger with Product / Product Heat Recovery (see Picture 3) is indispensable. In this unit, the product is treated in the inner tube as well as at the shell side. This Tubular Heat Exchanger from GEA is designed for aseptic product treatment and has been standard for 3 years in the UHT-Treatment of milk products.

The product / product heat exchanger is certified by the University Weihenstephan in Germany.

The results are:

- Shelf life up to 28 days (10° C storage temperature).
- Lactulose approx. 40 mg/kg.
- Production time up to 16 hours.



Picture 3

The economic aspects support indirect heating:

- Investment costs approx. 20-30% lower.
- Production costs: With direct heating from 70 to 125° C, the steam consumption is 3 to 4 times less with indirect heating from 107 to 12° C.
- No more treated steam is required for indirect heating.

Summary:

Practical tests show that indirect heat treatment is a worthwhile alternative.

The essentially lower investment and production costs is an enormous advantage.

