# the heat is on

## Double tube heat exchangers effective for handling waste streams

Corrugated double tube heat exchangers have a successful track record in handling waste streams.

By Michael Adkins

The use of corrugated double tube heat exchangers has proven to be an effective solution to handle waste streams. The correct design of these systems can improve process efficiency, reduce energy costs and significantly lower sewage treatment charges.

### Corrugated Double Tube Heat Exchangers

Corrugated double tube heat exchangers have a long and successful track record in the wastewater treatment industry. The corrugations enhance the turbulence in the waste stream, which improves heat transfer and reduces the thermal length required. The turbulence improves the heat transfer coefficient because it mixes the fluid, whereas a laminar flow relies solely on the thermal conductivity of the fluid to transfer heat from the middle of the flow to the heat exchanger walls. The resulting shorter length required to meet a specific thermal duty means less cost and units, with a smaller footprint—ideal when space is a premium. It also lowers the pressure drop across the system, adding to efficiency with reduced pumping power and cost. Fouling or snagging of waste particles is prevented by having no change in cross-sectional area along the length of the heat exchanger. The design also has no areas of low velocity where particles can sediment out.

### Sustainable Waste Management

Anaerobic digestion has become very important in the current industrial marketplace, with many companies discovering the effectiveness of using organic waste and effluents to generate biogas. The improved thermal efficiency and shorter length of the corrugated double tube heat exchangers fit with the compact design of the Clearfleau solution.

At a U.K. dairy, the Clearfleau digestion system was installed using corrugated double tube heat exchangers. The heat exchangers heat the anaerobic digester, which takes all the liquid feedstock from the dairy. This has dramatically reduced sewage treatment charges and energy costs at the site. The system transfers the residual heat from the digestion process back to the dairy as well as generating renewable energy for use across the site and reducing carbon footprint. The Clearfleau technology that utilizes the corrugated double

tube heat exchanger can further deliver at least 95% reduction in the chemical oxygen demand of the liquid bio-effluents fed into the digester.

## Food Waste Pasteurization

Pasteurization and anaerobic digestion of food waste is a rapidly growing business area and offers an effective alternative to increasingly expensive food waste landfill. The corrugated double tube heat exchanger is ideal for this type of application and can be designed into systems that meet Animal By-Products Regulation (ABPR) standards, which aim to prevent risk to animal or public health through transmission of disease from food waste streams.

At a U.K. waste management business, these heat exchangers are used for heating and cooling food sludge delivered to the site. When the waste is received, it is de-packaged before plastics and grit are removed. It then is stored in a soup tank where it is mixed with other feeds and waste streams. The waste is passed through a macerator to ensure a maximum particle of 12 mm, as required by the PAS110 specification for the pasteurization of food waste.

**A three-tank batch pasteurizer system for the treatment of mixed food waste**

A duty/standby pump configuration pumps the fluid into a thermal regeneration loop consisting of corrugated double tube heat exchangers. A final heating process then raises the temperature of the sludge to 75°C to pasteurize it before it passes to one of three stirred tanks utilized for filling, holding and emptying in hourly cycles and enabling a continuous batch process. The pasteurized sludge then is pumped to a cooling regeneration heat exchanger section of the system before passing into one of the digesters on site for anaerobic digestion. Heat recovered from the hot pasteurized waste stream is used to preheat the raw waste at the input of the system. The pasteurization heat exchangers also are designed to achieve full heating duty upon startup of the system when no pasteurized sludge has been produced to provide preheating.

The digesters generate methane, which then is burned in a combined heat and power plant that supplies the base electrical load of the site. Excess electricity is sold to the grid, and the heat produced from the process is recycled to the pasteurization process.

The corrugated double heat exchangers are ideal for this application, as the turbulent flow through them improves thermal efficiency and prevents fouling and blockage of the system. The thermal regeneration within the system reduces the heat load by more than 50%. The continuous batch process optimizes the use of heat and enables a system which provides better site control and power utilization. The temperature from the output of the pasteurization system is set, so it can act as the primary heating source for the digesters, optimizing process efficiency. The efficiency of the heat exchangers further ensures a compact design to match site requirements and space.

## Maximizing Plant Profitability

The design of corrugated double tube heat exchangers has proven ideal for the treatment of waste streams. They offer the potential to increase plant profitability through higher thermal efficiency for the effective treatment of waste. **iWWD**

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