

Cooling a Paste

Save with VisiMix!

VISIMIX SOLUTIONS

Industry:

Commodity chemicals

Job:

Preparation of paste: mixing and cooling



The Process

Cooling a paste in 3.5 m³ tank with a pitched paddle impeller

The Problem

Cooling the paste from 70° C to 40° C takes 9.5 – 10 hours for one batch. 2 batches must be produced daily, which take about 20 hours. This is more than two 8-hour day shifts, and, therefore, an expensive night shift is required.

The Task

Reduce process time so that the required 2 batches are completed within the day shifts. To permit this, the cooling time must be reduced to 7 hours or less.

The Traditional Approach

To decrease the cooling time, the heat transfer rate must be increased. This could be achieved by replacing the paddle impeller with a helical ribbon which is known to ensure efficient heat transfer in high viscosity media. However, such a system would be extremely expensive and may not guarantee sufficient reduction in the process time.

The VisiMix Approach

Selecting and modeling an inexpensive mixing system capable of increasing the heat transfer rate without a need to replace the impeller drive and shaft.

The VisiMix Conclusion

It is possible to reduce the cooling time by selecting a multistage pitch paddle impeller.

The VisiMix Solution

Replace the 1-stage impeller with a 3-stage impeller of a smaller tip diameter.

The Results

Replacing the impeller allows the following:

- the average heat transfer rate increased by about 45%;
- the cooling time decreased from 9.5 to 6.5 hours

An additional 10% decrease in the cooling time can be achieved by increasing the water flow rate through the heat transfer jacket.

The Saving

The modification allowed saving about \$500 per day in labor costs as a result of eliminating the need for a night shift. This amounts to about **\$ 125,000** per year.

The use of VisiMix enabled the company to save \$125,000 annually by reducing the number of working shifts.

Technical description

Job:

Cooling a viscous paste in a 3.5-liter tank

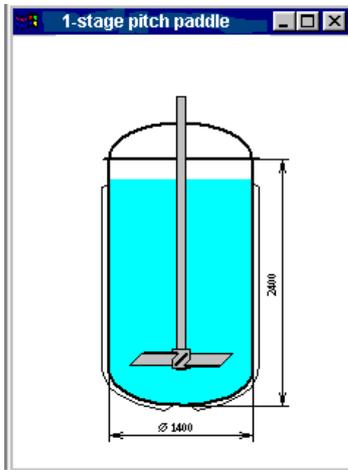


Figure 1. Single-stage pitched paddle impeller

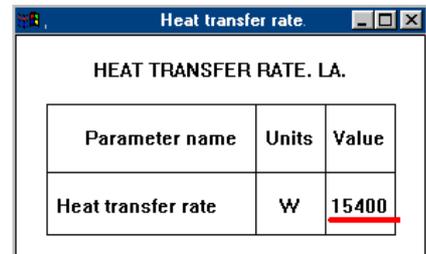
The existing system:

3.5-liter tank with a single-stage pitched paddle impeller (Fig. 1)

Cooling time: 9.5 – 10 hours.

3 shifts per day are required.

VisiMix has shown that the heat transfer in this system is not intensive enough. Fig. 2 shows the value for the **Heat transfer rate** calculated by VisiMix.

A screenshot of a software window titled "Heat transfer rate". The window displays a table with the following data:

Parameter name	Units	Value
Heat transfer rate	W	15400

Figure 2. Heat transfer rate provided by the existing system.

The VisiMix Solution:

The plant engineer has simulated the effect of different impellers on the heat transfer rate, and consequently on the cooling time. Of several variants he selected the cheapest impeller which proved to provide the desired cooling time of less than 7 hours.

The modified system:

The single-stage pitched paddle impeller was replaced with a 3-stage impeller of a smaller tip diameter (Fig. 3). VisiMix checked the power consumption of the modified system against the motor power rating.

VisiMix has shown that the **Heat transfer rate** in the modified system has increased almost 1.5 times (Fig. 4).

Cooling time: 6.5 hours.

Now 2 batches are produced in just two day shifts.

VisiMix can thus be used for optimizing the mixing system so that the process time is considerably reduced and hundreds of thousands of dollars are saved annually.

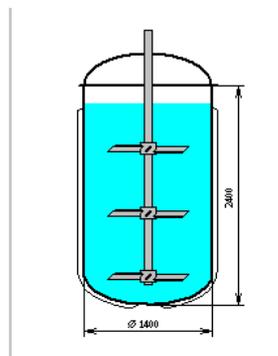
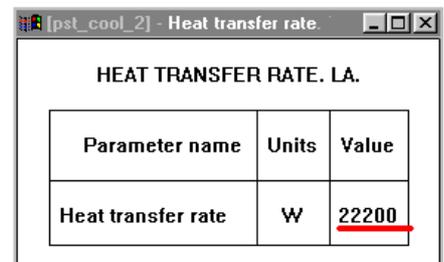


Figure 3. Three-stage pitched paddle impeller recommended by VisiMix

A screenshot of a software window titled "[pst_cool_2] - Heat transfer rate". The window displays a table with the following data:

Parameter name	Units	Value
Heat transfer rate	W	22200

Figure 4. Heat transfer rate provided by the modified system.