

Paints

VISIMIX SOLUTIONS

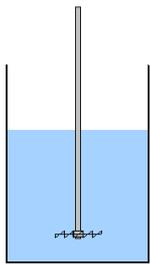
Save with VisiMix!

The Process	Mixing of several components in a 12-liter canister to obtain high quality paint in compliance with customer requirements.
The Problem	<u>Unsatisfactory product quality</u> . For batches larger than 7.5 liter, it is difficult to achieve high quality of paint due to: - <i>Long mixing time</i> - <i>Overheating of the batch due to power generated by mixing</i>
The Task	Ensure the same paint quality in large batches as in small ones
The Traditional Approach	Changing the impeller speed does not bring positive results since the increase in the impeller speed leads to overheating . Some improvement in quality can be achieved by cooling the canister during the mixing. However, even this modification does not ensure the required process duration and paint quality.
The VisiMix Approach	Simulation of mixing in the tank; comparing levels of uniformity achieved by different mixing systems without overheating.
The VisiMix Conclusion	It is possible to select a more suitable impeller based on the VisiMix simulation. This allows for the decrease of the mixing time, prevents overheating without a need to cool the mixture due to reduction of the total energy consumption.
The VisiMix Solution	<ul style="list-style-type: none">▪ <i>Replace the 3.5 inch tooth-disk impeller with a 4.5 inch tooth-disk</i>▪ <i>Decrease rotational speed from 1400 to 1100 rpm</i>
The Results	The required paint quality of batches up to 12 liter is achieved. The degree of uniformity improves 1.5-2 times compared to the original impeller. The required mixing time is reduced to 7 min.
The Savings	The recommended modification allows saving about \$40,000 annually on just one mixer as a result of a 30% decrease in the batch duration. Additional benefits are achieved as a result of better paint quality and savings on the cooling system.

A VisiMix cost-efficient solution helps reduce process time, achieve better paint quality and avoid overheating, thus saving \$40,000 annually in just one mixing unit.

Technical description

Job: Preparing quality paint in a 12-liter canister according to customer's specifications.



Variable speed drive
Motor power: 6000 W

Tip diameter: **3.5 "**

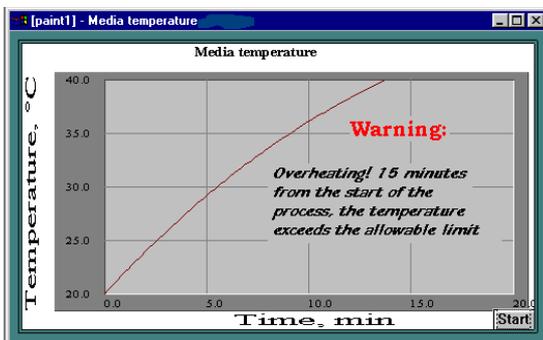
Rotational speed:
1400 rpm

In this system, the mixing is accompanied by fast heating of the media resulting from the energy generated by mixing. The maximum allowable temperature increase for the paint is 20 °C.

For small batches of less than 7.5 liters, 10-15 minutes are enough to achieve good mixing, but the larger, 10-12 liters batches need much longer mixing, and they overheat faster than the required quality is achieved. This is shown by the VisiMix simulation in Fig. 2 below.

Figure 1. The original mixing tank with a small tooth-disk impeller.

Changing the impeller speed does not bring positive results because reducing the impeller power at lower rpm results in an increase in the mixing time, and vice versa.



Some improvement in quality can be achieved by cooling the canister during the mixing. However, due to the high viscosity of the mixture, the heat transfer rate is not high enough.

To achieve the desired quality, i.e. the high degree of mixture uniformity, practically the entire media in the canister must pass through zones of intensive mixing and high shear in the vicinity of the impeller. The lower the media fraction that has not passed through these zones, the better the paint quality.

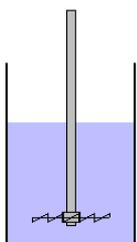
Figure 2. VisiMix simulation of the media temperature and the warning message.

VisiMix Laminar is the only software tool capable of calculating this fraction (**Unmixed part of media**) as a function of impeller design, tank volume, mixture properties, and process time. It also calculates energy consumption and heat transfer, and allows quantitative comparison of mixtures produced with different impellers and mixing times.

VisiMix analysis of the mixing in small batches has shown that in order to obtain the desired paint quality the **Unmixed part of media** must be smaller than **0.1%**. VisiMix has also shown that in larger batches this value can be achieved only after about **20** minutes of mixing (Fig. 3), which is unacceptably long because of overheating.

UNMIXED PART OF MEDIA (%), FINAL VALUE		
Parameter name	Units	Value
Process duration	s	1200
Unmixed part of media (%)		0.0943

Figure 3. Unmixed part of media in the original mixing system.



Tip diameter:
4.5 "

Rotational speed:
1100 rpm

UNMIXED PART OF MEDIA (%), FINAL VALUE		
Parameter name	Units	Value
Process duration	s	420
Unmixed part of media (%)		0.0832

Figure 5. Unmixed part of media in the modified system. The mixing time is just 7 min.

Simulation of mixing with impellers of different diameters has shown that the problem can be solved without overheating if the **3.5"** impeller is replaced by a **4.5"** impeller, and the rotational speed is decreased to **1100 rpm**.

Figure 4. Improved system.