

## Reusable Micro-Mixers

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### Abstract

One of the most important parts of microanalysis systems is the mixing unit. Fluids flowing in channels with millimeters, micrometers, or even nanometer sizes exhibit a different behavior than ever before in daily life. This is because the ratio between the volume of the liquid and the physical surface in contact with the liquid is high. As a result, turbulent flow does not occur in the channels and the amount of liquid interference is reduced considerably. Micro-mixers are adapted to device designs to remove this problem and even increase the rate of various reactions occurring in the chip chambers. Mixing with surface acoustic wave (SAW) resonators in micro-wells is a fast and highly efficient application. However, the production of these mixers is costly because it requires clean rooms and expensive equipment. This study was conducted to investigate the reuse of SAW generators and to keep the loss of efficiency at a minimum level in this process. In this respect, it was aimed to reduce system production costs. SAW generators was tested with various liquids and water-based jellies as fixed on to the surface of the device with liquid reservoir. In these measurements, a thermal camera was used to analyze the formation of heat on the surface. The reason for the formation of heat is that SAW energy, which is moving on the surface, is turned into heat and lost. Especially in media transitions, these losses are at the maximum level. Another series of experiments were carried out to measure liquid mixing performance. In the tests performed, the mixing time of a pure water with coloured water was investigated. The chamber where the liquid mixing process is carried out is produced with 3D printer so that it is possible to reduce the cost by producing from the same chamber in dozens in a single fabrication process. In addition, this method has much more reasonable cost than the PDMS production process which require a clean room facility. As a result of the tests made on the prepared models, optimization was carried out to physically fix the reusable micro-mixers to the microfluidic system. In this way, the SAW device, which is the most expensive part of the system and requires clean room facilities for its fabrication, has been re-usable on other platforms. As a result, system production costs could be significantly reduced.

**Key words:** Acoustic mixers, micro mixers, SAW