CASE STUDY

Automated RNA Extraction with EchoLUTION™ Reduces Associated Costs by 59 % Compared to Silica-Based Methods

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Introduction

BioEcho creates breakthrough technologies, products, and workflows that make the isolation of nucleic acids easier and faster. They significantly increase sample throughput while delivering reliable results in downstream analysis, such as sequencing and transcriptomic analysis. These improvements are possible with the elimination of tedious binding, washing, and elution steps: our EchoLUTION technology requires only a single purification step. The nucleic acids from the sample lysate pass through the purification matrix without interaction while all impurities remain in the matrix (Figure 1). The high-quality nucleic acid in the flow-through is ready to be used in downstream applications. With fewer steps to perform, researchers spend less time at the lab bench, leaving more time to plan subsequent experiments. In addition, the environmental impact is reduced, as EchoLUTION kits produce up to 70 % less plastic waste in comparison to conventional kits.

As we show in this case study, our technology also allows the users to reduce the costs associated with DNA/RNA extraction. Here, we compared the cost of using the EchoLUTION technology to a silica-based method for the automated RNA extraction of 1,000 samples from cultured cells.

Assumptions

To calculate the cost, RNA purification was simulated with the EchoLUTION Cell Culture RNA Kit and a conventional silica-based extraction kit (RNeasy® 96 Kit, QIAGEN®, Germany). DNase incubation was not included in the procedures. The automated workflow was performed by the Microlab® STAR™ (Hamilton®, Switzerland) pipetting robot using a 96-well plate format. We determined the costs for 1,000 purifications, which corresponds to two to three 96-well plates per week throughout a month (low throughput) or to ten plates per week when talking about higher throughput.

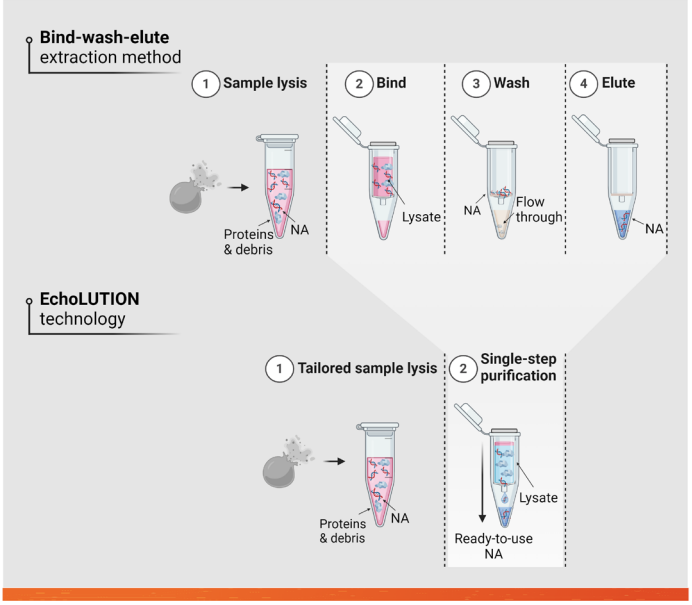

Figure 1. Main nucleic acid extraction steps in the processes. *Conventional purification methods require steps for binding, washing, and eluting, whereas the EchoLUTION method requires a single centrifugation. The nucleic acids pass freely through the purification matrix, while sample lysate impurities are retained in the matrix.*

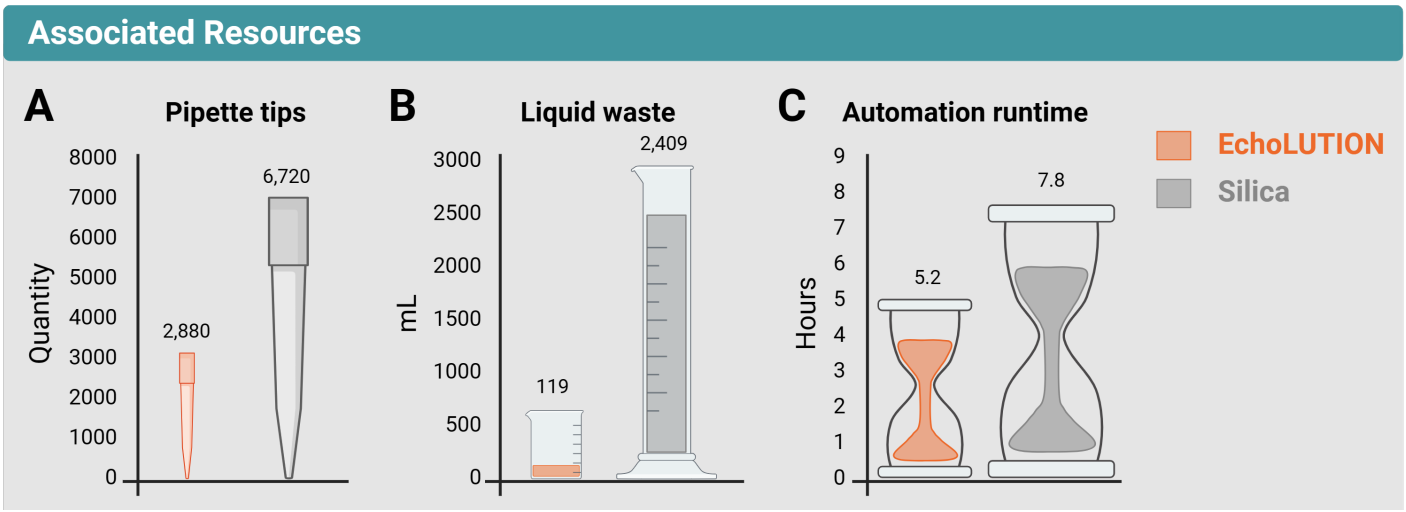

Figure 2. Overview of the associated resources needed for the automated RNA extraction of 1,000 samples with two different methods.

Calculations

Associated resources

For the cost calculations, we considered the pipette tips and buffer amount needed, and the automation runtime, as associated resources.

We first calculated the number of tips required for the RNA extraction process using 96-well plates based on the kit protocols. With EchoLUTION, 288 tips are used for one plate compared to 672 tips for the silica method. Thus, the number of tips required for 1,000 samples is 2,880 for EchoLUTION and 6,720 for the silica method (Figure 2A).

To calculate disposal costs, we also determined the amount of buffer needed for each method (119 mL EchoLUTION vs. 2,409 mL silica), as used buffers become liquid waste. By examining the costs for buffers and tips, we can assess the costs according to the number of steps: the EchoLUTION procedure requires fewer pipetting steps and smaller amounts of buffer for nucleic acid extraction (Figure 2B).

To estimate the personnel costs, we considered the time it took to process RNA from dry cell pellets in a 96-well plate with a Microlab STAR automated liquid handler. Processing one plate with the EchoLUTION technology only took 30 minutes. In comparison, silica-based methods are reported to take approximately 45 minutes[1]. We converted these processing times to hours and estimated full-time equivalent (FTE) efforts for 1,000 samples at 5.2 h with EchoLUTION vs. 7.8 h with silica (Figure 2C).

Associated costs

To estimate the associated costs for the RNA extraction of 1,000 samples, we calculated the costs of consumables (described above), we used a pipette price of 0.10 € per tip (based on the average price from different Hamilton® Co-RE® II Tips). We also added the costs of additional consumables that are not included in the kits, such as

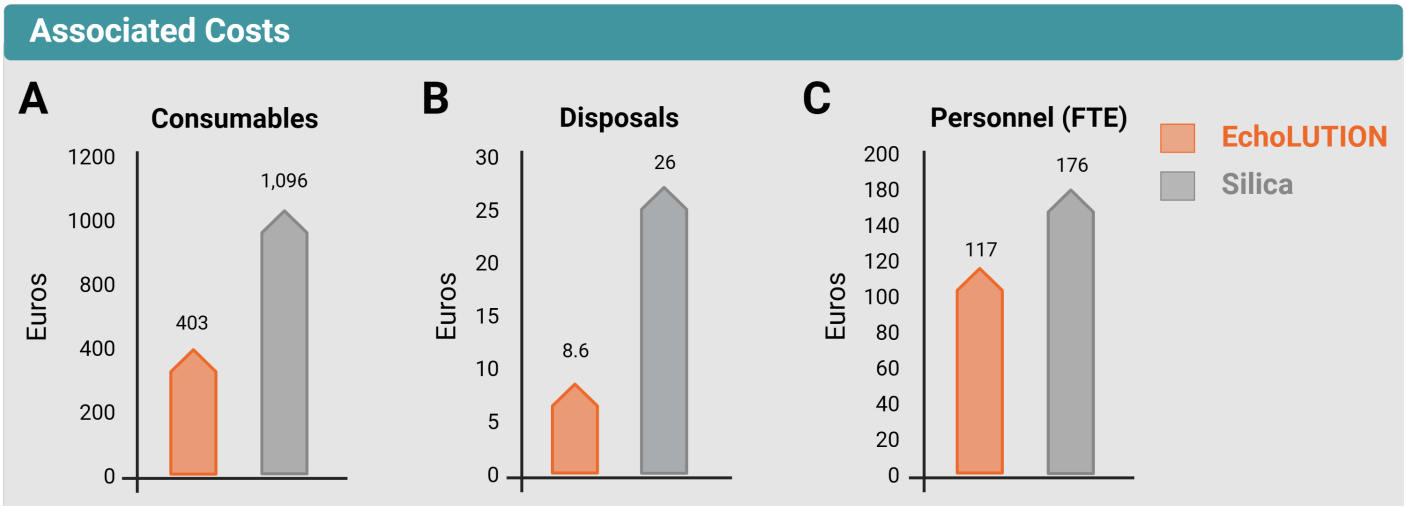

Figure 3. Associated costs for the automated RNA extraction of 1,000 samples with two different kits.

the Conditioning Plates (Product no. 060-001-002) and Lysis Plates (Product no. 060-004-008) from BioEcho, and the S-Blocks (Cat. no. 19585) from QIAGEN. Note that for sustainability reasons the Conditioning Plate is reusable and can be used up to 20 times, and this was taken into consideration for the calculations (Figure 3A).

We calculated the disposal costs based on the price for laboratory material waste in Cologne[2] (North Rhine-Westphalia, Germany): €3.25/kg. Here, we considered the weight of hazardous reagents and plastic waste generated by both methods, including tips, plates, tubes, and bottles (Figure 3B).

To calculate the personnel costs, we estimated the mean salary for a technician in Germany at €22/h (Figure 3C).

Finally, we used the calculations above to determine the total associated costs for each technology. Concerning consumables, disposal, and FTE cost (Figure 4A), the use of EchoLUTION saves €769 compared to the silica-based method.

In addition to the associated costs, we included the kit price to calculate the total cost. In 2024, the price per reaction is €4.60 for the EchoLUTION Cell Culture RNA Kit (8 × 96) and €5.75 for the RNeasy 96 Kit (4 × 96).

Figure 4 summarizes the total costs, which include associated costs (Figure 4B, dark-colored portion of the bar) and the list price per reaction for each kit (Figure 4B, light-colored portion of the bar). The total cost for automated RNA extraction of 1,000 samples with EchoLUTION is €5,130 and with the silica-based kit is €7,050 (Figure 4B). This corresponds to a total savings of approximately €1,920 by using the EchoLUTION kit.

Conclusions

Automated RNA purification with the EchoLUTION Cell Culture RNA Kit allows a total cost reduction of €1,520, which is 22 % less compared to a silica-based method. In particular, the associated costs with EchoLUTION are drastically reduced: 59 % less using EchoLUTION. This use case shows how the EchoLUTION technology lowers your investment in nucleic acid purification procedures. All our kits reduce the number of steps, as our workflow does not require binding, washing, and elution steps, saving time and reducing the cost of consumables and disposal for considerable total savings.

References

1. Automated Total RNA Isolation from Cells and Tissue on the MICROLAB® STAR. 041019_RNA_Extraction.indd (mn-net.com)

2. AWB-Handzettel-Gewerbeschadstoffsammlung.pdf (awbkoeln.de)

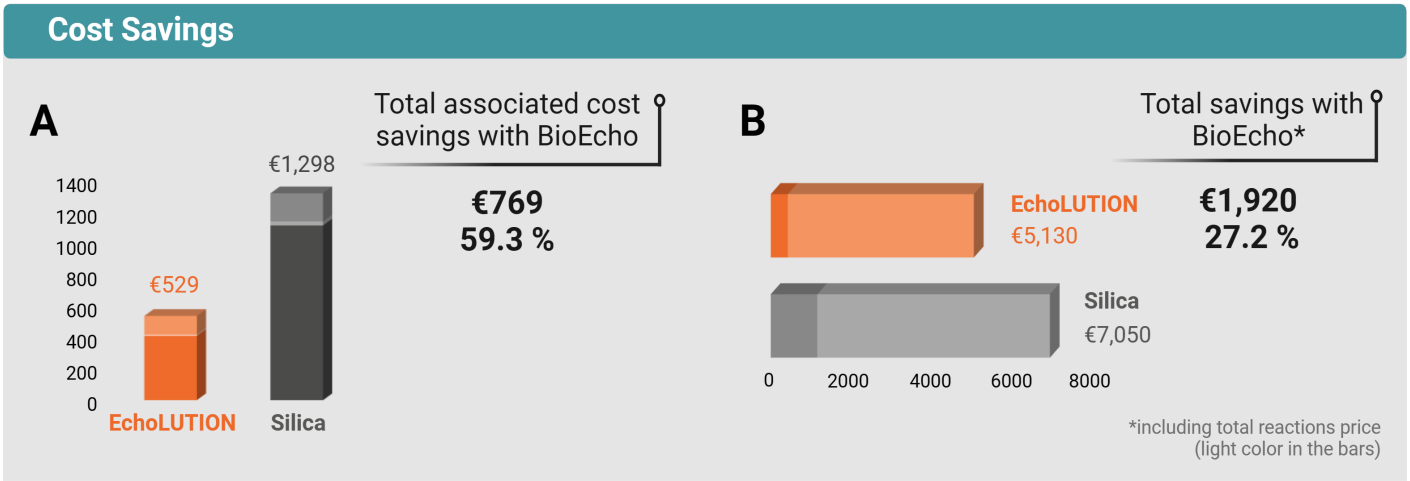

Figure 4. Total cost estimation for the automated RNA extraction from 1,000 cell culture samples with EchoLUTION and a silica-based method. A. *Total associated costs. Differently colored portions of the bars represent, from bottom to top: consumables, disposal, and personnel costs .* ***B.*** *Total costs. Differently colored portions of the bars represent the total associated costs (dark) and costs based on the 2024 kit price (light).*

Ordering information

Product	Reactions	Product no.
EchoLUTION Cell Culture RNA Kit (2 x 96) EchoLUTION Cell Culture RNA Kit (8 x 96)	2 x 96 8 x 96	011-114-002 011-114-008
gDNA Removal Mix*	2 x 96 8 x 96 2 x 384 8 x 384	011-901-002 011-901-008 011-901-302 011-901-308
Conditioning Plates**	2 plates 8 plates	060-001-002 060-001-008
Conditioning Plates A (for automation)**	2 plates 8 plates	060-002-002 060-002-008
Lysis Plates***	8 plates	060-004-008

*gDNA Removal Mix should be additionally purchased if gDNA removal is required.

**For sustainability reasons, Conditioning Plates are not included in our kits; these plates are reusable and can be purchased separately.

***Lysis Plates are not included in the kit. Lysis Plates are used for sample lysis.

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