

INSTRUCTION MANUAL

EZ RNA Methylation[™] Kit Catalog Nos. R5001 & R5002

Highlights

- Fast and reliable bisulfite conversion of RNA for methylation analysis.
- Specifically optimized for complete conversion of non-methylated cytosine in RNA.
- Ideal for all RNA inputs.

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For Research Use Only

Ver. 1.0.4

EZ RNA Methylation [™] Kit	R5001 50 rxns.	R5002 200 rxns.	Storage Temperature
RNA Conversion Reagent	5 tubes	20 tubes	Room Temp.
RNA Binding Buffer	25 ml	100 ml	Room Temp.
RNA Wash Buffer ¹ (concentrate)	12 ml	48 ml	Room Temp.
RNA Desulphonation Buffer	10 ml	40 ml	Room Temp.
DNase/RNase-Free Water	1 ml	4 ml	Room Temp.
Zymo-Spin [™] IC Columns	50 columns	200 columns	Room Temp.
Collection Tubes	50 tubes	200 tubes	Room Temp.
Instruction Manual	1	1	_

Note - Integrity of kit components is guaranteed for one year from date of purchase. Reagents are routinely tested on a lot-to-lot basis to ensure they provide maximal performance and reliability.

¹ Add 48 ml 100% ethanol (52 ml of 95% ethanol) to the 12 ml **RNA Wash Buffer** concentrate (R5001) or 192 ml 100% ethanol (208 ml of 95% ethanol) to the 48 ml **RNA Wash Buffer** concentrate (R5002) before use.

Specifications:

- **RNA Input:** Samples containing 32 ng 3 μg of DNA-free RNA. For optimal results, the amount of input RNA should be between 0.5 1 μg.
- **Conversion Efficiency:** > 99% of non-methylated C residues are converted to U with > 99% protection of 5-methylcytosine.
- RNA Recovery: > 80%

Use of Methylation Specific PCR (MSP) is protected by US Patents 5,786,146 & 6,017,704 & 6,200,756 & 6,265,171 and International Patent WO 97/46705. No license under these patents to use the MSP process is conveyed expressly or by implication to the purchaser by the purchase of this product.

Note - [™] Trademarks of Zymo Research Corporation. This product is for research use only and should only be used by trained professionals. It is not intended for use in diagnostic procedures. Some reagents included with this kit are irritants. Wear protective gloves and eye protection. Follow the safety guidelines and rules enacted by your research institution or facility.

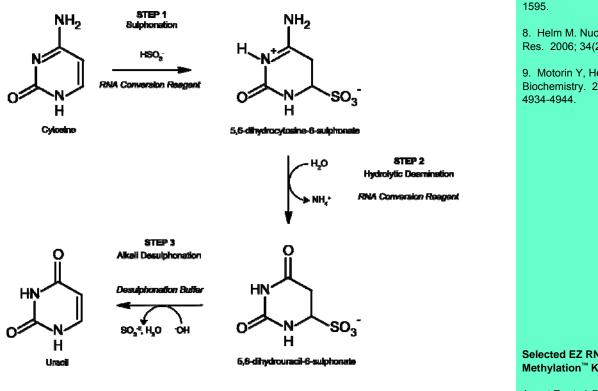
Note: For purification of high-quality DNA-free RNA, we recommend the *Quick*-**RNA**[™] (R1050) or **Directzol**[™] (R2050) purification kits, see page 9 for details. DNase I treatment of RNA samples is recommended.

Note: m4mC is also partially resistant to conversion with bisulfite, however, in comparison with 5-mC, m4mC may be more easily converted to U during the procedure.

Introduction to RNA Methylation:

Although the majority of nucleic acid modification research involves 5-methylcytosine in DNA, RNA is also extensively modified. In fact, there exist over a hundred modifications to RNA (1). 5-methylcytosine (5-mC) is present in RNA, and methylation is a common and naturally-occurring event in the RNA from both prokaryotic and eukaryotic organisms (2, 3). However, the function of RNA methylation remains unknown. Some reports describe a role for RNA methylation in translational regulation (4, 5), while others support a role for methylation in regulating RNA stability (6, 7) or the facilitation of RNA structure formation (8, 9).

The ability to detect and quantify 5-methylcytosine in RNA efficiently and accurately has been troublesome due to the inability of RNA to withstand the pH and temperatures used in the standard workflow for bisulfite conversion of DNA. Zymo Research offers a solution to these problems with the EZ RNA Methylation[™] Kit that has been optimized and validated for bisulfite conversion of RNA. This technique involves treating RNA with a unique bisulfite conversion reagent, which converts non-methylated cytosines into uracil while preserving the integrity of the RNA. Methylated cytosines remain unchanged during the treatment. After performing bisulfite treatment, the methylation profile of the RNA can be determined using techniques like RT-PCR followed by DNA sequencing (see figure on page 3).



The Chemistry of Bisulfite Conversion

References:

1. Cantara WA, et al. Nucleic Acids Res. 2011: 39: D195-201.

2. Motorin Y, Helm M. Nucleic Acids Res. 2010; 38(5): 1415-1430.

3. Squires JE, Preiss T. Epigenomics. 2010; 2(5): 709-715.

4. Chow CS, et al. ACS Chem Biol. 2007; 2(9): 610-619

5. Baudin-Baillieu A, et al. Nucleic Acids Res. 2009; 37(22): 7665-7677.

6. Alexandrov A, et al. Mol Cell. 2006; 21(1): 87-96.

7. Schaefer M, et al. Genes Dev. 2010; 24(15): 1590-1595

8. Helm M. Nucleic Acids Res. 2006; 34(2): 721-733.

9. Motorin Y, Helm M. Biochemistry. 2010; 49(24):

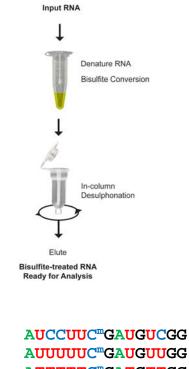
Selected EZ RNA Methylation[™] Kit Citation:

Amort T, et al. RNA Biol. 2013; 10(6): PMID 23595112.

For bisulfite treatment of DNA for methylation analysis, see the comprehensive line of **EZ DNA Methylation™** products from Zymo Research. (D5001-D5047)

Product Description:

The **EZ RNA Methylation**[™] **Kit** features rapid and reliable bisulfite treatment and conversion of cytosines in RNA for methylation analysis. The kit streamlines the threestep process for complete conversion of cytosine in into uracil. RNA denaturation and bisulfite conversion processes are combined into a single step. No buffer preparation is necessary. The **RNA Conversion Reagent** is provided ready-to-use: simply add the reagent to an RNA sample and incubate as indicated. Also, innovative in-column desulphonation technology eliminates messy precipitation steps, ensuring researchers obtain consistent results. The product has been designed to minimize template degradation, loss of RNA during treatment and clean-up, and to provide complete conversion of cytosine for accurate methylation analysis. Recovered RNA is ideal for RT-PCR, sequencing, library preparation and Next-Gen sequencing.



Original RNA with Methylated CpG: Converted RNA: cDNA Sequence:

Sequencing results following bisulfite treatment. RNA with methylated C (5-mC) at nucleotide position #7 was processed using the **EZ RNA Methylation[™] Kit**. The recovered RNA was amplified by RT-PCR and then cloned and sequenced. The methylated cytosine at position #7 remained intact while the non-methylated cytosines at positions #3, 4, and 13 were completely converted into uracil (post-bisulfite treatment) and detected as thymine following RT-PCR and sequencing.

Reagent Preparation:

• **Preparation of RNA Wash Buffer:** Add 48 ml of 100% ethanol (52 ml of 95% ethanol) to the 12 ml **RNA Wash Buffer** concentrate or 192 ml of 100% ethanol (208 ml of 95% ethanol) to the 48 ml **RNA-Wash Buffer** concentrate before use.

Protocol for Bisulfite Conversion of RNA:

 Add 130 μl of **RNA Conversion Reagent** to 20 μl of RNA sample in a PCR tube. Mix the sample by flicking the tube or pipetting up and down, then centrifuge briefly to ensure there are <u>no</u> droplets in the cap or sides of the tube.

Note: If the sample volume is less than 20 $\mu\text{I},$ compensate with DNase/RNase-Free Water.

- 2. Place the PCR tube(s) in a thermal cycler and perform the following steps:
 - 1. 70°C for 5 minutes
 - 2. 54°C for 45 minutes
 - 3. 4°C up to 20 hours

Note: The 4°C storage step is optional.

- 3. Place a **Zymo-Spin[™] IC Column** into a **Collection Tube** and add 250 µl of **RNA Binding Buffer** to the column.
- 4. Load the sample (from Step 2) into the **Zymo-Spin[™] IC Column** containing the **RNA Binding Buffer** and mix by pipetting up and down.
- 5. Add 400 µl of 95-100% ethanol to the sample-**RNA Binding Buffer** mixture in the column. Close the cap and immediately mix by inverting the column several times.
- 6. Centrifuge at full speed (\geq 10,000 x g) for 30 seconds. Discard the flow-through.
- 7. Add 200 µl RNA Wash Buffer to the column and centrifuge at full speed for 30 seconds.
- Add 200 μl of **RNA Desulphonation Buffer** to the column and let stand at room temperature (20°C – 30°C) for 30 minutes. After the incubation, centrifuge at full speed for 30 seconds. Discard the flow-through.
- Add 400 μl RNA Wash Buffer to the column and centrifuge at full speed for 30 seconds. Repeat the wash step with an additional 400 μl RNA Wash Buffer. Discard the flow-through.
- 10. Centrifuge the **Zymo-Spin[™] IC Column** in the emptied **Collection Tube** at full speed for 2 minutes. Remove the **Zymo-Spin[™] IC Column** carefully from the **Collection Tube** and transfer it into an RNase-free Tube.
- 11. Add ≥ 10 µl of DNase/RNase-Free Water directly to the column matrix and let stand for 1 minute at room temperature. Centrifuge at full speed for 30 seconds. The eluted RNA can be used immediately or stored at -20°C for up to 3 months. For long-term storage, keep at or below -70°C.

Note: The elution volume can be > 10 μ l depending on the requirements of your experiments.

Appendix I: Using 28S rRNA as a Positive Control

We recommend using 28S ribosomal RNA (*H. sapiens*) as a positive control for RNA methylation analysis, as the C at position 4447 (GenBank accession # NR_003287) is generally 100% methylated. Total RNA from cells or tissues (i.e. HeLa, HCT116, keratinocytes, brain tissue, liver tissue, etc.) can be used directly for the bisulfite conversion. The following sequence is the 28S rRNA region amplified (post-conversion) using the primer set indicated below.

Original (non-converted):

4321 -----ggg gccucacgau ccuucugacc uuuuggguuu uaagcaggag gugucagaaa aguuaccaca 4391 gggauaacug gcuuguggcg gccaagcguu cauagcgacg ucgcuuuuug auccuu \underline{c} gau gucggcucuu 4461 ccuaucauug ugaagcagaa uucaccaagc guuggauugu ucacccacua auagggaacg ugagcugg--

Bisulfite-Converted:

H 28SF primer: 5'-GGGGTTTTAYGATTTTTGATTTTTGGG-3' H 28SR primer: 5'-CCAACTCACRTTCCCTATTAATAAATAAAC-3'

Representative sequencing data obtained using 28S rRNA: The RT-PCR sequencing results of 10 clones (below) were obtained using bisulfite-converted total RNA extracted from HeLa cells. Underlined <u>C</u> represents 5-mC, highlighted <u>C</u> represents non-converted cytosine, *italics* are primer regions. The original, non-converted RNA sequence with non-methylated <u>C</u> highlighted is shown below the converted cDNA sequencing results for comparison.

Conversion Efficiency (C to T): C: 99.5%

101 HeLa01 - GGGGTTTATGATTTTTTGGGTTTTAAGTAGGAGGGTGTAGAAAGTTATTA
Orig GGGGCCUCACGAUCCUUCUGACCUUUUGGGUUUUAAGCAGGAGGUGUCAGAAAAGUUACCACAGGGAUAACUGGCUUGUGGCGGCCAAGCGUUCAUAGCGA
201 102 201 HeLa01 - TGTTGTTTTTTGATTTTTGGATGTTGGTTTTTTTTTT
Orig CGUCGCUUUUUGAUCCUUCGAUGUCGGCUCUUCCUAUCAUUGUGAAGCAGAAUUCACCAAGCGUUGGAUUGUUCACCCACUAAUAGGGAACGUGAGCUGG

Appendix II: Bisulfite Conversion and PCR Optimization

1.	illustrates what occurs t	of Double-Stranded DNA Templates. The following o a DNA template during bisulfite conversion. The same dary structure or double-stranded RNA.	Note: Methylated "C" is underlined in the example
	Template:	A: 5'-GACCGTTCCAGGTCCAGCAGTGCGCT-3' B: 3'-CTGGCAAGGTCCAGGTCGTCACGCGA-5'	
	Bisulfite-Converted:	A: 5'-GATCGTTTTAGGTTTAGTAGTGCGTT-3'	Note: Following bisulfite conversion, the strands no longer complementa
		B: 3'-TTGGCAAGGTTTAGGTTGTTATGCGA-5'	
2.	PCR Primer Design.	Generally, primers 26 to 32 bases are required for	

amplification of bisulfite-converted samples. All Cs should be treated as Ts for primer design purposes, unless they are in a CpG context. When using specific primers for the reverse transcription reaction to perform RT-PCR, it is important to use the "reverse" primer, as the "forward" primer will not hybridize to the template. See example below.

Bisulfite-Co	onverted:	A: 5'-GATCG	TTTTAGGTTTAGTAGTGCGTT-3'	
Primers:	Reverse:	_	3′-ATCATCACRCAA-5′	R = G/A
	Forward:	5′- GATYG	TTTTAGGT-3'	Y= C/T

Zymo Research provides primer design assistance with its Bisulfite Primer Seeker Program, available at: www.zymoresearch.com/tools/bisulfite-primer-seeker. Please feel free to contact us at tech@zymoresearch.com for additional help.

- 3. Amount of RNA Required for Bisulfite Conversion. The minimal amount of human RNA required for bisulfite-treatment and subsequent PCR amplification is 32 ng. The optimal amount of RNA per bisulfite treatment is 0.5 to 1 μ g. Although, up to 3 µg of RNA can also be processed, it should be noted that high input levels of RNA may result in incomplete bisulfite conversion for some GC-rich regions.
- **4.** PCR Conditions. We recommend using 1 4 µl of eluted RNA for each RT-PCR. However, up to 10 µl can be used if necessary. Usually, 35 to 45 cycles are required for successful PCR amplification of bisulfite-converted RNA. Optimal amplicon size should be between 100 – 200 bp; however larger amplicons can be generated with optimization of the PCR conditions. We have found that annealing temperatures between 55 - 60°C typically work well. As most non-methylated cytosine residues are converted into uracil, the bisulfite-treated RNA usually is AU-rich and has low GC composition. Thus, it may be necessary to reduce the annealing temperature accordingly.

Non-specific PCR amplification is relatively common with bisulfite-treated RNA due to its AU-rich nature. PCR using "hot start" polymerases is strongly recommended for the amplification of bisulfite-treated RNA.

5. Quantifying RNA. For the absorption coefficient at 260 nm, use a value of 40 µg/ml for Ab₂₆₀ = 1.0 when determining the concentration of both normal and bisulfitetreated RNA.

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are ry.

Note: Only one strand (A) is amplified by a given primer set. Only the reverse primer binds to the converted RNA, the forward primer will bind the strand generated during the reverse transcription.

If the primer contains CpG dinucleotides with uncertain methylation status, then mixed bases with C and T (or G and A) can be used. Usually, there should be no more than one mixed position per primer and it should be located toward the 5' end of the primer. It is not recommended to have mixed bases located at the 3' end of the primer.

Zymo*Taq*[™] is a "hot start" DNA polymerase specifically designed for the amplification of bisulfite treated DNA. (E2001)

Frequently Asked Questions:

- Q: Should the input RNA be dissolved in TE, water, or some other buffer prior to its conversion?
- A: Water is recommended.

Q: Should the RNA be DNase I treated?

A: Yes, it is recommended to treat RNA samples with DNase I (e.g., E1010) prior to the bisulfite conversion.

(For clean-up of DNase I-treated RNA use the RNA Clean & Concentrator[™], R1015)

Q: At what temperature and for how long can converted RNA be stored?

- **A:** The sample should be stored at ≤ -20°C whenever possible and freeze-thaw cycles should be minimized. The quality of the RNA should remain relatively unchanged for up to 3 months. For long term storage samples should be kept at ≤ -70°C.
- Q: Which *Taq* polymerase(s) do you recommend for PCR amplification of cDNA generated from bisulfite-converted RNA?
- **A:** We recommend a "hot start" DNA polymerase (e.g., ZymoTaq[™], E2001).

Q: What RNA purification methods do you recommend?

A: For RNA purification from cells or soft tissues use Quick-RNA[™] kits (R1054). For samples in Tri-Reagent[®] or similar, the Direct-zol[™] kits (D2050, D2051) are recommended. Both technologies allow for total RNA recovery (including small RNAs) and facilitate on-column DNase I treatment.

Ordering Information:

Product Description	Catalog No.	Kit Size
EZ RNA Methylation [™] Kit	R5001	50 rxns.
EZ RNA Methylation [™] Kit	R5002	200 rxns.

For Individual Sale	Catalog No.	Amount(s)
RNA Conversion Reagent	R5001-1-1	1 tube
RNA Binding Buffer	R1013-2-25 R1013-2-100	25 ml 100 ml
RNA Wash Buffer (concentrate)	R1003-3-6 R1003-3-12 R1003-3-24 R1003-3-48	
RNA Desulphonation Buffer	R5001-3-10 R5001-3-40	
DNase/RNase-Free Water	W1001-1 W1001-4 W1001-6 W1001-10	1 ml 4 ml 6 ml 10 ml
Zymo-Spin [™] IC Columns (capped)	C1004-50 C1004-250	50 columns 250 columns
Collection Tubes	C1001-50 C1001-500 C1001-1000	50 tubes 500 tubes 1,000 tubes

THE Epigenetics COMPANY™

Popular RNA Products from Zymo Research

Product Detectprion Peopleman Catalog RNA Clean & Concentrator "-5 Cheatup and concentrator in modified, labeled, impure, dilated, Drase tested RNA Stocknam R1015 RNA Clean & Concentrator "-10 Canton and production of RNA from spaceous plass of organic extracts. Stocknam R1017 RNA Clean & Concentrator "-100 Canton and production of RNA from spaceous plass of organic extracts. Stocknam R1017 RNA Clean & Concentrator "-100 Chaste II included with R1013 and R104A. Stocknam R1017 RNA Clean & Concentrator "-100 Ceanup and concentration of RNA and/or DNA origos. Good for deam up of mRNAA 28 Stoplase. R1051 RNA Clean & Concentrator " Separation of BNA for spaceous plass. 2000clumn D4662 RNA Real RA Resource XII Stocknam 2000clumn D4662 RNA MiniPrep RNA Resource XII Stocknam R10017 RNA MiniPrep RNA Kinn Samples in Tracing TRI Reagent", TRLoT, and all after acid quantificam plenal Stocknam RNA MiniPrep RNA Kinn Reagent" RNA Kinn Reagent" Stocknam R10017 RNA MiniPrep RNA Kinn Reagent" RNA Kinn Reagent" R100017	-	-	COM		
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ZR Viral DNA/RNA Kit [™] At both and the form and the	ZR-96 Viral RNA Kit™	RNA (DNA) from body fluids (plasma serum CSE urine)	2x 96/plate		
ZR Virál DNA/RNA Kit 100/column D7021 ZR Whole-Blood RNA MiniPrep™ RNA from whole blood or partitioned blood. 50/column R1020 ZR Urine RNA Isolation Kit™ Cellular and endosomal RNA from urine. 20/column R1038 ZR Fungal/Bacterial RNA MicroPrep™ RNA from Tough-to-Lyse Samples 80/column R2010 ZR Fungal/Bacterial RNA MicroPrep™ RNA from bacteria, yeast, fungi; BashingBead™ lysis. 50/column R2010 ZR Plant RNA MiniPrep™ RNA from leaves, stems, buds, flowers, fruits, seeds, etc; BashingBead™ lysis. 50/column R2024 ZR Tissue & Insect RNA MicroPrep™ RNA from leaves, stems, buds, flowers, fruits, seeds, etc; BashingBead™ lysis. 50/column R2030 ZR Soil/Fecal RNA MicroPrep™ RNA from soil, sludge, sediment, feces. 50/column R2030 ZR Soil/Fecal RNA Kit™ RNA from yeast strains susceptible to Zymolyase. 50/column R1002 DNA/RNA Shield™ Quick-RNA™ MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column R1100-50 DNA/RNA Shield™ Guick-RNA™ MiniPrep Enzymes and Markers 50/column R1100-50 DNA/RNA Shield™ MiniPrep Lyophilized S0 R1100-50					
ZR Whole-Blood RNA MiniPrep [™] RNA from whole blood or partitioned blood. 100/column R1020 100/column R1020 100/column ZR Urine RNA Isolation Kit [™] Cellular and endosomal RNA from urine. 20/column R1038 50/column ZR Fungal/Bacterial RNA MicroPrep [™] RNA from tough-to-Lyse Samples 50/column R2010 ZR Fungal/Bacterial RNA MicroPrep [™] RNA from bacteria, yeast, fungi; BashingBead [™] lysis. 50/column R2010 ZR Plant RNA MiniPrep [™] RNA from leaves, stems, buds, flowers, fruits, seeds, etc; BashingBead [™] lysis. 50/column R2024 ZR Soil/Fecal RNA MicroPrep [™] RNA from insect, arthropod specimen and small tissue samples; BashingBead [™] lysis. 50/column R20204 YeaStar RNA Kit [™] RNA from soil, sludge, sediment, feces. 50/column R2030 YeaStar RNA Kit [™] RNA from soil, sludge, sediment, feces. 50/column R1002 DNA/RNA Shield [™] Quick-RNA [™] MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column R1100-50 DNA/RNA Shield [™] Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column R1100-50 DNA/RNA Shield [™] Lyophilized Enzymes and Markers 50/column w/ (50 ml) R1100-50	ZR Viral DNA/RNA Kit [™]				
ZR Whole-Blood RNA MiniPrep RNA from Whole blood of partitioned blood. 100/column R1021 ZR Urine RNA Isolation Kit [™] Cellular and endosomal RNA from urine. 20/column R1038 Strong Value Strong Value Strong Value Strong Value R1038 ZR Fungal/Bacterial RNA MicroPrep [™] RNA from bacteria, yeast, fungi; BashingBead [™] lysis. Strong Value Strong Value R2010 ZR Fungal/Bacterial RNA MiniPrep [™] RNA from bacteria, yeast, fungi; BashingBead [™] lysis. Strong Value Strong Value Strong Value R2014 ZR Plant RNA MiniPrep [™] RNA from leaves, stems, buds, flowers, fruits, seeds, etc; BashingBead [™] lysis, Strong Value Strong Value R2024 ZR Tissue & Insect RNA MicroPrep [™] RNA from insect, arthropod specimen and small tissue samples; BashingBead [™] lysis. Strong Value Strong Value R2030 ZR Soil/Fecal RNA MicroPrep [™] RNA from yeast strains susceptible to Zymolyase. Strong Value Strong Value R1002 Veastar RNA Kit [™] RNA from yeast strains susceptible to Zymolyase. Strong Value Strong Value R1100-50 DNA/RNA Shield [™] MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. Strong Value Strong Value					
ZR Urine RNA Isolation Kit™ Cellular and endosomal RNA from urine. 20/column R1038 81039 ZR Fungal/Bacterial RNA MicroPrep™ RNA from Tough-to-Lyse Samples 50/column R2010 ZR Fungal/Bacterial RNA MiniPrep™ RNA from bacteria, yeast, fungi; BashingBead™ lysis. 50/column R2014 ZR Plant RNA MiniPrep™ RNA from leaves, stems, buds, flowers, fruits, seeds, etc; BashingBead™ lysis, RT/PCR inhibitor removal. 50/column R2030 ZR Tissue & Insect RNA MicroPrep™ RNA from insect, arthropod specimen and small tissue samples; BashingBead™ lysis. 50/column R2030 ZR Soil/Fecal RNA MicroPrep™ RNA from insect, arthropod specimen and small tissue samples; BashingBead™ lysis. 50/column R2030 ZR Soil/Fecal RNA MicroPrep™ RNA from yeast strains susceptible to Zymolyase. 50/column R2040 YeaStar RNA Kit™ RNA from yeast strains susceptible to Zymolyase. 50/column R1002 DNA/RNA Shield™ W Quick-RNA™ MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column w/ (50 ml) R1100-500 DNA/RNA Shield™ w/ Quick-RNA™ MiniPrep Enzymes and Markers 50/column w/ (50 ml) R1100 DNase I w/ 10X Reaction Buffer Lyophilized 250 U E1009	ZR Whole-Blood RNA MiniPrep [™]	RNA from whole blood or partitioned blood.			
ZR Orine RNA isolation Kit Cellular and endosomal RNA from urine. 50/column R1039 RNA from Tough-to-Lyse Samples ZR Fungal/Bacterial RNA MicroPrep [™] RNA from bacteria, yeast, fungi; BashingBead [™] lysis. 50/column R2010 ZR Plant RNA MiniPrep [™] RNA from leaves, stems, buds, flowers, fruits, seeds, etc; BashingBead [™] lysis. 50/column R2014 ZR Plant RNA MiniPrep [™] RNA from leaves, stems, buds, flowers, fruits, seeds, etc; BashingBead [™] lysis. 50/column R2030 ZR Tissue & Insect RNA MicroPrep [™] RNA from insect, arthropod specimen and small tissue samples; BashingBead [™] lysis. 50/column R2030 ZR Soil/Fecal RNA MicroPrep [™] RNA from soil, sludge, sediment, feces. 50/column R2040 YeaStar RNA Kit [™] RNA from yeast strains susceptible to Zymolyase. 50/column R1002 DNA/RNA Shield [™] W/ Quick-RNA [™] MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column w/ (50 ml) R1100-50 DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep Enzymes and Markers 50/column w/ (50 ml) R1100 DNase I w/ 10X Reaction Buffer Lyophilized 250 U E1009					
RNA from Tough-to-Lyse Samples ZR Fungal/Bacterial RNA MicroPrep [™] RNA from bacteria, yeast, fungi; BashingBead [™] lysis. 50/column R2010 ZR Fungal/Bacterial RNA MiniPrep [™] RNA from bacteria, yeast, fungi; BashingBead [™] lysis. 50/column R2014 ZR Plant RNA MiniPrep [™] RNA from leaves, stems, buds, flowers, fruits, seeds, etc; BashingBead [™] lysis. 50/column R2024 ZR Tissue & Insect RNA MicroPrep [™] RNA from insect, arthropod specimen and small tissue samples; BashingBead [™] lysis. 50/column R2030 ZR Soil/Fecal RNA MicroPrep [™] RNA from soil, sludge, sediment, feces. 50/column R2040 YeaStar RNA Kit [™] RNA from yeast strains susceptible to Zymolyase. 50/column R1002 DNA/RNA Shield [™] Vels, biological liquid, tissue storage and DNA/RNA purification. 50/column w/ (50 ml) R1100-50 DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep Enzymes and Markers 50/column w/ (50 ml) R1100 DNase I w/ 10X Reaction Buffer Lyophilized 250 U E1009	ZR Urine RNA Isolation Kit [™]	Cellular and endosomal RNA from urine.			
ZR Fungal/Bacterial RNA MiniPrep™ RNA from bacteria, yeast, fungi, BashingBead™ lysis. 50/column R2014 ZR Plant RNA MiniPrep™ RNA from leaves, stems, buds, flowers, fruits, seeds, etc; BashingBead™ lysis, RT/PCR inhibitor removal. 50/column R2024 ZR Tissue & Insect RNA MicroPrep™ RNA from isexet, arthropod specimen and small tissue samples; BashingBead™ lysis. 50/column R2030 ZR Soil/Fecal RNA MicroPrep™ RNA from soil, sludge, sediment, feces. 50/column R2040 YeaStar RNA Kit™ RNA from yeast strains susceptible to Zymolyase. 50/column R1002 DNA/RNA Shield™ Cells, biological liquid, tissue storage and DNA/RNA purification. 50 ml R1100-50 DNA/RNA Shield™ w/ Quick-RNA™ MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column w/ (50 ml) R1100 DNase I w/ 10X Reaction Buffer Lyophilized 250 U E1009		RNA from Tough-to-Lyse Samples			
ZR Fungal/Bacterial RNA MiniPrep S0/column R2014 ZR Plant RNA MiniPrep [™] RNA from leaves, stems, buds, flowers, fruits, seeds, etc; BashingBead [™] lysis, RT/PCR inhibitor removal. 50/column R2024 ZR Tissue & Insect RNA MicroPrep [™] RNA from insect, arthropod specimen and small tissue samples; BashingBead [™] lysis. 50/column R2030 ZR Soil/Fecal RNA MicroPrep [™] RNA from soil, sludge, sediment, feces. 50/column R2040 Yeastar RNA Kit [™] RNA from yeast strains susceptible to Zymolyase. 50/column R2040 Veastar RNA Kit [™] RNA from yeast strains susceptible to Zymolyase. 50/column R1002 DNA/RNA Shield [™] Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column w/ (50 ml) R1100-50 DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep Enzymes and Markers 50/column w/ (50 ml) R1100		RNA from bacteria, veast, fundi, BashingBead™ lvsis			
ZR Plant RNA MiniPrep RT/PCR inhibitor removal. S0/column R2024 ZR Tissue & Insect RNA MicroPrep [™] RNA from insect, arthropod specimen and small tissue samples; BashingBead [™] lysis. 50/column R2030 ZR Soil/Fecal RNA MicroPrep [™] RNA from soil, sludge, sediment, feces. 50/column R2040 YeaStar RNA Kit [™] RNA from yeast strains susceptible to Zymolyase. 50/column R1002 DNA/RNA Shield [™] DNA and RNA Sample Preservation and Storage 50/column R1100-50 Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column w/ (50 ml) R1100-50 DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column w/ (50 ml) R1100 Enzymes and Markers DNase I w/ 10X Reaction Buffer Lyophilized 250 U E1009	ZR Fungal/Bacterial RNA MiniPrep [™]		50/column	R2014	
R1/PCR Innibitor Perroval. Cells, biological liquid, tissue storage and DNA/RNA purification. S0/column (S0 ml) ZR Soi/Fecal RNA MicroPrep [™] RNA from insect, arthropod specimen and small tissue samples; BashingBead [™] lysis. 50/column R2030 ZR Soi/Fecal RNA MicroPrep [™] RNA from soil, sludge, sediment, feces. 50/column R2040 YeaStar RNA Kit [™] RNA from yeast strains susceptible to Zymolyase. 50/column R1002 DNA/RNA Shield [™] Cells, biological liquid, tissue storage and DNA/RNA purification. 50 ml R1100-50 DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column w/ (50 ml) R1100 DNase I w/ 10X Reaction Buffer Lyophilized 250 U E1009	ZR Plant RNA MiniPrep [™]		50/column	R2024	
ZR Soil/Fecal RNA MicroPrep™ RNA from soil, sludge, sediment, feces. 50/column R2040 YeaStar RNA Kit™ RNA from yeast strains susceptible to Zymolyase. 50/column R1002 DNA and RNA Sample Preservation and Storage 50 ml R1100-50 DNA/RNA Shield™ w/ Quick-RNA™ MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column w/ (50 ml) R1100 Enzymes and Markers DNase I w/ 10X Reaction Buffer Lyophilized 250 U E1009	-				
YeaStar RNA Kit [™] RNA from yeast strains susceptible to Zymolyase. 50/column R1002 DNA and RNA Sample Preservation and Storage DNA/RNA Shield [™]					
DNA and RNA Sample Preservation and Storage DNA/RNA Shield [™] 50 ml R1100-50 DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. 50 ml R1100-250 DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep Enzymes and Markers 50/column w/ (50 ml) R1100 DNase I w/ 10X Reaction Buffer Lyophilized 250 U E1009					
DNA/RNA Shield [™] 50 ml R1100-50 DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. 50/column w/ (50 ml) R1100-250 DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep Enzymes and Markers 50/column w/ (50 ml) R1100 Lyophilized					
DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep Cells, biological liquid, tissue storage and DNA/RNA purification. 250 ml R1100-250 DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep Enzymes and Markers 50/column w/ (50 ml) R1100 DNase I w/ 10X Reaction Buffer Lyophilized Lyophilized E1009			50 ml	R1100-50	
DNA/RNA Shield [™] w/ Quick-RNA [™] MiniPrep 50/column w/ (50 ml) R1100 Enzymes and Markers DNase I w/ 10X Reaction Buffer Lyophilized 250 U E1009		Colla, biological liquid, tippup storage and DNA/DNA surficientian			
Enzymes and Markers DNase I w/ 10X Reaction Buffer Lyophilized 250 U E1009	DNA/RNA Shield w/ Quick RA/AM MiniBros	Cells, biological liquid, tissue storage and DNA/RNA purification.	50/column w/ (50 ml)	P1100	
DNase I w/ 10X Reaction Buffer Lyophilized 250 U E1009	UNATINA SIIIEIU W QUICK-KIVA MINIPrep			K I 100	
ZR small-RNA ⁻ Ladder I ssRNA (17, 21, 25, 29 nt) 10 µg R1090					
	ZK small-RNA [®] Ladder	sskna (17, 21, 25, 29 nt)	10 µg	R1090	