SAFC®
Pharma & Biopharma Raw Material Solutions

Data Sheet

Nucleoside Triphosphates (NTPs) Emprove® Expert

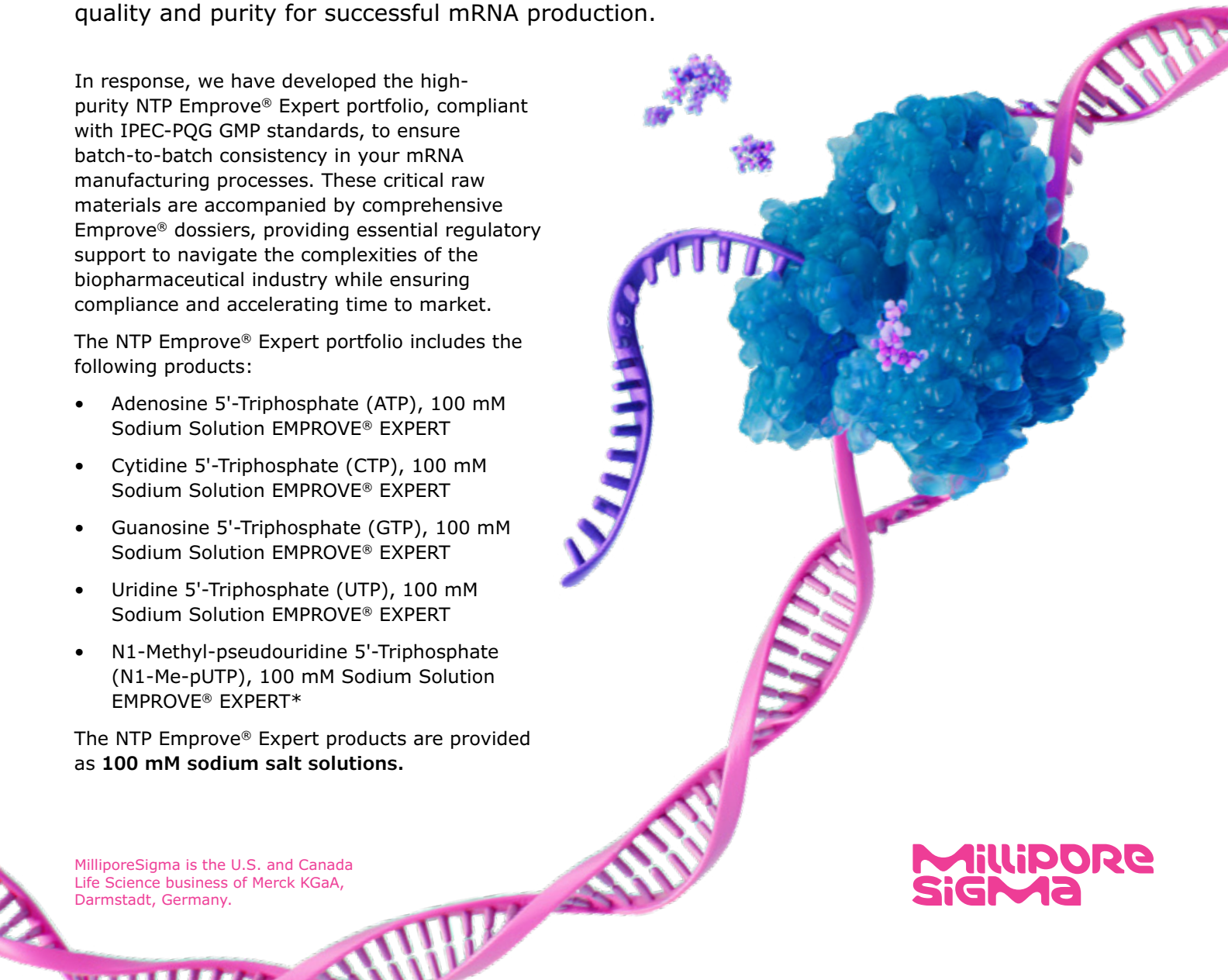
mRNA therapies represent a revolutionary approach to therapeutics such as vaccines, cancer treatments, and immunotherapies, offering novel ways to treat complex diseases. As a result, global interest in mRNA manufacturing has grown, while regulatory expectations have become increasingly stringent. In this environment, manufacturers require raw materials suitable for pharmaceutical use, ensuring the highest levels of quality and purity for successful mRNA production.

In response, we have developed the high-purity NTP Emprove® Expert portfolio, compliant with IPEC-PQG GMP standards, to ensure batch-to-batch consistency in your mRNA manufacturing processes. These critical raw materials are accompanied by comprehensive Emprove® dossiers, providing essential regulatory support to navigate the complexities of the biopharmaceutical industry while ensuring compliance and accelerating time to market.

The NTP Emprove® Expert portfolio includes the following products:

- Adenosine 5'-Triphosphate (ATP), 100 mM Sodium Solution EMPROVE® EXPERT
- Cytidine 5'-Triphosphate (CTP), 100 mM Sodium Solution EMPROVE® EXPERT
- Guanosine 5'-Triphosphate (GTP), 100 mM Sodium Solution EMPROVE® EXPERT
- Uridine 5'-Triphosphate (UTP), 100 mM Sodium Solution EMPROVE® EXPERT
- N1-Methyl-pseudouridine 5'-Triphosphate (N1-Me-pUTP), 100 mM Sodium Solution EMPROVE® EXPERT*

The NTP Emprove® Expert products are provided as **100 mM sodium salt solutions.**



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Key Benefits

- **Improved batch-to-batch consistency** through IPEC-PQG GMP compliant manufacturing with validated QC methods, manufacturing processes, and stability studies
- **Animal origin-free (AOF)** to minimize contamination risks and support safety of high-risk applications.
- **High purity (≥99%) Emprove® Expert products** with specifications that meet the high demands of the biopharma industry:
  - **Specified low microbial and endotoxin levels,** suitable for high-risk applications.
  - **Specified absence of nuclease activity** to minimize degradation risk.
  - Extended impurity testing including specified low levels of **residual solvents.**
- **Backed by our Emprove® Program,** provides comprehensive regulatory, technical, and supply information to facilitate your risk assessment, material qualification, and process optimization efforts.

Product Application

NTPs are crucial for producing mRNA-based therapeutics and vaccines. The four **natural/non-modified NTPs (ATP, CTP, GTP, UTP)** serve as essential building blocks for synthesizing mRNA through the in vitro transcription (IVT) process, where T7 RNA polymerases incorporate them into the growing mRNA strand.

Non-modified NTPs can be exchanged by modified NTPs.[1,2]

Product Specifications

Name	ATP	CTP	GTP	UTP	N1-Me-pUTP
Chemical Name	Adenosine Triphosphate	Cytidine Triphosphate	Guanosine Triphosphate	Uridine Triphosphate	N1-Methyl-Pseudouridine Triphosphate*
CAS Number	56-65-5	86-01-1	65-47-4	63-39-8	1428903-59-6
Molecular Weight	507.18 g/mol	523.18 g/mol	483.18 g/mol	484.18 g/mol	498.17 g/mol
Chemical Formula	$C_{10}H_{12}N_5O_{13}P_3$	$C_{10}H_{15}N_5O_{14}P_3$	$C_9H_{14}N_3O_{12}P_2$	$C_9H_{13}N_2O_{12}P_2$	$C_{10}H_{13}N_2O_{12}P_2$

Molecular weight, CAS, Chemical formula is for free acid.

Physicochemical Information

- All NTPs are provided in a **sodium salt form**, dissolved in an **aqueous solution** at a concentration of **100 ± 5 mM and pH 7 ± 0.1.**
- High purity (≥99%)
- Storage: −20 °C
- Shelf-life: 1 year; extension to 2 years after completion of stability studies

The Emprove® Program

The Smart Way to Master Compliance and Control

Ensuring the compliance of your pharma and biopharma products involves the compilation of a vast amount of data, which can be time-consuming and resource-intensive. To help facilitate and accelerate your risk assessment continuum, we have developed the Emprove® Program, offering convenient access to reliable information for a broad portfolio of products.

Each product in the portfolio is complemented with different types of dossiers: Material Qualification Dossier, Quality Management Dossier, and Operational Excellence Dossier. They provide information on the manufacturing process, stability data, elemental impurity information, product quality reports, analytical procedures, and much more.

The dossiers can be accessed online in our new Emprove® Suite, our information-as-a-service digital platform. A subscription can help you stay current. In addition to viewing and downloading dossiers, you can also receive notification updates on changes to documents, as well as generate metrics and reports.

For more information, please visit: SigmaAldrich.com/emprove-program

Ordering Information

Product Description	Material Number	Pack Size (mL)
Adenosine 5'-Triphosphate (ATP), 100 mM Sodium Solution EMPROVE® EXPERT	137201.0002	1
	137201.0010	10
	137201.0050	50
	137201.0200 (on demand only)	200
Guanosine 5'-Triphosphate (GTP), 100 mM Sodium Solution EMPROVE® EXPERT	137202.0002	1
	137202.0010	10
	137202.0050	50
	137202.0200 (on demand only)	200
Cytidine 5'-Triphosphate (CTP), 100 mM Sodium Solution EMPROVE® EXPERT	137203.0002	1
	137203.0010	10
	137203.0050	50
	137203.0200 (on demand only)	200
Uridine 5'-Triphosphate (UTP), 100 mM Sodium Solution EMPROVE® EXPERT	137204.0002	1
	137204.0010	10
	137204.0050	50
	137204.0200 (on demand only)	200
N1-Methyl-pseudouridine 5'-Triphosphate (N1-Me-pUTP), 100 mM Sodium Solution EMPROVE® EXPERT*	137206.0002	1
	137206.0010	10
	137206.0050	50
	137206.0200 (on demand only)	200

References

1. Karikó, K., et al. (2021). “The Critical Contribution of Pseudouridine to mRNA COVID-19 Vaccines.” Nat Rev Immunol.
2. Li, B., et al. (2016). “Effects of Chemically Modified Messenger RNA on Protein Expression.” Bioconjug Chem.

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For additional information, please visit
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