



# Benzonase® endonuclease Safety Plus Emprove® Expert

Benzonase® endonuclease — the smart solution for DNA removal in biopharmaceutical production has proven its value for over 30 years. Balancing efficiency and regulatory compliance by delivering reliability and high-quality due manufacturing under good manufacturing practices (GMP ICH Q7). Additionally, to the stringent quality control and extensive documentation packages coming with Benzonase® endonuclease Emprove® Expert, the all new Safety Plus product elevates the high-quality level even

further by adding the most recent manufacturing and analytical technologies delivering enhanced risk mitigation. The Benzonase® endonuclease Safety Plus EMPROVE® Expert is manufactured using a non-animal origin chemically-defined fermentation medium. Release testing confirms the absence of mycoplasma and adventitious viruses for enhanced product safety. Tailgate samples for the large pack size are provided to avoid opening the large pack during incoming goods control, adding a further layer of safety.

## Benefits

Features / Application	Standard Benzonase® endonuclease	Benzonase® endonuclease Safety Plus Emprove® Expert
Origin	<i>Serratia marcescens</i> , Production: <i>E. coli</i> K12 strain W3110; 30 kDa; PI 6.85; sequence homology data	
GMP manufacturing according to ICH Q7	Yes	Yes
FDA Drug master file (DMF) & Emprove®	Yes	Yes
Non-Animal-Origin (NAO), recombinant from <i>E. coli</i> in chemically defined production medium	No	Yes
Shipment with temperature strips	No	Yes
Tailgate samples for large pack size	No	Yes (with 5M unit size)
Lot release <i>in vitro</i> test for absence of adventitious viruses (3 cell lines) and Mycoplasma test	No	Yes
Endotoxins (LAL)	< 0.25 EU/1,000 U	< 0.25 EU/1,000 U
Microbial testing	< 10 CFU/100,000 U	< 10 CFU/100,000 U
Target customer	Viral Vaccines	Viral & Gene Therapy
Long term product availability	Both Benzonase® products will remain in our portfolio	

## Product Application

Benzonase® endonuclease Safety Plus Emprove® Expert is a companion product to our existing Benzonase portfolio. All Benzonase® endonuclease products share the same nucleic acid sequence (proven by LC-MS/MS mass spectrometry), robustness and activity. Acting as endonuclease, degrading both DNA and RNA to small 3–5 base pairs (<6 kDa) fragments with no base preference, they are the ideal tool for nucleic acid removal in virus vector and vaccine manufacturing as demanded by the regulators. The use of Benzonase® endonuclease additionally increases the yield in virus purification, protects the downstream chromatography and filter devices from fouling and reduces feed stream viscosity.

With its new features, Benzonase® endonuclease Safety Plus Emprove® Expert is ideally suited for manufacturing of cell and gene therapy agents such as adeno associated and lenti viruses, oncolytic viruses and viral vector vaccines.

## Handling and Optimization Instructions

The enzyme is a protein consisting of two subunits with a molecular weight of about 30 kDa each. The protein has an isoelectric point (pI) at pH 6.85. Benzonase® endonuclease requires Mg<sup>2+</sup> (1–2 mM) for to be active, but retains effective under a wide range of operating conditions:

- pH 6.0–10.0
- Temperature 0–42 °C
- Concentration of monovalent ions (Na<sup>+</sup>, K<sup>+</sup>) 0–150 mM
- DDT, 2-Mercaptoethanol >100 mM
- Detergents (e.g., sodium deoxycholate or sodium dodecyl sulfate) up to 1%
- Urea up to 7 M

## The Emprove® Program – Your Fast Track through Regulatory Challenges

The Emprove® Program complements our product portfolio, and provides three types of dossiers to support different stages of development and manufacturing operations such as qualification, risk assessment, and process optimization. This program consolidates comprehensive product-specific testing, quality and regulatory information, making it readily available to our customers to simplify their compliance needs.

## Ordering Information

Benzonase® endonuclease Safety Plus Emprove® Expert is available in different pack sizes to support different applications from R&D to process development to production scale operations.

Cat. No.	Product Name	Units Activity
1.03773.1010	Benzonase® endonuclease Safety Plus EMPROVE® Expert	100,000 U
1.03773.0001	Benzonase® endonuclease Safety Plus EMPROVE® Expert	500,000 U
1.03773.0010	Benzonase® endonuclease Safety Plus EMPROVE® Expert	5,000,000 U
	+ Tailgate sample in same outer package	+50,000 U
1.01681.0001	Benzonase® ELISA kit II for residual Benzonase® Detection	NA

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