



¹³C-Enriched Carbon Sources for Solid-State NMR of Proteins

- BioExpress® 1000
- Glycerol
- Glucose



Tailoring ¹³C Enrichment of Proteins for Solid-State NMR

For many years, the use of highly enriched, uniform isotope-labeled recombinant proteins has enabled the study of protein structure and dynamics by NMR spectroscopy. This approach has been relatively easy to perform since uniformly ¹³C-labeled carbon sources such as ¹³C₆ glucose have been readily available. Unfortunately, highly enriched, uniform ¹³C labeling of proteins is not conducive to some NMR experiments (such as solid-state NMR experiments using stationary aligned samples) because strong, homonuclear ¹³C-¹³C dipole-dipole coupling can act to broaden ¹³C resonances very significantly, sometimes so severely that they are beyond detection. An effective approach to alleviate this problem is to use proteins containing spatially isolated ¹³C sites. Such sparsely labeled proteins can either be produced using uniform, random fractionally enriched carbon sources or specific ¹³C-labeled carbon sources.

Uniform Fractionally ¹³C-Enriched Bacterial Cell Growth Media and Glucose [U-¹³C₆]

CIL is pleased to offer uniform fractionally ¹³C enriched BioExpress® 1000, as well as fractionally enriched glucose for those researchers that use minimal essential media instead of a ready-made rich culture medium.

Catalog #	Product	Amount
CGM-1000-CN-25-S	BioExpress® 1000 (¹³ C, 25%; ¹⁵ N, 98%)	10 mL (10x)
CGM-1000-CN-25	BioExpress® 1000 (¹³ C, 25%; ¹⁵ N, 98%)	100 mL (10x)
CGM-1000-CN-35-S	BioExpress® 1000 (¹³ C, 35%; ¹⁵ N, 98%)	10 mL (10x)
CGM-1000-CN-35	BioExpress® 1000 (¹³ C, 35%; ¹⁵ N, 98%)	100 mL (10x)
CGM-1000-CN-45-S	BioExpress® 1000 (¹³ C, 45%; ¹⁵ N, 98%)	10 mL (10x)
CGM-1000-CN-45	BioExpress® 1000 (¹³ C, 45%; ¹⁵ N, 98%)	100 mL (10x)
CLM-1396-25-1	Glucose (¹³ C, 24-25%)	1 g

The number of adjacent ¹³C sites in most amino acid residues can be minimized by using uniform fractionally ¹³C enriched bacterial cell growth media or glucose [U-¹³C₆].

Opella, et al.,¹ have reported optimal results using BioExpress® media with fractional ¹³C enrichments between 25% and 35%.

Specific ¹³C-Labeled Carbon Sources

CIL offers the following specific ¹³C-labeled substrates for use in the microbial expression of proteins labeled with isolated ¹³C sites.

Catalog #	Compound	Amount
CLM-1397	Glycerol (2- ¹³ C, 99%)	1 g
CLM-1857	Glycerol (1,3- ¹³ C, 99%)	1 g
CLM-746	Glucose (2- ¹³ C, 99%)	1 g

Glycerol [1,3-¹³C₂] and glycerol [2-¹³C] have been shown to give rise to complementary labeling patterns. When choosing the appropriate specific ¹³C-labeled carbon source, the ¹³C enrichment of the expressed protein can be tailored to highlight regions of interest.

Advantages

Glycerol [2-¹³C]

- Increases overall labeling of carbons
- Significantly lower levels of carbonyl and aliphatic side chain carbons

Glycerol [1,3-¹³C₂]

- Creates reduced intensity in the α-carbon region¹

Glucose [2-¹³C]

- Minimizes adjacent ¹³C pairs in most residues
- Reported to be more useful than specifically labeled glycerol in detecting backbone ¹³C resonances¹

¹ Filipp, F.V.; Sinha, N.; Jairam, L.; Bradley, J.; Opella, S.J. **2009**. Labeling strategies for ¹³C-detected aligned-sample solid-state NMR of proteins, *J Magn Reson*, 201, 121-130.