

# Ampicillin vs. Carbenicillin

## Ampicillin

Ampicillin is a semi-synthetic penicillin. Antibiotics of the class penicillins are derivatives of 6-aminopenicillanic acid consisting of a  $\beta$ -lactam ring linked to a thiazolidine ring and a side chain. This nucleus is from the condensation of the amino acids L-cysteine and D-valine. The function of penicillins is to inhibit protein synthesis through activity associated with the  $\beta$ -lactam ring. Spectra are dependent on the side chain of individual congeners. The  $\beta$ -lactam blocks transpeptidation through association with the penicillin-binding proteins (PBPs). These antibiotics are analogs of the substrate, D-alanyl-D-alanine, whose bond is normally broken to form the cross-bridge glycines in transpeptidation. This analog competes for the binding of PBPs. As a result, no cross-bridges are formed and the cell wall becomes weak and eventually ruptures. Penicillins are inactive against cells with previously made cell walls. They work only against the synthesis of new cell walls and is, as a result, bacteriocidal to actively growing cells.

Because the activity of the antibiotic is derived from the  $\beta$ -lactam ring,  $\beta$ -lactamases (enzymes that destroy the  $\beta$ -lactam ring) confer resistance to the antibiotic thereby enabling the cell to grow in the presence of the antibiotic.

Ampicillin stock solutions should be made at 100 mg/mL with water, sterile-filtered, then distributed into single-use aliquots, and stored at  $-20^{\circ}\text{C}$ . The final working concentration of ampicillin is 100 mg/L.

## Carbenicillin

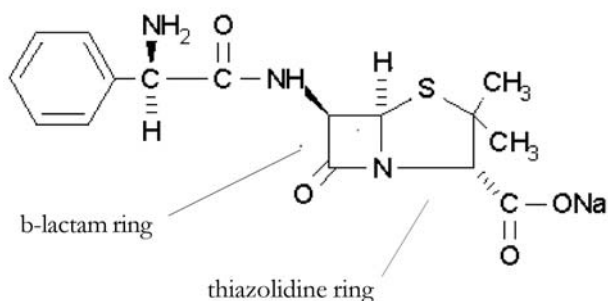
Carbenicillin is recommended as a substitute for ampicillin at the same concentration in molecular biology applications. Both ampicillin and carbenicillin are semi-synthetic penicillins related to penicillin. Carbenicillin is penicillin with a carboxyl and benzyl group whereas ampicillin is an aminopenicillin.

Because it is a member of the penicillin family of antibiotics, carbenicillin inhibits cell wall synthesis in peptidoglycan cross-linking.

Carbenicillin demonstrates improved stability over ampicillin when used in growth media. It is more resistant to heat and low pH induced degradation over time making it particularly useful for large-scale liquid culture growth. It also reduces the presence of satellite colonies seen with ampicillin. Satellite colonies are very small colonies visible on the plate that will grow very close to the larger colonies to survive. These cells are not resistant themselves, so they must grow near the antibiotic-resistant colonies that are destroying the antibiotic in their immediate vicinity to survive. Satellites only develop with antibiotics such as ampicillin because  $\beta$ -lactamases destroy the antibiotic outside of the cell. Satellites are more likely to develop if the ampicillin plate is old resulting in partial degradation of the antibiotic. Carbenicillin, being more stable than ampicillin and less labile to  $\beta$ -lactomase activity, reduces the presence of satellites.

### Ampicillin, Sodium Salt

Formula:  $\text{C}_{16}\text{H}_{18}\text{N}_3\text{SNa}$   
 Molecular Weight: 371.4 g/mol  
 Synonyms: D[-]- $\alpha$ -aminobenzylpenicillin  
 Cat. No: 61-238-RH: 1 x 10 g  
 Cat. No: 61-238-RM: 1 x 100 g  
 Storage: 2 to  $8^{\circ}\text{C}$   
 Shipping: 15 to  $30^{\circ}\text{C}$



### Carbenicillin, Disodium Salt

Formula:  $\text{C}_{17}\text{H}_{16}\text{N}_2\text{O}_6\text{SNa}_2$   
 Molecular Weight: 422.4 g/mol  
 Synonyms:  $\alpha$ -Carboxybenzylpenicillin  
 Cat. No: 46-100: 1 x 5 g  
 Storage: 2 to  $8^{\circ}\text{C}$   
 Shipping: 15 to  $30^{\circ}\text{C}$

