Sulbactam Sodium
PRODUCT DATA SHEET

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Product Name:	Sulbactam Sodium
Product Number:	S011
CAS Number:	69388-84-7
Molecular Formula:	$C_8H_{10}NNaO_5S$
Molecular Weight:	255.22
Form:	Powder
Appearance:	White crystalline powder
Source:	Semi-synthetic
Water Content (Karl Fischer):	Not more than 1.0%
Storage Conditions:	2-8 °C

Description:

Sulbactam sodium is an irreversible inhibitor of several bacterial penicillinases and cephalosporinases. In the presence of low concentrations of sulbactam, ampicillin and other beta-lactams readily inhibit the growth of a variety of resistant bacteria that contain beta-lactamases. Sulbactam was first developed by the central research division of Pfizer, Inc. and was first described in 1978.

Sulbactam sodium used alone displays only weak antibacterial activity, with the notable exception of its potent effects on susceptible and resistant strains of *Neisseria gonorrhoeae*. Sulbactam sodium appears to be somewhat less potent but markedly more stable (in aqueous solution) than the beta-lactamase inhibitor clavulanic acid.

Sulbactam Sodium is able to inhibit the most common forms of β-lactamase but is not able to interact with the AmpC cephalosporinase. Thus, it confers little protection against bacteria such as *Pseudomonas aeruginosa*, *Citrobacter*, *Enterobacter*, and *Serratia*, which often express this gene.

Sulbactam is commonly combined to form ampicillin/sulbactam (2:1). It does possess some antibacterial activity when administered alone, but it is too weak to have any clinical importance.

Recently, sulbactam has been used in treating *Acinetobacter* septicemia and is receiving renewed interest.

Synonyms: (2S,5R)-3,3-dimethyl-7-oxo-4-thia-1-azabicyclo[3.2.0]heptane-2-carboxylic acid 4,4-dioxide sodium, Betamaze, CP 45899, CP-45,899, Penicillanic acid 1,1-dioxide sodium, Penicillanic acid S,S-dioxide sodium, Penicillanic acid dioxide sodium, Penicillanic acid sulfone sodium

Mechanism of Action:

Sulbactam sodium contains a beta-lactam ring that binds strongly to beta-lactamase at or near its activation site, thereby permanently inhibiting enzymatic activity. This action protects other beta-lactam antibiotics (penicillins, cephalosporins, etc.) from beta-lactamase catalysis, thereby enhancing their antibacterial activity.

Sulbactam also shows antibacterial activity against various strains, sulbactam able to bind to and inhibit penicillin binding proteins PBP1 and PBP3. This antibacterial activity varies depending on species.

Spectrum:

Antimicrobial activity

Sulbactam sodium has very weak antimicrobial activity against most bacteria. Its only notable activity is against *N. gonorrhoeae, N. meningitidisAcinetobacter baumannii.*

Beta-Lactamase activity

Sulbactam sodium inhibits a wide range of group 2 β-lactamases, including those from *Staph. aureus*, *K. pneumoniae* and *B. fragilis.* It is a good-to-moderate inhibitor of the TEM enzymes of groups 2b and 2be but has little effect on group 1, group 2br or group 3 β-lactamases. It does not induce the activity of cephalosporinases from Gram-negative bacteria but is a weak inducer of penicillinases from *Staph. aureus.*

A concentration of 4–8 mg/L restores the activity of ampicillin for many β-lactamase-producing strains of *Staph. aureus*, *H. influenzae*, *Mor. catarrhalis*, enterobacteria and *B. fragilis*, but there is a large inoculum effect.

Microbiology Applications

Sulbactam is commonly used in combination with B-lactam antibiotics to prevent degredation by B-lactamase enzymes.

Sulbactam has recently been used to treat *acinetobacter* septicemia.

Plant Biology Applications

Sulbactam can be used in combination with ampicillin and cefoperazone to suppress B-lactamase activity when used in Agrobacterium mediated plant genetic modifications (Ogawa and Mii, 2004).

References:

Sulbactam Sodium. Chemical Book. N.p., 2010. Web. 23 Aug. 2012.

Ogawa Y. and Mii M., Screening for highly active Ë-lactam antibiotics against Agrobacterium tumefaciens. Arch Microbiol, Vol. 181, pp. 331-336, 2004.

Noguchi JA, Gill MA. 1988. Sulbactam: a beta-lactamase inhibitor. Clin Pharm 7:37–51.

Penwell, William F et al. “Molecular mechanisms of sulbactam antibacterial activity and resistance determinants in Acinetobacter baumannii” *Antimicrobial agents and chemotherapy* vol. 59,3 (2015): 1680-9.

Qi Jie, et al. "Sulbactam Protects Hippocampal Neurons Against Oxygen-Glucose Deprivation by Up-Regulating Astrocytic GLT-1 via p38 MAPK Signal Pathway" *Frontiers in Molecular Neuroscience* vol. 11, 281 (2018)

English, A. R., Retsema, J. A., Girard, A. E., Lynch, J. E., & Barth, W. E. (1978). CP-45,899, a beta-lactamase inhibitor that extends the antibacterial spectrum of beta-lactams: initial bacteriological characterization. *Antimicrobial agents and chemotherapy*, *14*(3), 414-9.