Tetracycline Hydrochloride, EP/USP
PRODUCT DATA SHEET

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Product Name:	Tetracycline Hydrochloride, EP/USP
Product Number:	T004
CAS Number:	64-75-5
Molecular Formula:	$C_{22}H_{24}N_2O_8$ •HCl
Molecular Weight:	480.90
Form:	Powder
Appearance:	Yellow, crystalline powder
Source:	*Streptomyces sp.*
Potency (on a dry basis):	Not less than 900µg/mg (on dried basis)
pH:	1.8-2.8
Optical Rotation:	-240° to -255°
Storage Conditions:	-20°C

Description:

Tetracycline HCl is a light-sensitive bacteriostatic polyketide antibiotic frequently used in a wide range of *in vitro* cell culture applications. Tetracycline (achromycin) is a first-generation tetracycline antibiotic and was first identified in 1953 by Chemist Lloyd Conover's team at Pfizer, in collaboration with R.B. Woodward of Harvard University. Tetracycline is a naturally occurring antibiotic from *S. aureofaciens, S. rimosus*, and *S. viridofacien* that shows wide ranging activity against both gram-negative and gram-positive bacteria.

Tetracycline is a protein synthesis inhibitor. Tetracycline bind the 30s ribosomal subunit, preventing the aminoacyl-tRNA from attaching to the A site. Consequently, protein synthesis is inhibited. Resistance to tetracycline arises from loss of cell wall permeability, tetracycline efflux, ribosome protection and tetracycline modification.

Tetracycline is used to study transcriptional activation. Knowledge of tetracycline led to the development of a popular inducible expression system in eukaryotic cells known as Tet-Off and Tet-On. Tetracycline is also used in multidrug resistance studies and in cell culture applications as a selective agent. Additionally, it promotes expression of the P450 proteins.

TOKU-E offers three forms of tetracycline: Tetracycline HCl (T004), Tetracycline, USP (T051), and Tetracycline, EP (T016). Tetracycline, USP and Tetracycline, EP are sparingly soluble in aqueous solution at 0.231 mg/mL. Tetracycline HCl, is slightly soluble in aqueous solution at 10mg/mL.

Tetracycline HCl conforms to both EP and USP specifications.

Mechanism of Action:

Tetracycline HCl inhibits bacterial growth in gram-positive and gram-negative bacteria by disrupting codon-anticodon interactions at the ribosome, thus blocking protein synthesis. Specifically, tetracycline binds to a single site on the 30S ribosomal subunit and inhibit protein synthesis by blocking the attachment of charged aminoacyl-tRNA to the A site on the ribosome. Thus, they prevent introduction of new amino acids to the nascent peptide chain.

Mammalian cells are not vulnerable to the effect of tetracycline as these cells contain no 30S ribosomal subunits so do not accumulate the drug.

Spectrum:

Tetracycline HCl is a broad-spectrum antibiotic, effective against both gram-positive, gram-negative bacteria, and mycoplasma. A few species of bacteria display intrinsic resistance to tetracycline, including *Pseudomonas aeruginosa*. Acquired (as opposed to inherent) resistance has proliferated in many pathogenic organisms and greatly eroded the versatility of Tetracycline derivatives. Resistance amongst *Staphylococcus*, *Streptococcus*, *Neisseria gonorrhoeae*, and members of the *Enterobacteriaceae* is now quite common. Tetracyclines show activity against protozoan parasites as well.

Microbiology Applications

Tetracycline HCl is routinely used as a selective agent to select for bacterial cells that have been transformed with a plasmid that contains the tetracycline resistance gene, tet. Tetracycline is typically used at 10 µg/mL.
Tetracycline HCl has several clinical uses in treating bacterial infections such as Q fever, Rocky Mountain spotted fever, tick fevers, typhus fever, Brill-Zinsser disease as well as to treat upper respiratory infections and acne. It has been used in studies of multidrug resistance and potential side effects including acute pancreatitis.

It has been recognized for some time that the spectrum of activity of tetracyclines encompasses various protozoan parasites such as *P. falciparum, Entamoeba histolytica, Giardia lamblia, Leishmania major, Trichomonas vaginalis*, and *Toxoplasma gondii*

Plant Biology Applications

Tetracycline has shown to suppress aster yellows disease symptoms on China Aster and Chrysanthemum plants. Tetracycline HCl has shown to suppress aster yellows disease symptoms on China Aster and Chrysanthemum plants. Tetracyclines are sprayed onto fruit trees and other plants to treat infection by *Erwinia amylovora*, injected into palm trees to treat mycoplasma infections (lethal yellow), and used to control infection of seeds by *Xanthomonas campestris* (black rot). Multiple applications of tetracycline resulted in symptomless plant growth. Multiple applications of tetracycline resulted in symptomless axillary plant growth (Davis R.E. and Whitcomb, 1970).

Cancer Applications

Tetracycline derivatives induce apoptosis in osteoclasts, Jurkat T lymphocyte cells and in cultured monocytes and macrophages. It is a compound that has been shown to induce apoptosis in various cells.

Tetracyclines HCl and chemically modified tetracyclines, like Col-3, inhibit the activity of several matrix metalloproteinases (MMPs) that are important enzymes in tumor cell invasion and metastatic ability

Insect Biology Applications

Tetracyclines have applications in the treatment of insects of commercial value; e.g., oxytetracycline is used to treat foulbrood disease of the honeybee, which is caused by either *Bacillus larvae* or *Streptococcus pluton.*

References:

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