www.ijarp.com ISSN 2456-9992 Page: 01-20
International Journal Advanced Research Publications
Review Article
Volume: 02
Issue: 06

ETHOSUXIMIDE: PHARMACEUTICAL FORMULATION STRATEGIES AND CLINICAL EFFECTIVENESS –A COMPREHENSIVE REVIEW

***Answara Parveen A. K., Ayishath Raihana P.**

Department of Pharmaceutics, Malik Deenar College of Pharmacy Seethangoli,Kasaragod Kerala India.

Article Received: 17 May 2026, Article Revised: 5 June 2026, Published on: 25 June 2026

***Corresponding Author: Answara Parveen A. K.**
Department of Pharmaceutics, Malik Deenar College of Pharmacy Seethangoli, Kasaragod Kerala India.
Doi: https://doi-doi.org/101555/ijarp.5745

ABSTRACT

This practice school report focuses on the pharmaceutics aspects of ethosuximide, an antiepileptic drug used for the treatment of absence seizures. The objective was to understand the formulation and evaluation processes of ethosuximide capsules by connecting academic knowledge with industrial practices. The report covers epilepsy and pharmacological aspects of ethosuximide, preformulation studies, capsule formulation, and evaluation tests. It provides an overview of the pharmaceutical processes involved in developing a stable, effective, and quality ethosuximide capsule dosage form.This comprehensive review aims to bridge theoretical knowledge with practical application, enhancing understanding of pharmaceutical processes involved in developing ethosuximide as in antiepileptic drug.

INTRODUCTION

Epilepsy, a common chronic set of neurological disorders characterized by seizures, affects more than 50 million people worldwide. In fact, it is estimated that the annual incidence of new onset epilepsy in the general population is more than 80 per 100,000, occurring mostly in children and the elderly. Epilepsy is not a single specific disease, or even a single syndrome, but rather a broad category of symptom complexes arising from any number of disordered brain functions.[1]

It is affects both sexes and all ages with worldwide distribution. The prevalence and the incidence of epilepsy are slightly higher in men compared to women and tend to peak in the elderly, reflecting the higher frequency of stroke, neurodegenerative diseases, and tumors in this age-group.[2]

Often there is no recognizable cause, although it may develop after brain damage ,such as trauma , infection or tumour growth ,or other kinds of neurological disease , including various inherited neurological syndromes.[3]

Epilepsy is treated mainly with drugs, though brain surgery may used for severe cases. Current antiepileptic drugs are effective in controlling seizures in about 70% of patients, but their use is often limited by side effects.[4]

CLASSIFICATION

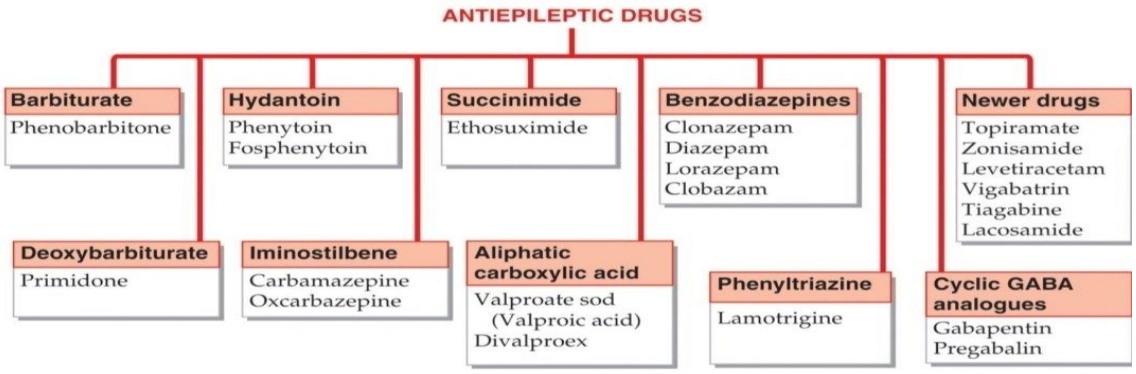

Figure No 1: Classificationof anti-epileptic drugs.[5]

ETHOSUXIMIDE

Ethosuximide is a succinimide anticonvulsant drug primarily used in the treatment of absence (petit mal) seizures, particularly in children and adolescents. It acts mainly by reducing low threshold T-type calcium currents in thalamic neurons, thereby suppressing the abnormal thalamocortical activity responsible for absence seizures.[7]

Molecular Formula: $C_7H_{11}NO_2$

Molecular weight: 141.170g/mol

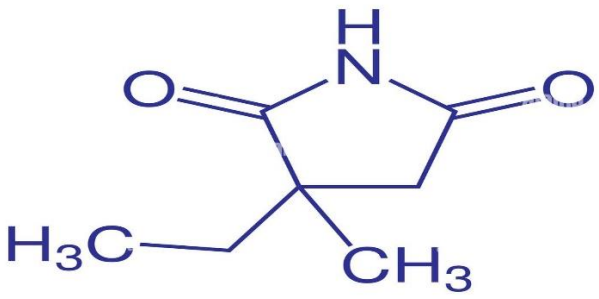

Figure No 2: Structure of ethosuximide.

Mechanism of action

Binds to T-type voltage sensitive calcium channels. Voltage-sensitive calcium channels (VSCC) mediate the entry of calcium ions into excitable cells and are also involved in a variety of calcium-dependent processes, including muscle contraction, hormone or neurotransmitter release, gene expression, cell motility, cell division and cell death. The isoform alpha-1G gives rise to T-type calcium currents. T-type calcium channels belong to the "low-voltage activated (LVA)" group and are strongly blocked by mibefradil. A particularity of this type of channels is an opening at quite negative potentials and a voltage-dependent inactivation. T-type channels serve pace making functions in both central neurons and cardiac nodal cells and support calcium signaling in secretory cells and vascular smooth muscle. They may also be involved in the modulation of firing patterns of neurons which is important for information processing as well as in cell growth processes.[8]

Side effects

- Dizziness
- Drowsiness
- Abdominal pain
- Loss of appetite
- Nausea
- Vomiting
- Headache
- Diarrhea
- Weight loss
- Depression
- Suicidal thoughts
- Mood changes
- Signs of infections
- Swollen joints and pain
- Rashes
- Tiredness
- Rapid breathing
- Fainting
- Liver problems.[6,9]

Drug interaction

Drug–drug interactions of ethosuximide:

- Valproic acid: Inhibits metabolism → ↑ ethosuximide plasma levels and risk of toxicity.
- Enzyme inducers (phenytoin, carbamazepine, phenobarbital): ↑ hepatic metabolism → ↓ ethosuximide levels and reduced efficacy.
- CNS depressants: May enhance sedation and CNS adverse effects when used together.

Drug–food interactions of ethosuximide:

- Food has no significant effect on absorption.
- Can be taken with or without food.
- Taking with food may reduce gastrointestinal irritation (nausea, vomiting).[7]

Contraindication:

- Hypersensitivity to ethosuximide
- Allergy to succinimide derivatives
- Severe hepatic impairment
- Severe renal impairment
- History of severe blood dyscrasias[10]

Pharmacokinetics

Table No 1: Pharmacokinetics of ethosuximide.[5]

Parameter	Pharmacokinetic details
Absorption	• Well absorbed after oral administration with bioavailability of about 90–100%. • Peak plasma concentration is reached in 3–7 hours in adults and 1–4 hours in children. • Food has no significant effect on absorption.
Distribution	• Plasma protein binding is low (≤10%). • Volume of distribution is approximately 0.6–0.7 L/kg. • Ethosuximide readily penetrates the CNS, with CSF concentrations nearly equal to plasma levels. • It crosses the placenta and is excreted in breast milk.
Metabolism	• Extensively metabolized in the liver by microsomal enzymes to inactive metabolites. • Enzyme-inducing antiepileptic drugs (phenytoin, carbamazepine, phenobarbital) increase its clearance, while valproate may increase plasma levels of ethosuximide.
Elimination	• Elimination half-life is about 50–60 hours in adults and ~30 hours in children. • Approximately 70–80% is excreted in urine as metabolites and 10–20% as unchanged drug.
Steady state	• Achieved in about 7–10 days of regular dosing due to the

	long half-life.
Therapeutic plasma concentration	• Usual therapeutic range is 40–100 µg/mL; concentrations above 150 µg/mL increase the risk of toxicity.

Toxicity

Ethosuximide toxicity is usually mild at therapeutic doses but may occur with overdose. Common toxic effects include gastrointestinal irritation (nausea, vomiting, abdominal pain) and central nervous system symptoms such as drowsiness, dizziness, headache, and ataxia. Rare but serious adverse effects include behavioral disturbances, depression, blood dyscrasias, and hypersensitivity reactions

Marketed formulation of ethosuximide

Table No 2: Marketed formulation of ethosuximide.[4]

Brand/Generic	Dosage Form	Strength	Route	Main Uses
Zarontin (brand)	Capsule	250 mg	Oral	Control of absence (petit mal) seizures
Zarontin Oral Solution (brand)	Oral solution / syrup	250 mg/5 mL	Oral	Control of absence (petit mal) seizures
Generic Ethosuximide	Capsule	250 mg	Oral	Control of absence (petit mal) seizures
Generic Ethosuximide	Oral solution/syrup	250 mg/5 mL	Oral	Control of absence (petit mal) seizures

PREFORMULATION STUDY

Pre-formulation studies were evolved in 1950 & 1960s. Pre-formulation testing is the first step in the rational development of dosage forms of a drug substance. It can be defined as an investigation of physical and chemical properties of a drug substance alone and when combined with excipients. The overall objective of pre-formulation testing is to generate information useful to the formulator in developing stable and bioavailable dosage form that can be mass produced. Pre-formulation investigations are designed to deliver all necessary data especially physicochemical, physico-mechanical and biopharmaceutical properties of drug substances, excipients and packaging materials.

IMPORTANCE

- To develop the elegant dosage forms (stable, effective & safe)
- It is important to have an understanding of the physical description of a drug substance before dosage form development.
- It is first step in rational development of a dosage form of a drug substance before dosage form development.

- To choose the correct form of a drug substance.
- To establish compatibility with the common excipients.
- To establish the physicochemical parameters of new drug substance.
- To establish the kinetic rate profile.[11]

PREFORMULATION STUDIES OF ETHOSUXIMIDE

CHARACTERIZATION OF ETHOSUXIMIDE

ORGANOLEPTIC PROPERTIES

Table No 3: Organoleptic properties of ethosuximide.[8]

Properties	Description
Colour	White to Off-White
odour	Characteristics odour
taste	Tasteless (capsules are swallowed whole)
appearance	Orange, oval oral capsule containing the drug and excipients

2.PHYSICAL PROPERTIES:

a) Determination of melting point

The melting point of ethosuximide was detected using the capillary method by Thiele's melting point apparatus. In this method, the temperature was note at which point the sample started melting to finish. For this, ethosuximide was filled into a capillary tube sealed at one end and is then tied in a manner that it remains dipped in a liquid paraffin bath. Then the melting temperature was noted.

The melting point of ethosuximide was found to be between **64.5 °C**[8]

b)Determination of solubility

Solubility of a drug can be determine by dispersing the drug in a solvent. The suspension is agitatedat a steady temperature. Samples of suspension are withdraw as a function of time, clarified by centrifugation , and assayed to establish a plateau concentration.

Table No 4:Solubility studies of ethosuximide[12]

Solvents	Solubility
Ethanol	Very soluble
Hexane	Very slightly soluble
Water	Freely soluble

c)Hygroscopicity

Hygroscopicity is determined by accurately weighing a sample of the drug and exposing it to a controlled relative humidity environment at a constant temperature. The sample is reweighed at specified time intervals, and the increase in weight due to moisture absorption indicates the hygroscopic nature of ethosuximide, highlighting the need for proper packaging and storage conditions. Hygroscopic in nature[13]

3.CHEMICAL PROPERTY

a) Partition Coefficient

The partition coefficient was determined using the shake-flask method, in which a known amount of ethosuximide was added to a system containing mutually saturated n-octanol and water. The mixture was shaken for sufficient time to attain equilibrium at room temperature and then allowed to separate into two distinct phases. After separation, the concentration of ethosuximide in the aqueous phase was quantified using an appropriate analytical technique, and the concentration in the octanol phase was calculated. The partition coefficient was obtained as the ratio of the drug concentration in the octanol phase to that in the aqueous phase and expressed as log P. The low log P value reflects the hydrophilic nature of ethosuximide and supports its good aqueous solubility and favorable absorption characteristics.

The octanol–water partition coefficient (log P) of ethosuximide has been reported as **0.38,** indicating low lipophilicity.[14]

b) Dissociation constant

Dissociation constant is the equilibrium constant for the dissociation reaction of a compound. It is determine by performing potentiometric titration.

The dissociation constant pKa of ethosuximide was found to be **9.3**.[13]

c)Polymorphism

The ability of a molecule to exist in multiple solid crystalline forms with the same chemical makeup but distinct molecular packing or conformations is known as polymorphism.

The reported types include:

1. Crystalline Polymorphism

There are two crystalline forms of ethosuximide, which are referred to as CRI and CRII. These forms can interconvert based on temperature circumstances and have different molecular packing and thermal behaviour.

2.Conformationally Disordered (CONDIS) Phase

Conformational disorder is a crystalline structure in which molecules within the same crystal lattice assume various conformations. This kind of polymorphism is thought to be unique in relation to molecular flexibility.

3. Amorphous / Glassy Form (Non-crystalline)

Ethosuximide can produce a glassy (amorphous) phase under certain processing conditions or rapid cooling. This phase lacks long-range crystalline organization and has distinct thermal properties from crystalline forms.[15]

d) PH stability profile

Ethosuximide is dissolved in buffer solutions with varying pH values (e.g., 1.2, 4.5, 6.8, and 9.0) to conduct a pH stability study. For a predetermined amount of time, the produced solutions are kept at a regulated temperature (25 °C or 37 °C). At specified intervals, samples are taken out and subjected to analysis using an appropriate analytical technique, such as HPLC or UV spectrophotometry. The pH at which ethosuximide is most stable is found by calculating and comparing the proportion of medication that remains under various pH situations.[16]

Ethosuximide has chemical stability, especially in neutral to slightly acidic environments. According to stability studies, the medication degrades very little between pH 3 and pH 7, supporting its strong stability in the pH of the gastrointestinal tract and in the majority of aqueous pharmaceutical formulations. Even though ethosuximide is thought to be less pH-sensitive than many other antiepileptic medications, hydrolytic stress may cause some degradation at heavily acidic or alkaline pH values. Its consistent shelf life and adaptability in formulation are facilitated by this advantageous pH stability profile.[17]

e) Determination of absorption maxima

To create a diluted solution (10–20 µg/mL), a known amount of ethosuximide is dissolved in an appropriate solvent, such as distilled water or phosphate buffer (pH 6.8). Using the same solvent as the blank, the solution is scanned in a UV-visible spectrophotometer over the 200–400 nm range. The absorption maximum (λmax) is the wavelength at which the absorbance is at its highest. Ethosuximide exhibits a distinctive λmax at around 218–220 nm. There is a noticeable peak at this wavelength on an absorbance versus wavelength graph.. The λmax were determined and it was found to be 220nm.[18]

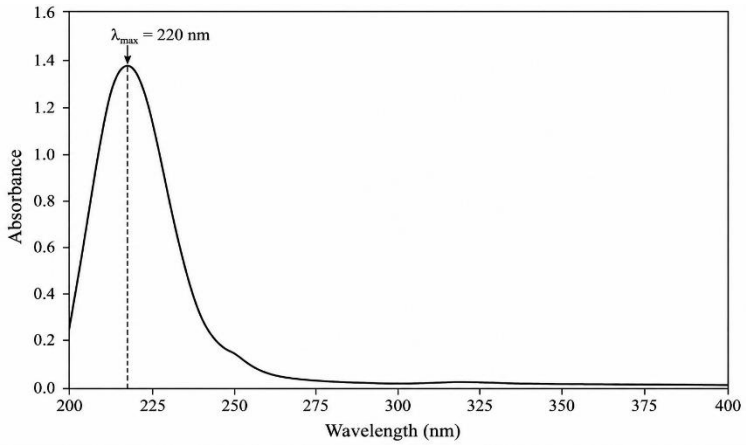

Figure No 3: λmax of ethosuximide.

FOURIER TRANSMISSION INFRARED (FTIR) SPECTROSCOPY

FTIR spectra of pure drug and its mixture with excipients (1:1) were recorded with a FTIR spectrophotometer using KBr disc method. Each sample was gently triturated with KBr powder in a weight ratio of 1: 100 and pressed using a hydrostatic press at a pressure of 10 tons for 5 min. The disc was placed in the sample in the sample holder and scanned from 4000 to 500 cm^{-1} at a resolution of 1cm^{-1}.[19]

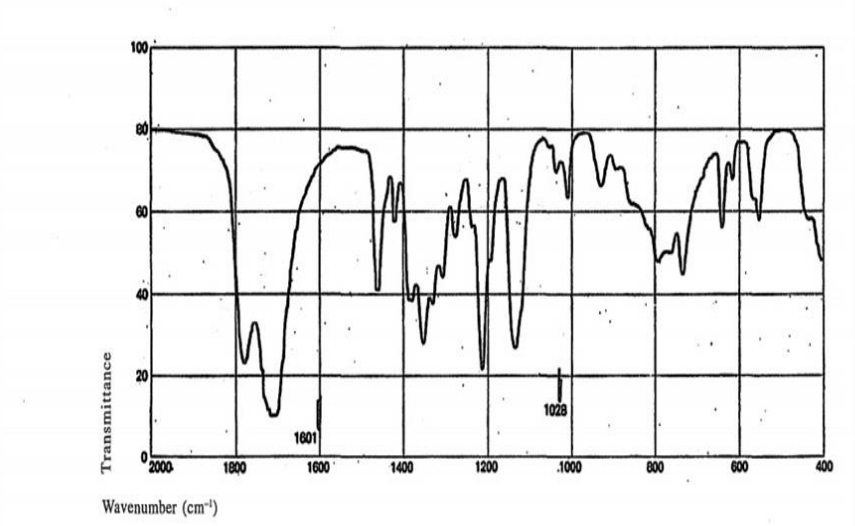

Figure No 4: FTIR spectrum of ethosuximide.

Table No 5: Interpretation FTIR spectrum of ethosuximide.

Wavenumber (cm^{-1})	Functional Group
1700-1750	C=O stretching (Imide carbonyl)
1600	C=C bending
1400-1450	C–H bending
1200-1300	C–N / C–O stretching
600-800	Fingerprint region

FORMULATIONCONSIDERATION

Drug formulation is an essential component of pharmaceutical research and development, involving a complex process of combining an active pharmaceutical ingredient (API) with various excipients to create a final product that is safe, effective, and acceptable to patients. This process ensures optimal delivery of the medication for the desired therapeutic effect while maintaining stability and enhancing patient compliance. The science of drug formulation is not only about achieving the right therapeutic action but also ensuring that the medication can be consistently produced and withstands the rigors of storage and distribution. In this article, we will explore the intricacies of drug formulation, what it involves, and its significance in the successful development and commercialization of pharmaceuticals.[20]

CAPSULES

A capsule is a type of Unit dosage form in the pharmaceutical industry. It consists of small, cylindrical components made of either soft or hard gelatin, filled with a powder or liquid. Capsules are taken orally and are designed to release their contents after swallowing. They are commonly used for medications intended to be absorbed in the stomach or small intestine. Capsules have a body, and the upper part is called the cap, with the main medicament and excipients filled in between them.[21]

SOFT GELATIN CAPSULES

A softgel or soft gelatin capsule is a solid capsule (outer shell) surrounding a liquid or semi-solid center (inner fill). An active ingredient can be incorporated into the outer shell, the inner fill, or both. They are oral dosage form for medicine similar to capsules. Softgel shells are combination of gelatin, water, opacifier and a plasticizer such as glycerin and/or sorbitols. The soft gelatin capsule are produced from a single piece of gelatin. They do not have a cap and body. Soft gelatin capsule comes in various shape and spherical, elliptical, oblong and special tube shapes with and without twist off.[22]

FORMULATION OF ETHOSUXIMIDE CAPSULE

Ethosuximide oral capsule is an anticonvulsant used to treat absence (petit mal) seizures in ad ults and children.[7]

✓ **FILLING SOLUTION**

Table No 6: Formula of filling solution.

S/N	INGREDIENTS	QUANTITY(mg)
1	Ethosuximide	250
2	Polyethylene glycol 400	100
3	Methyl & Propyl Parabens	20-40
4	Sorbitol	10

✓ **GELATIN CAPSULE SHELL**

Table No 7: Formula for gelatin capsule shell.[23]

S/N	INGREDIENTS	QUANTITY(mg)
1	Gelatin	40
2	Titanium dioxide	2
3	Glycerin	20
4	Colorants	q.s
5	Purified water	q.s

METHOD OF PREPARATION

- Ethosuximide soft gelatin capsules are prepared by dissolving the drug in a suitable solvent like polyethylene glycol 400 along with plasticizers such as glycerin to form a clear fill solution
- Separately, gelatin is hydrated, heated, and mixed with plasticizers to prepare the shell mass.
- The liquid fill is then encapsulated into gelatin shells using the rotary die process
- The formed capsules are dried under controlled temperature and humidity, followed by inspection, polishing, andpackaging.[22]

EVALUATION OF CAPSULES

- Evaluation of capsules refers to the process of assessing the quality, performance, and safety of capsule dosage forms in pharmaceuticals. This evaluation is crucial to ensure that capsules deliver the intended therapeutic effect and meet regulatory standards.[28]
- Finished capsules are subjected to a number of tests in accordance with compendial standards and regulatory requirements for unit dose capsule products, These halteries often tests help identify whether the hatch is acceptable for marketing or its intended usage, the finished capsules are evaluated by the following test;

APPEARANCE

- Capsules should be uniform in color and size, free from cracks, deformation, or discoloration.
- PROCEDURE: Visual inspection.[24]

WEIGHT VARIATION

- Each capsule is weighed to ensure dosage consistency.
- PROCEDURE: Weight uniformity test for capsules is necessary. The weight of each capsule has to be in a certain range. For this test, you are going to need a sensitive analytical balance. Then, the capsules are weighed individually and then their average weight is determined. All the capsules with weight range of ±10% of the mean of the average weight of the capsules are considered good and quality capsule, hence, assuring uniformity in every dose. A pharmaceutical lab instrument such as check weigher is an effective tool when evaluating weight uniformity.

Table No 8:Percentage deviation for weight variation.[25]

Average mass(mg)	Percentage deviation(%)
Less than 300mg	±10%
More than 300mg	±7.5%

UNIFORMITY OF CONTENT

- Uniformity of content is the fact that each capsule ought to contain equal amounts of a certain active ingredient. Several capsules are taken, extracted and the concentration is tested using an appropriate technique such as the High-Performance Liquid Chromatography (HPLC).
- In case the difference between the capsules falls under the specified limits, the batch is considered successful in the test.

DISINTEGRATION TEST

- Disintegration testing is used to determine the period taken for capsules to disintegrate after consumption. This is an important criterion for special drug releases.
- PROCEDURE: The USP disintegration apparatus consist of 6 glass tubes that are 3 inches long, open at the top, and held against a 10-mesh screen at the bottom end of the basket rack assembly. To test for disintegration time, one capsule is placed in each tube and the basket rack is positioned in specified medium at 37+2°C such that capsule

remains 2.5 cm below the surface of the liquid on their upward movement and descend not closer than 2.5 cm from the bottom of the beaker. A standard motor driven device is used to move the basket assembly containing the capsules up and down through distance of 5 to 6 cm at a frequency of 28 to 32 cycles per minute. Operate the apparatus for the specified time. The capsule complies with the test according to USP, if all of the capsules have disintegrated completely. If 1 or 2 capsules fail to disintegrate completely, repeat the test on 12 additional capsules. The requirement is met if not less than 16 of the total of 18 capsules tested are disintegrated

Figure No 5: Disintegration apparatus.

DISSOLUTION TEST

- Dissolution Test is an official method to determine the dissolution rate of a solid dosage from. There are currently four dissolution apparatus described in the US and European Pharmacopoeias for the testing of oral solid drug products. These are the basket and paddle apparatus, the reciprocating cylinder and the flow through cell.
- PROCEDURE**:** The capsules is placed in a basket and the basket is immersed in the dissolution medium and caused to rotate at a specified speed. The dissolution mediums is held in a covered 1000ml glass vessel and maintained at37±0.5°C by means of a constant temperature suitable water bath The stirred speed and type of dissolution mediums are specified in individuals monograph.[26]

Figure No 6: Dissolution apparatus[27]

MOISTURE PERMEATION TEST

This test determines how moisture-proof the shell of the capsule is. Specialized equipment is used to expose the capsules to certain levels of humidity to see the degree of moisture penetration through the shell. The integrity of the capsule in keeping out moisture ensures the stability of the contents inside.[28]

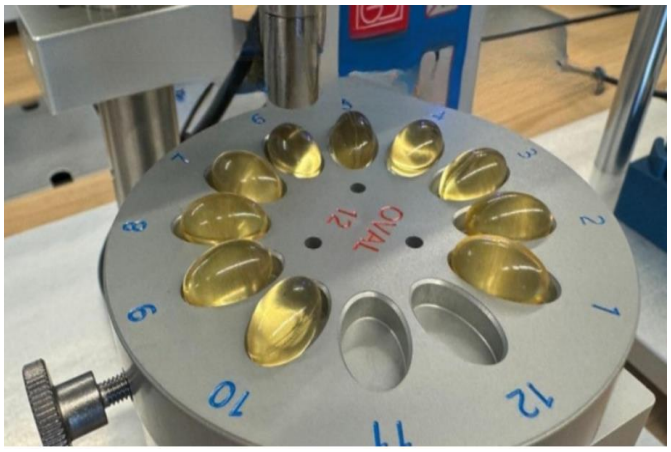

Figure No 7: Moisture permeation apparatus.

LEAKAGE TEST

Soft gelatin capsules can sometimes develop leaks, and their contents can be compromised. In the leakage test, the capsules are dipped in a liquid medium and observed for any leakage. If leakage is noticed, it means shell integrity has failed. This test ensures that soft gels remain intact during storage and use

Figure No 8: Leakage apparatus[25]

PACKAGING

A Pharmaceutical package container is an article or device which contains the pharmaceutical product and the container mayor may not in direct contact with the product. The container which is designed for pharmaceutical purpose must be stable.

1. Primary packaging

Primary package are those packages which are in direct contact with the pharmaceutical formulation. The main aim of primary package is to protect the formulation from environmental, chemical, mechanical and/or other hazards.

1. Strip Package: In this the contents are sealed in a packet. The package is made up of two layers of film. A strip containing many pockets and each pocket contains single dose of medicament.

2. Blister Package: It is made up of base layer (PVC layer) with cavities which contain pharmaceutical product. This type of package provides greater protection than strip package. The lid is made up of aluminium or paper foil. The package is sealed by combining lid and base with the application of heat and pressure.

2. Secondary packaging

The package external to primary package is known as secondary package. This package provides additional protection during warehousing and also provides information about drug product for eg: Leaflets.

1.Paper and paperboards: Secondary package are used to store primary package containing pharmaceutical preparations. Secondary package is directly in contact with the primary package but not with pharmaceutical preparations. Secondary package mainly contains shippers or cartons which give the physical protection to the primary package. These are prepared of cellulose fibers obtained from wood. Paperboards are also used as secondary package which are thicker than paper and heavy in weight.Examples of paperboards are white board, solid board, chipboard, fiber board. These boards are mainly laminated using

polyethylene or waxes. Chipboard is obtained from recycled paper. Bleached sulphate boards are the example of solid boards which are laminated with polyethylene.

III .Tertiary packaging

It is the outer package of secondary packaging and prevents damage to the products. It is used for bulk handling and shipping. Examples: Barrel, crate, container, pallets, slip sheet.[29]

LABELLING

Proprietary and Non-proprietary Name:

- Example : Ethosuximde capsule ,USP.
- Both the brand name(if applicable) and generic name (ethosuximide)must appear.

Strength of the drug

- Expressed per unit(250mg).

Dosage Form

- Clearly state it has capsule.

Route of Administration

- For oral use only

Quantity

- Number of capsule per package(eg:10 capsules,100 capsules).

Storage Instructions

- Example:Store at 25° C (77° F); excursions permitted to 15–30° C (59–86° F) [see USP Controlled Room Temperature].
- Protect from light and moisture.

Manufacturer's Information

- Name and address of the manufacturer or distributor.
- Example:Strides Pharma Science Limited.

  Bengaluru - 562106 India.

  Strides Pharma Inc.

  East Brunswick, NJ 08816.

Batch/Lot Number

- Essential for traceability and pharmacovigilance

Expiration Date

- Indicates the date after which the drug should not be used.

List of Ingredients

- Active ingredient: Ethosuximide.
- Inactive ingredients: Gelatin, Glycerin, Light mineral oil, Methyl paraben, Polyethylene glycol, Propyl paraben ,Sorbitol.

Directions for Use

- "Use as directed by a physician".
- Optional: Summary of dosage instructions.

Warnings and Precautions

- Do not stop using ethosuximide suddenly. Stopping suddenly may cause increased seizures.[26,29]

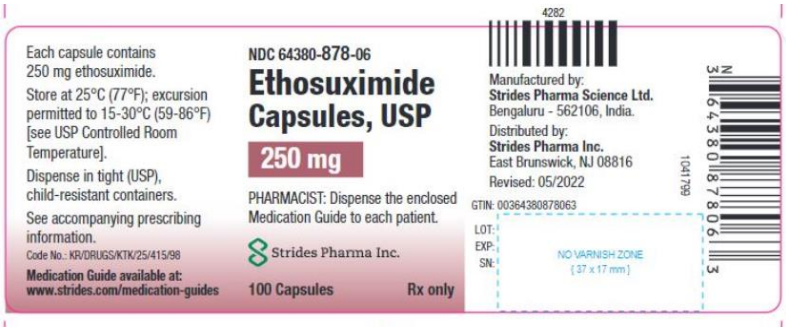

Figure No 9: Label of ethosuximide capsule[30]

STORAGE

- Store protected from moisture at a temperature not exceeding 30°
- The capsule should not be stored in refrigerator.[26]

HANDLING OF ETHOSUXIMIDE CAPSULE

Personal Protective Equipment (PPE)

- Wear gloves: Always use impervious gloves when handling etoposide capsules or blister packs to prevent direct contact with the drug.
- Avoid direct contact: Do not touch the capsules directly. If accidental contact occurs, wash the affected area with soap and water immediately.

Capsule Integrity

- Do not open or crush capsules: Opening or crushing capsules can release the drug's powder, which is hazardous if it comes into contact with skin, eyes, or mucous membranes. If exposure occurs, rinse the affected area with water immediately.

Disposal Procedures

- Follow local guidelines: Dispose of unused or expired etoposide capsules according to local regulations for cytotoxic waste.

Spillage management

- In case of a spill, wear gloves to clean the area.
- If the drug contacts the skin, wash the area with soap and water. If it contacts the eyes, rinse immediately with water for at least 10 minutes and seek medical attention if irritation persists.

Storage Conditions

- Protect from light and moisture: Keep the medication in its original packaging to shield it from light and moisture, which can degrade the drug's efficacy.[12]

CONCLUSION

Epilepsy is a neurological disorder characterized by recurrent seizures caused by abnormal electrical activity in the brain. Seizures may be generalized or partial, with absence seizures being a common type involving brief loss of consciousness. Antiepileptic drugs are used to control seizures, and ethosuximide is mainly used for treating absence seizures by blocking T-type calcium channels. Preformulation studies help evaluate the physical and chemical properties of the drug before formulation. Ethosuximide is formulated as soft gelatin capsules containing gelatin, plasticizers, and liquid fill materials. These capsules are manufactured mainly by the rotary die process and evaluated through tests such as weight variation, disintegration, dissolution, leakage, and moisture permeation. Proper packaging, labeling, storage, and handling are important to maintain the quality, stability, and effectiveness of the capsules.

REFERENCE

1. Hirose G. An overview of epilepsy: its history, classification, pathophysiology and management. Brain and nerve= Shinkeikenkyu no shinpo. 2013 May 1;65(5):509-520.
2. Regis J, Frouinº JM, Reyº PR, Peragutº JC, Samsonº Y. Epilepsy: Abstracts. StereotactFunctNeurosurg. 1997;69:247.
3. Stafstrom CE, Carmant L. Seizures and epilepsy: an overview for neuroscientists. Cold Spring Harb Perspect Med. 2015;5(6):a022426.

4. Tripathi KD. Essentials of Medical Pharmacology. 6th ed. New Delhi: Jaypee Brothers Medical Publishers; 2019. Section 7, Drugs Acting on Central Nervous System; p. 401-402.
5. Tripathi KD Essentials of medical pharmacology. 8th edition. New Delhi: Jaypee Brother Medical publishers 2018 P No 458-460.
6. Padmaja Udaykumar. Textbook of Medical Pharmacology. 2nd ed. New Delhi: CBS Publishers & Distributors; 2006.P No 202.
7. KafzungBG,VanderahTW.Basic and clinical pharmacology 16th edition. New York: Mc Graw Hill;2021 P No .410-412.
8. DrugBank Online. Epilepsy [Internet]. Edmonton (AB): DrugBank; [cited 2026 Apr 6]. Available from: https://go.drugbank.com/conditions/DBCOND0001435.
9. Rang HP, Dale MM, Ritter JM, Flower RJ, Henderson G. Rang and Dale's Pharmacology. 8th ed. Edinburgh: Elsevier Churchill Livingstone; 2016. p. 566-569.
10. Sweetman SC, editor. Martindale: The Complete Drug Reference. 39th ed. London: Pharmaceutical Press; 2017. p. 632-634.
11. Desu PK, Vaishnavi G, Divya K, Lakshmi U. An overview on preformulation studies. Indo Am J Pharm Sci. 2015;2(10): 1399-1407.
12. BenchChem Technical Support Team. Synthesis and Chemical Properties of Ethosuximide: A Technical Guide for Laboratory Use [Internet]. Ontario (CA): BenchChem; 2026 [cited 2026 May 22]. Available from: BenchChem PDF Guide
13. ChemBK. Ethosuximide [Internet]. China: ChemBK; 2024 [cited 2026 May 22]. Available from: ChemBK Ethosuximide Page
14. Atkinson HC, Berg EJ .Experimental determination of octanol-water partition coefficient of anticonvulsant drugs.Jpharmsci 1988;77(6) 503-506
15. Osiecka N, Juszynska-Galazka E,GalewzkiZ,Jawaorska-Golab T, Deptucha A, Massalaska-Aroclz M. Insight into polymorphism of the ethosuximide. J Therm Anal calorim 2018;133(2): 961-967
16. International council for Harmonisation ICH Q1A; stability testing of new substances and producta.Geneva ICH 2003.
17. United states Pharmacopeia .united states Pharmacopeia-National formulary(USP-NF).Rockville(MD);united states Pharmacopieaconvention;stability characteristics of ethosuximide.
18. Nabizadeh H, Mohammadi A, Dolatabadi R, Nojavan S, Vahabizad F. Sensitive determination of ethosuximide in human fluids by electromembrane extraction coupled

with high performance liquid chromatography ultraviolet spectroscopy. Journal of the Chinese Chemical Society. 2023 Jan;70(1):76-86.

19. Indian Pharmacopoeia Commission. Indian Pharmacopoeia 2022.Vol 1. New Delhi:Infra red reference spectra; 2022. p. 625
20. Lachman L, Lieberman HA, Kanig JL. The theory and practice of industrial pharmacy. 3rd ed. Philadelphia: Lea &Febiger; 1986.
21. Naresh B. Capsules, types and formulation (complete guide) [Internet]. Pharmaguddu; 2020 Dec 28 [cited 2026 May 22]. Available from: Pharmaguddu
22. Cole ET. Liquid-filled and sealed hard gelatin capsules. In: Augsburger LL, Hoag SW, editors. Pharmaceutical dosage forms: capsules. 3rd ed. New York: Informa Healthcare; 2008. p. 183-226.
23. Rowe RC, Sheskey PJ, Quinn ME. Handbook of pharmaceutical excipients. 6th ed. London: Pharmaceutical Press; 2009.
24. Pervaiz F, Zahra SA, Qaiser F, Fatima SK, Khan RM. Characterization and evaluation of capsules and study of QC tests for capsules. Glob Pharm Sci Rev. 2018;3(1):7-18.
25. Testronix Instruments. Leak test apparatus price and manufacturer in India [Internet]. Faridabad (IN): Testronix Instruments; 2026 [cited 2026 May 22].
26. United States Pharmacopeia (USP). Ethosuximide Capsules Monograph. Rockville, MD: United States Pharmacopeial Convention; 2025.
27. Pallavi K. *Capsules* [Internet]. Hyderabad (IN): G. Pulla Reddy College of Pharmacy; [cited 2026 May 22].
28. Mohite A, Kokane S. Application of QbD approach to analytical method development and validation of ethosuximide in bulk and pharmaceutical dosage form. Int J Pharm Sci. 2025;3(10):3284-3307.
29. Nasa P. A review on pharmaceutical packaging material. World J Pharm Res.2014;3(5):344-368.
30. Drugs.com. Ethosuximide: package insert / prescribing information [Internet]. Drugsite Trust; 2025 [cited 2026 May 22]. Available from: Drugs.com Ethosuximide Package Insert.