iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** X **Month of publication:** October 2022

DOI: https://doi.org/10.22214/ijraset.2022.47119

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue X Oct 2022- Available at www.ijraset.com

An Overview on Albendazole: Anthelmintic Agent

Soumallya Chakraborty[1], Chiranjit Mandal[2], Somenath Bhattacharya[3], Rohan Pal[4], Bhaskar Ghosh[5], Udita Saha[6], Dr. Amitava Roy[7], Dr. Arin Bhattacharjee[8]

[1, 3]*Assistant Professor, Department of Pharmaceutical Chemistry, Global College of Pharmaceutical Technology, Nadia, West Bengal, India*

[2] *Student, Department of Pharmaceutical Technology, Brainware University, Kolkata*

[4] *Assistant Professor, Department of Pharmacology, Global College of Pharmaceutical Technology, Nadia, West Bengal, India*

[5] *Lecturer, Department of Pharmaceutical Analysis, Global College of Pharmaceutical Technology, Nadia, West Bengal, India*

[6] *Lecturer, Department of Pharmaceutical Chemistry, Global College of Pharmaceutical Technology, Nadia, West Bengal, India*

[7] *Professor, Department of Pharmaceutical Chemistry, Global College of Pharmaceutical Technology, Nadia, West Bengal, India*

[8] *Principal, Department of Pharmaceutical Technology, Global College of Pharmaceutical Technology, Nadia, West Bengal, India*

Abstract: ***Albendazole is very important drug in medicinal world. It is broad spectrum anthelmintic drug. The drugs which can kill or destroy the worms or parasites in body can be called as anthelmintic drug. Worm or parasitic infections are very serious kinds of infections in human especially in childhood. But it can be seen in adults also. Medications with proper hygiene can control the diseases to spread among the society. The drugs act by inhibiting the microtubule in the parasite. It can damage the DNS in parasites. The growth of parasite is destroyed by albendazole. It is the derivatives of Benzinidazole ring. Benzimidazole is very potent in destruction of worms or having the anthelmintic property. Benzene can be combined with imidazole ring can be classified as benzimidazole derivative. Albendazole, mebedendazole, thiabendazole, etc are the drugs under that classification. Under this albendazole is one of the important drug compared to that class. The study represents the drug structure, mechanism of action, ADMET, side effects, uses of albendazole.***

Keywords: Albendazole, Mechanism of action, Pharmacokinetics, Synthesis, Properties, Interactions, Uses.

I. INTRODUCTION

Albendazole is a antiparasitic drug. And it is a prodrug and the active metabolite (albendazole sulfoxide) has good efficacy against roundworm, hookworm, pinworm, threadworm, tapeworm and tricuriasis. This drug also known as Albendazolum was patented in 1975. It is a broad-spectrum synthetic benzimidazole type. Its IUPAC name is methyl-(5-propythio)-2-benzimidazole carbamate. It has a role as an anthelmintic agent.

Helminthiasis also known as worm infection is any microparasitic disease of humans and other animals in which a part of the body is infected with parasitic worms, known as helminthis. There are numerous species of these parasites, which are broadly classified into tapworm, flukes, and roundworms. They almost live in the gastrointestinal tract of their hosts, but they may also lair into other organs, where they influence physiological damage. Antihelmintics are drugs that either vermicide or vermifuge infesting helminths. Albendazole is a medication used for the treatment of a variety of parasitic worm infections. Albendazole is the medication of an anthelmintic or anti-worm. It stops newly hatched insect larvae from growing or multiplying in your body. Albendazole is uses to treat flatworm, Fasciolosis, Cestodes, Filariasis, Cysticercosis, Hydatic disease, enterobiasis, ascariasis, toxocariasis, trichinosis, microsporidiosis, and intestinal myiasis [1-5].

II. MECHANISM OF ACTION

Albendazole inhibits the microtubules synthesis. It binds to beta-tubulin protein and inhibits its polymerization. It block glucose uptake by parasite and deplets its glycon stores. Then parasites immobilized and die slowly. As a vermicide, albendazole causes degenerative transfer in the intestinal cells of the worm by binding to the colchicine-sensitive site of beta-tubulin, thus inhibiting its polymerization or assembly into microtubules (it binds much better to the beta-tubulin of parasites than of mammals). Albendazole produces to impaired uptake of glucose by the larval and ancient stages of the susceptible parasites, and reduce their glycogen stores and albendazole prevents the formation of spindle fibres required for cell division, which in turn blocks development and egg production; existing eggs are stopped from hatching. Albendazole is works by keeping the worms from absorbing sugar (glucose), thereby depleting their energy level. This causes the worms to die thereby treating worm infection [1-3, 6-10].

Albendazole at higher dose inhibits the production of two important enzymes such as malate dehydrogenase and fumarate reductase which helps to destroy the helminths metabolic pathway and helps to inhibit energy production by Krebs cycle [1, 7-11].

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue X Oct 2022- Available at www.ijraset.com

III. PHARMACOKINETICS

Absorption of albendazole can vary from one person to another depends on their gastric pH and when taken empty stomach gastric pH are varies from person to person. Women having different pharmacokinetics of albendazole due to the lower oral clearance and volume of distribution respect to men due to lower serum peak concentration. Albendazole is more soluble in acidic pH absorbed easily and food helps to increase gastric acid secretion thus lowering the stomach pH. Fatty meal contain high portion of lipid and albendazole is highly soluble in lipid and easily cross the lipid barrier presence in mucus surface of gastro intestinal tract. Albendazole acts as a prodrug for systemic parasite while albendazole sulfoxide acts as the real antihelminthic. When reached systemic circulation. At 43% plasma concentration albendazole sulfoxide enters the cerebrospinal fluid and easily cross the blood brain barrier. Albendazole sulfoxide is usedto treat neurocystocercosis due to its ability to enter the central nervous system. Due to its very fast 1st pass metabolism it is very difficult to detect in plasma. Cytochrome P450 oxidases and flavin containing monooxygenase (FMO) oxidized albendazole to produce albendazole sulfoxide known as ricobendazole and albendazole oxide. Absorption of albendazole by oral route varies in human, rats and cattle [1-5, 12-16].

IV. SIDE EFFECTS

Very few numbers of peoples are experience headache as a side effect of albendazole. Due to the sudden destruction of cysticerci (tapeworm larvae) 1 to 10% people suffer from nausea or vomiting, dizziness or vertigo, fever and acute inflammation [1-3, 13, 16-17].

V. OVERDOSE

Albendazole cannot be absorbed in high quantities to show its toxicity due to low solubility. 2500 mg/kg albendazole oral dose shows LD_{50} in case of rat and can kill the sheep and cattle more than the normal doses of 20 times and 30 times respectively. No specific antidotes are available for albendazole side effects but loss of appetite, vomiting, diarrhea, dizziness and sleepiness are associated problems of albendazole over dose [1-5, 13, 17-18].

VI. INTERACTIONS

Half life and plasma concentration of albendazole sulfoxide's R(+) enantiomer decrease by the effect of antiepileptics druds like carbamazepine, phenytoin, and phenobarbital. Cemetidine helps to increases the serum albendazole concentrations as well as half life of albendazole and and doubles albendazole sulfoxide levels in bile. The half-life of albendazole sulfoxide increases from 7.4 hours to 19 hours. When cimetidine interfering with CYP3A4 and helps to inhibits the breakdown of albendazole sulfoxide but in the other hand cemetidine reduce the gastric pH which decrease the solubility as well as absorption rate of albendazole. Corticosteroids helps to increase the steady-state plasma concentration of albendazole sulfoxide; The anti-parasitic praziquantel and levamisole increases the maximum plasma concentration of albendazole sulfoxide by 50%, and the anti-parasitic levamisole increases the AUC (total drug exposure) by 75% respectively [1-6, 13, 18-19].

VII. SYNTHESIS OF ALBENDAZOLE

Albendazole is methyl 5 [propyl thio] 1H benzimidazole 2 yl carbamate. The synthesis of albendazole can be divided in three pathways. First pathway involves albendazole can by synthesized from 3-mercapto phenyl acetamide in presence of 1-bromopropane.

The starting material of this synthesis is 3-mercapto phenyl acetamide. The first step of this process is happened through S-alkylation mechanism to yield 5-propyl thio phenyl acetamide. This is first step. This compound is treated with nitric acid to form 5-propyl thio-2-nitro phenyl acetamide. It is one of the intermediate cum second step. The 2nd intermediate compound is reacted with hydrogen paladium as catalyst in presence of sodium hydroxide to produce 5-propyl thio ortho phenylene diamine. First pathway is having three intermediate steps.

Another one pathway involves methyl S methyl thiourea carboxylate can be prepared from S methyl thiourea sulphate and methyl chloroformate in presence of sodium hydroxide and sulphuric acid. This is one step pathway. The last pathway combines first two pathways including combination of 5-propyl thio ortho phenylene diamine and S methyl thiourea carboxylate to yield final compound albendazole. Simultaneously ammonia and methanethiol can be eliminated from the main compound albendazole. The last pathway is also one step reaction [20,21].

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue X Oct 2022- Available at www.ijraset.com

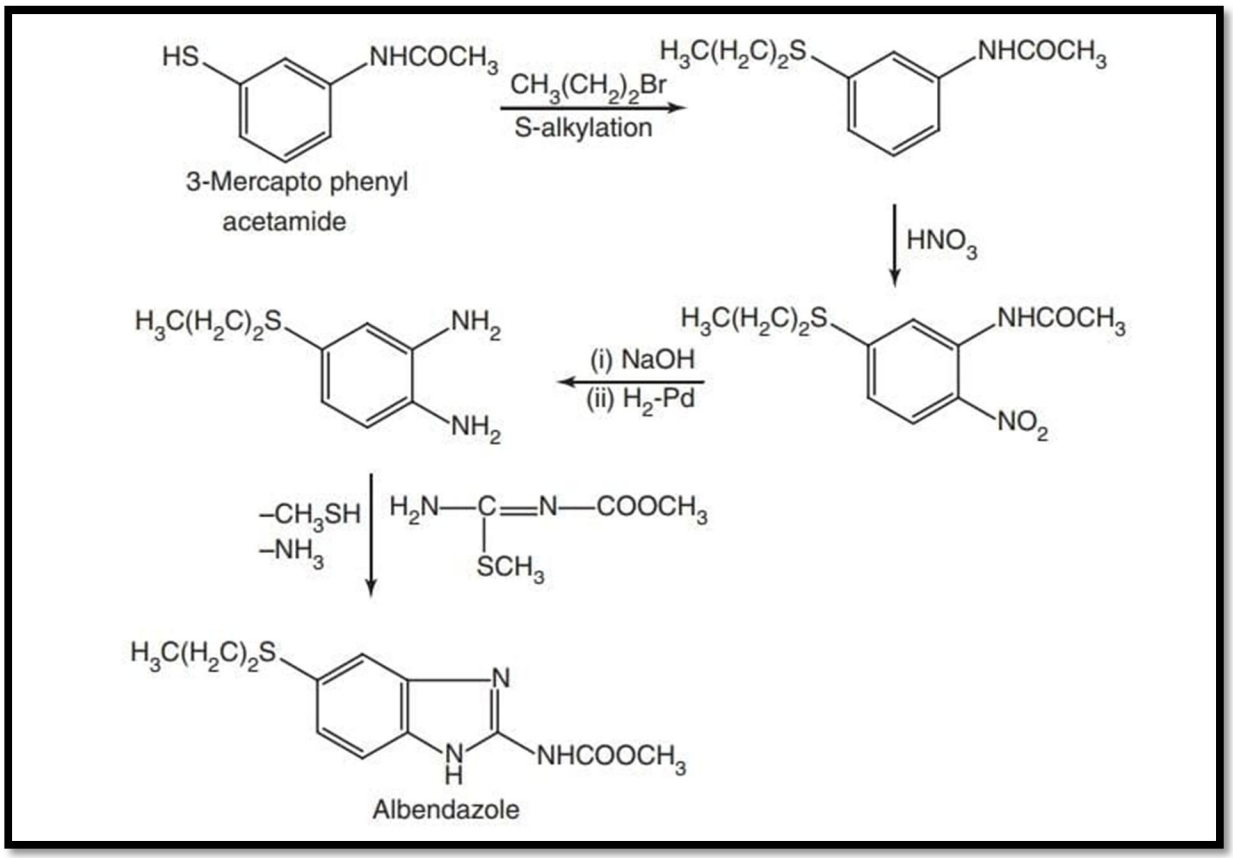


Figure 1: Synthesis of Albendazole [20,21]

VIII. ASSAY

The sample is dissolved with anhydrous acetic acid. The solution is titrated against 0.1 M percolic acid using crystal violet as indicator. The end point is then calculated and determined [21,22].

IX. STRUCTURAL FEATURES

Albendazole is methyl 5 [propyl thio] 1H benzimidazole 2 yl carbamate. It is the IUPAC name of albendazole. It is benzimidazole derivative. Molecular weight 265.3 gm. Molecular formula is $C_{12}H_{15}N_3O_2S$ [20-22].

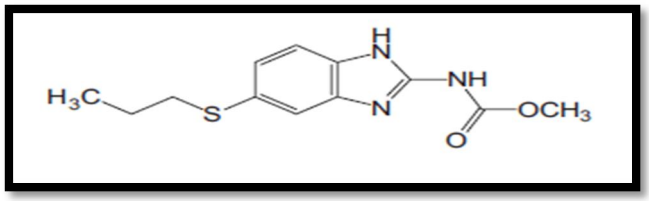


Figure 2: Structure of Albendazole [10]

X. PROPERTIES

Albendazole is anthelmintic drug. It is white light yellow in color. It is powder type in shape. It is soluble in formic acid and acetic acid. It is soluble in methylene chloride very slightly. It is having the melting point in between 208-210°C [20-22].

XI. ADVERSE EFFECTS

Usually the drug is safe. But some adverse effects are nausea, dizziness, vomiting, abdominal pain, headache, hair fall, mild diarrhoea, alopecia, neutropenia, weakness, itching, fever, confusion, allergic reactions, etc. Sometimes overdose can cause jaundice [13, 23].

XII. USES

Albendazole is available in tablet or syrup formulation. It is used for different types of worm or parasite infections as an anti parasitic agent or anthelmintic agent. It is used for pinworm or Enterobius infection. It is also used in round worm (Ascaris), whipworm, tapeworm, hookworm infections and flukes. It can be given in neurocysticercosis due to tapeworm infections. It is used in hydatid or cystis hydatid of peritonium, lung, liver etc. The drug can be given for both child as well as adult. It acts as broad spectrum drug used also in filariasis [13. 23].

XIII. DOSAGE FORMS

Albendzole is available in different types of formulations like Tablet, Syrup, etc. The dose of tablet is usually 400 mg for single dose [13, 23].

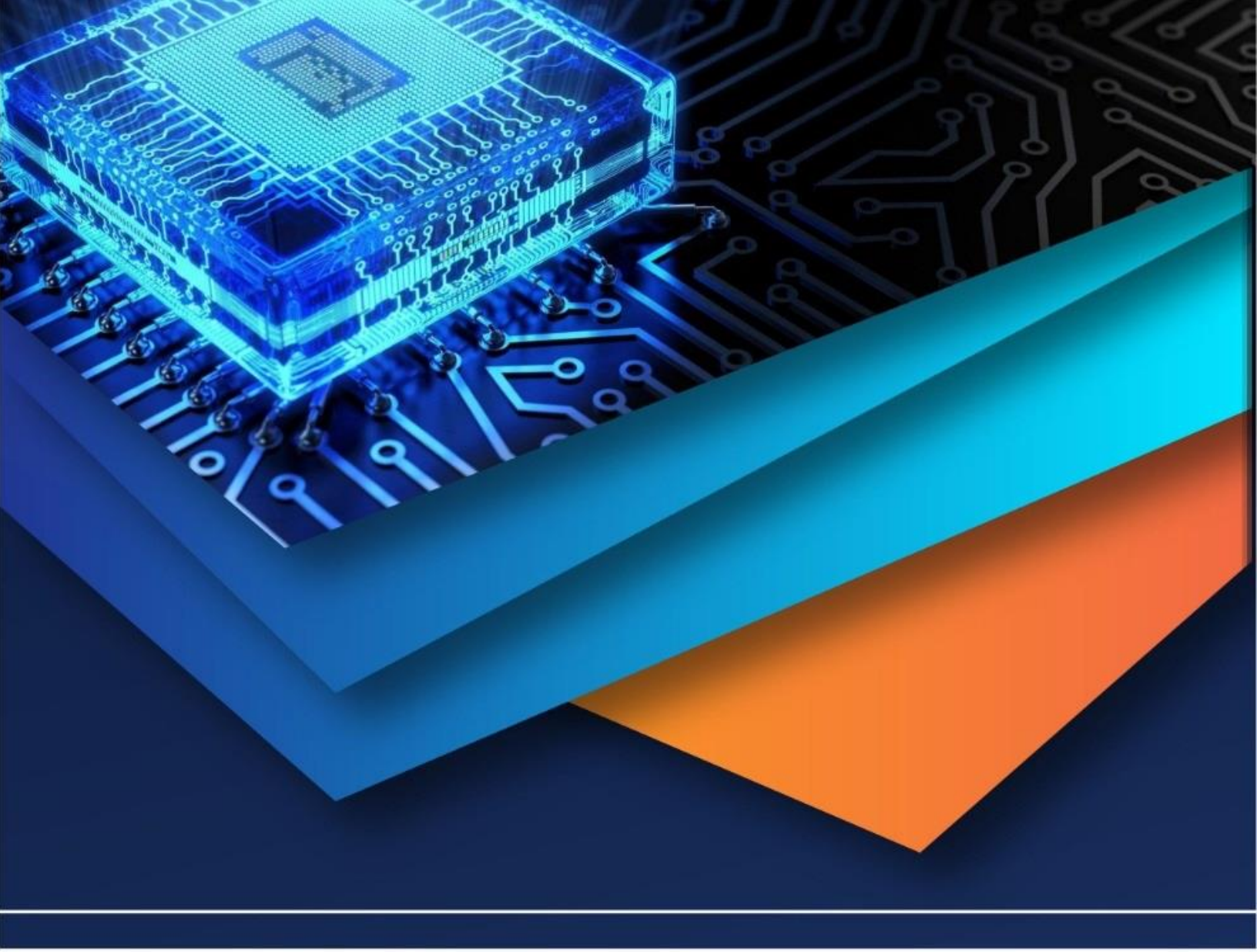
XIV. CONCLUSION

Albendazole is very potent in the treatment of different types of worms and parsites. Parasite infection is happened in different places in human body. Basically worms can cause severe colorectal infections. But the infections can be happened in very serious places like meninges in head. So it is very serious infections caused by parasites. Parasite can cause cerebral paralysis. Albendazole treat in these conditions by destroying the microtubule in parasites and corrupt their DNA formations. The parasites can be killed by using the drug. It is having broad spectrum anthelmintic property with containing benzimidazole derivative. Lastly it is safe drug for its usefulness.

Conflict of interest: Nil

REFERENCES

[1] Molina AJ, Merino G, Prieto JG, Real R, Mendoza G, Alvarez AI; Absorption and metabolism of albendazole after intestinal ischemia/reperfusion; Eur J Pharm Sci.; 2007; 31(1): 16-24.
[2] Oxberry ME, Reynoldson JA, Thompson RC; The binding and distribution of albendazole and its principal metabolites in Giardia duodenalis; J Vet Pharmacol Ther; 2000; 23(3): 113-120.
[3] Ramirez T, Benitez-Bribiesca L, Ostrosky-Wegman P, Herrera LA; In vitro effects of albendazole and its metabolites on the cell proliferation kinetics and micronuclei frequency of stimulated human lymphocytes; Arch Med Res.; 2001; 32(2): 119-122.
[4] Haque A, Hollister WS, Willcox A, Canning EU: The antimicrosporidial activity of albendazole; J Invertebr Pathol; 1993; 62(2): 171-177.
[5] A.D. Dayan; Albendazole, mebendazole and praziquantel. Review of non-clinical toxicity and pharmacokinetics; Acta Tropica; 2003; 86: 141-159.
[6] J. Horton; Albendazole: a review of anthelmintic efficacy and safety in humans; Parasitology; 2000; 121: S113-132.
[7] Lanchote VL, Garcia FS, Dreossi SA, Takayanagui OM; Pharmacokinetic interaction between albendazole sulfoxide enantiomers and antiepileptic drugs in patients with neurocysticercosis; Therapeutic Drug Monitoring; 2002; 24: 338–45.
[8] Rawden HC, Kokwaro GO, Ward SA, Edwards G; Relative contribution of cytochromes P-450 and flavin-containing monoxygenases to the metabolism of albendazole by human liver microsomes; Br J Clin Pharmacol; 2000; 49 (4): 313–322.
[9] Silvana E. Vignaduzzo, María A. Operto, Patricia M. Castellano; Development and Validation of a Dissolution Test Method for Albendazole and Praziquantel in Their Combined Dosage Form; J. Braz. Chem. Soc.; 2015; 26(4); 729-735.
[10] P C van Schalkwyk, T L Geyser, M Récio, F P Erasmus; The anthelmintic efficacy of albendazole against gastrointestinal roundworms, tapeworms, lungworms and liverflukes in sheep; J S Afr Vet Assoc; 1979; 50(1): 31-35.
[11] N. G. Raghavendra Rao, Yogita Tyagi, Shubhanshu Sidola; A Comparative Study of Different Marketed Formulations of Albendazole; World Journal of Pharmaceutical Research; 2020; 9(6): 736-759.
[12] Piyush Yadav, Rupali Singh; A Review on Anthelmintic Drugs and Their Future Scope; International Journal of Pharmacy and Pharmaceutical Sciences; 2011; 3(3): 17-21.
[13] Saleha Sungkar, Asri S. Ridwan, Gladys Kusumowidagdo; The Effect of Deworming Using Triple-Dose Albendazole on Nutritional Status of Children in Perobatang Village, Southwest Sumba, Indonesia; Journal of Parasitology Research; 2017; 1-5.
[14] Antonella Teggi, Marco Gregorio Lastilla, Franco De Rosa; Therapy of Human Hydatid Disease with Mebendazole and Albendazole; Antimicroblal agents and chemotherapy, 1993, 37(8): 1679-1684.
[15] Douglas Vieira Thomaz, Edson Silvio Batista Rodrigues, Luane Ferreira Garcia, Isaac Yves Lopes de Macêdo, Murilo Ferreira de Carvalho, Ruiter Lima Morais, Emily Kussmaul Gonçalves Moreno, Karla Carneiro de Siqueira Leite, Fabio Bahls Machado, Mayk Teles de Oliveira, Marcos Pereira Caetano, Morgana Fernandes Alecrim, Eric de Souza Gil; Electrochemical Study Of Albendazole And Mebendazole Adsorbates On Activated Charcoal Modified Electrode; Life Science Informatics Publications; 2018; 4(3); 156-163.
[16] Shane Ashley Pawluk, Craig Allan Roels, Kyle John Wilby, Mary H. H. Ensom; A Review of Pharmacokinetic Drug–Drug Interactions with the Anthelmintic Medications Albendazole and Mebendazole; Clin Pharmacokinet; 2015.
[17] Showkat Ahmad Dar, Vipin Nautiyal, Vikas Phulia, Subodh Gupta, Primal Sardar, N.P. Sahu; Bioavailability of Albendazole and its Metabolities in Plasma of Pangasianodon hypophthalmus with High Performance Liquid Chromatography; Int.J. Curr. Microbiol. App. Sci; 2017; 6(8): 2392-2400.
[18] Dnyaneshwar G. Sitre, Ravindra K. Kamble; Formulation Development and Evaluation of New Albendazole Tablets with Integrated Quality by Design (QbD) Approach; Journal of Drug Delivery and Therapeutics; 2021; 11(2):123-134.
[19] V. Alagarsamy; Text book of medicinal chemistry; Anthelmintics; CBS Publishers and Distributors Pvt. Ltd.; 2016; Volume-2; 3rd Edition; Page No. 473-474.
[20] https://www.pharmacy180.com/article/benzimidazoles-2424/
[21] Indian Pharmacopoeia; The Indian Pharmacopoeia Commission Ghaziabad; 2007; Volume-2; Page No. 74-75.
[22] Padmaja Udaykumar; Medical Pharmacology; Anthelmintics and drugs used in scabies and pediculosis; CBS Publishers and Distributors Pvt Ltd; 2011; 3rd Edition; Page No. 493-495.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY