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TUE 05 CHEMICAL SYNTHESIS OF BILE ACIDS AND THEIR PHYSICO-CHEMICAL PROPERTIES
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TUE 05 AN OVERVIEW ON COVID-19 OUTBREAK: EPIDEMIC TO PANDEMIC
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## ABSTRACTING AND INDEXING INFORMATION

EMBASE -Elsevier, PubMed (Selected citations), Web of Science - Emerging Sources Citation Index (Coverage till January 2021), Scopus (2014-17), Corss Ref.,Hinari- WHO, Chemical Abstract, Scirus - Elsevier's, Gale- Expanded Academic ASAP, EBSCO, Google, Google scholar, International consortium for the advancement of academic publication (ICAAP), Scientific common, Pharmaceutical Sciences Open Access Resources (PSOAR), Index Copernicus, Ulrich's International Periodical Directory, ProQuest, New York University Health Sciences Libraries, Research Gate, Open-J-Gate, Geneva Foundation for Medical Education & Research, Ayush Research portal and Genamics Journal Seek.

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Volume 12 (2021) - Issue 12, December

## REVIEW ARTICLES

*Department of Quality Assurance, Mumbai University, Mumbai, Maharashtra, India.*
DOI: 10.13040/IJPSR.0975-8232.12(12).6112-27

Abstract | HTML Full Text | PDF

02. NANO STRUCTURED LIPID CARRIER SYSTEM- A NOVEL TARGETING CARRIER

Oral administration of drugs is considered a convenient route; however, various drugs that are insoluble in water or cannot permeate across gastrointestinal tract membrane cannot be delivered by this route. To enhance the permeability through the physiological barriers, lipophilic drugs are introduced but, lipophilic drugs have low oral bioavailability. To enhance the bioavailability, a third-gene...

S. Satya Lakshmi and K. Persis Joni *
*Department of Pharmaceutics, Vignan Institute of Pharmaceutical Technology, Duvvada, Visakhapatnam, Andhra Pradesh, India.*
6128-6138
DOI: 10.13040/IJPSR.0975-8232.12(12).6128-38

Abstract | HTML Full Text | PDF

03. NATURAL GELLING AGENTS POLYMER IN PHARMACEUTICAL PREPARATION

Pharmaceutical preparation mostly contains active ingredients and excipients. The function of excipients to improve the physicochemical properties of pharmaceutical manufacturing products. In pharmaceutical preparation, polymer plays a key role act as excipients in any dosage formulation development. Polymers are derived from the source of natural and synthetic. The polymer should have basic prope...

Muhammad Masood Ahmad and Syed Nasir Abbas Bukhari
*Department of Pharmaceutics, College of Pharmacy, Jouf University, Sakaka, Saudi Arabia.*
6139-6150
DOI: 10.13040/IJPSR.0975-8232.12(12).6139-50

Abstract | HTML Full Text | PDF

04. MANNICHBASES: AN OVERVIEW OF HETEROCYCLIC COMPOUND WITH VARIOUS BIOLOGICAL ACTIVITIES

In Organic chemistry, largest families of organic compounds belong to heterocyclic compounds. In place of a carbon atom incorporation of an oxygen, a nitrogen, a sulfur, or an atom of a related element gives rise to a heterocyclic compound..Heterocyclic compounds are of very essential for our day-to-day life. It has a broad range of applications in medicinal chemistry as well as in agrochemicals p...

C. Geethapriya * and Karthikeyan Elumalaiim
*Department of Pharmaceutical Chemistry, R. R. College of Pharmacy, Chikkabanavara, R. R. Layout, Bangalore, Karnataka, India.*
6151-6165
DOI: 10.13040/IJPSR.0975-8232.12(12).6151-65

Abstract | HTML Full Text | PDF

05. CLERODENDRUM INFORTUNATUM: AN UNHEEDED BOON OF NATURE

The excavation for new delegates into the chemotherapeutic family and modernization of existing candidates are evergreen goals of cancer researchers. It is quite interesting to make out that the plant kingdom has gifted us with an array of anti-cancer compounds, reporting over 60% of the drugs today coming out from natural sources such as plants, marine organisms, and micro-organisms. With the evo...

B. S. Akhil, Asha Lekshmi and K. Sujathan
*Division of Cancer Research, Regional Cancer Centre, Thiruvananthapuram, Kerala, India.*
6166-6174
DOI: 10.13040/IJPSR.0975-8232.12(12).6166-74

Abstract | HTML Full Text | PDF

## RESEARCH ARTICLES

22. ANTITOXIC EFFECTS OF GUM ARABIC (ACACIA SENEGAL) AND GUAR GUM (CYAMOPSIS TETRAGONOLOBUS) AGAINST HEPATORENAL TOXICITY INDUCED BY MERCURIC CHLORIDE IN RATS

Heavy metal accumulates mostly in the liver and kidney as these organs involved in the detoxification and excretion of foreign materials. In the present study, we explored the effect of Gum Arabic (GA) and Guar Gum (GG) on mercuric chloride (HgCl2) induced hepatorenal toxicity. Twenty-eight adult male albino rats “Sprague Dawely” weighing 250-300 g were divided into four equal groups: the firs...

Amira Abd El-Rhman * and Nehad Naem Hamed Shosha
*Department of Biochemistry and Nutrition, Faculty of Women for Arts, Science and Education Ain Shams University, Cairo, Egypt.*
6353-6361
DOI: 10.13040/IJPSR.0975-8232.12(12).6353-61

Abstract | HTML Full Text | PDF

23. ISOLATION, CULTURE, AND ANTI-MRSA POTENTIAL OF A MARINE-ASSOCIATED BACTERIA ZOOSHIKELLA KANGWENSIS

Isolation, identification, culturing, and chemical screening of a marine-associated bacterial strain, S6.2, were performed in this study. Anti-MRSA analysis of its extract was also conducted. Strain S6.2 was isolated from an unidentified red marine sponge and identified as Zooshikella kangwensis by 16S rDNA sequencing and biochemical characterization. On marine agar, the colonies embedded in the m...

Rachow Khawchamnan, Monthon Lertcanawanichakul, Pharkphoom Panichayupakaranant, Wen Han Lin and Patchara Pedpradab *
6362-6369

*Department of Marine Science, Faculty of Sciences and Fishery Technology, Rajamangala University of Technology Srivijaya, Sikao District, Trang Province, Thailand.*
DOI: 10.13040/IJPSR.0975-8232.12(12).6362-69

Abstract | HTML Full Text | PDF

24. A CONCISE TWO-STEP METHOD FOR PREPARATION OF MEMANTINE HYDROCHLORIDE FROM 1, 3-DIMETHYLADAMANTANE

Memantine hydrochloride is a medicine used to medicate patients with moderately severe to severe Alzheimer's disease and other neurodegenerative disorders; because of mechanisms of neuroprotection, the efficiency of memantine have been delivered in preclinical and clinical experiments. Several approaches for preparing memantine hydrochloride have been announced. The process began with 1,3-dimethyl...

Thi Hong Tham Nguyen, Trong Diep Nguyen, Dinh Chau Phan and Binh Duong Vu *
*Vietnam Military Medical University, No.160, Phung Hung str., Phuc La ward, Ha Dong district, Hanoi, Vietnam.*
6370-6383
DOI: 10.13040/IJPSR.0975-8232.12(12).6370-83

Abstract | HTML Full Text | PDF

25. HEPATOPROTECTIVE ACTIVITY OF DORSTENIA BRASILIENSIS AGAINST ACUTE HEPATITIS INDUCED BY ACETAMINOPHEN AND CARBON TETRACHLORIDE IN MICE

The aim of this study was to assess the influence of extract of D. brasiliensis (CEDb) on acute liver injuries induced by both acetaminophen, and carbon tetrachloride in mice as an initial step to validate its popular use. A liquid-chromatography method coupled to Mass Spectrometry showed the presence of coumarins dorstenin, bergapten, and psoralene in CEDb. Swiss albino male mice were pre-treated...

A. M. Velázquez, E. M. G. Diarte, A. K. Galeano, A. J. Burgos-Edwards, N. L. Alvarenga, O. Y. Heinichen, Y. Montalbetti, M. A. Campuzano-Bublitz, M. L. Kennedy, M. C. Hellión-Ibarrola and D. A. Ibarrola *
*Departamento de Farmacología, Facultad de Ciencias Químicas, Universidad Nacional de Asunción, Campus UNA, San Lorenzo, Paraguay.*
6384-6392
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26. ANTAGONISTIC MECHANISM OF ANTI-FUNGAL COMPOUNDS FROM ASPERGILLUS GIGANTEUS ON HUMAN FUNGAL PATHOGENS

Cryptococcus neoformans and Candida albicans are the major causative agents for infections, cryptococcosis, and candidiasis in human. Anti-fungal drugs for the treatment of fungal infections may show less effective activity on the pathogens due to the poor absorption or inadequate drug distribution, and some pathogens may evolve anti-fungal drug resistance. The development of anti-fungal drugs fro...

R. Ramya and D. Kavitha *
*Department of Biochemistry, Biotechnology and Bioinformatics, School of Biosciences, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore - 641043, Tamil Nadu, India.*
6393-6402
DOI: 10.13040/IJPSR.0975-8232.12(12). ).6393-02

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# Volume 11 (2020) - Issue 1, January



REVIEW ARTICLES

M. Mayuri and G. V. N. Kumar *
*Department of Pharmacology, Drug Standardization Unit, Dr. D. P. Rastogi Central Research Institute for Homeopathy, Noida, Uttar Pradesh, India.*
35-40
DOI: 10.13040/IJPSR.0975-8232.11(1).35-40

Abstract | HTML Full Text | PDF | Citation

| | Title | Views | PDF | Cited |
|---|---|---|---|---|
| 5. | CANDIDA, A HUMAN PATHOGEN AND MAJOR TYPES OF CANDIDIASIS | 3119 | 856 | 0 |

The fungus candida with over 355 species is an anamorphic yeast. It consists of over 20 human pathogenic species which are the cause of candidiasis. Candidiasis encompasses infections that range from superficial, such as oral thrush and vaginitis, to systematic and potentially life-threatening diseases. Candida species are opportunistic human pathogens which despite treatment with antifungal drugs...

P. Surain * and N. K. Aggarwal
*Department of Microbiology, Kurukshetra University, Kurukshetra, Haryana, India.*
41-67
DOI: 10.13040/IJPSR.0975-8232.10(1).41-67

Abstract | HTML Full Text | PDF | Citation

## RESEARCH ARTICLES

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|---|---|---|---|---|
| 6. | PREPARATION AND CHARACTERIZATION OF ATENOLOL-β-CYCLODEXTRIN ORALLY DISINTEGRATING TABLETS | 3337 | 1003 | 0 |

Atenolol is a hypertension drug that has a low solubility characteristic in water and gastric fluid. The rate of absorption of the drug with poor solubility characteristics is determined by the dissolution process. In this study, an attempt has been conducted to increase the dissolution of atenolol by increasing its solubility. The solubility of atenolol has been enhanced by the inclusion complex ...

K. C. Rani *, N. Parfati and Stephanie
*Department of Pharmaceutics, Faculty of Pharmacy, University of Surabaya, Surabaya, East Java, Indonesia.*
68-79
DOI: 10.13040/IJPSR.0975-8232.11(1).68-79

Abstract | HTML Full Text | PDF | Citation

| | Title | Views | PDF | Cited |
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| 7. | A VALIDATED LC-MS/MS BIOANALYTICAL METHOD FOR THE SIMULTANEOUS DETERMINATION OF THREE ACE-INHIBITORS IN HUMAN PLASMA | 2082 | 744 | 0 |

A selective and rapid LC-MS/MS spectrophotometric method has been developed and validated for the simultaneous determination of three ACE-inhibitors used in anti-hypertensive therapy, namely enalapril maleate, perindopril, and ramipril in human plasma using high-performance liquid chromatography-tandem mass spectrophotometry (LC-MS/MS) with electrospray ionization (ESI). Separation of analytes and...

A. A. El-Zaher, H. A. Hashem, E. F. Elkady and M. A. Allam *
*Department of Pharmaceutical Chemistry 1, Faculty of Pharmacy, Cairo University, Kasr El-Aini St., Cairo, Egypt.*
80-90
DOI: 10.13040/IJPSR.0975-8232.11(1).80-90

Abstract | HTML Full Text | PDF | Citation

| | Title | Views | PDF | Cited |
|---|---|---|---|---|
| 8. | DEVELOPMENT AND CHARACTERIZATION OF ANTI-DANDRUFF NIOSOMAL HAIR GEL CONTAINING TEA TREE OIL | 1923 | 813 | 0 |

Dandruff is the excessive shedding of dead skin cells from the scalp, apparently caused by a fungus called Malassezia restricta and M. globosa. Malassezia formerly called Pityrosporum is a yeast causing infection of skin and scalp. Tea tree oil (TTO) is an essential oil that is obtained by steam distillation of the leaves and terminal branches of Melaleuca alternifolia (Myrtales: Myrtaceae). Tea t...

A. Sreedhar *, R. Mallya and M. Apte
*SVKM's Dr. Bhanuben Nanavati College of Pharmacy, Vile Parle W, Mumbai, Maharashtra, India.*
91-103
DOI: 10.13040/IJPSR.0975-8232.11(1).91-03

Abstract | HTML Full Text | PDF | Citation

| | Title | Views | PDF | Cited |
|---|---|---|---|---|
| 9. | PHARMACOGNOSTICAL STANDARDIZATION OF PLANT CRYPTOLEPIS BUCHANANI ROEM. & SCHULT. AERIAL PART | 1648 | 753 | 0 |

Cryptolepis buchanani Roem. & Schult. (Family: Asclepiadaceae) commonly-known as Wax leaved climber, Kali Sariva in English and Sanskrit. It is broadly used in Ayurveda as a remedy of ailment. Though, its diverse medicinal aspects, no detail pharmacognostical study is available till date. The present study is to investigate the pharmacognostical characteristics of C. buchanani aerial part. The...

Abstract | HTML Full Text | PDF | Citation

15. PHYTOCHEMICAL SCREENING AND EVALUATION OF PHARMACOLOGICAL ACTIVITIES OF BUCHANANIA LANZAN SPRENG LEAVES

1233 543 0

The aim of this research was to perform phytochemical screening and evaluation of the pharmacological activities of Buchanania lanzan Spreng. leaves. Preliminary phytochemical screening revealed the presence of phytoconstituents like steroids, tannins, saponins, carbohydrates, alkaloids, and flavonoids. Three leaf extracts were prepared by using solvents e.g. chloroform, ethyl acetate, and ethanol...

V. P. Nagulwar * and S. A. Deshpande
*Government College of Pharmacy, Amravati, Maharashtra, India.*
DOI: 10.13040/IJPSR.0975-8232.11(1).156-62
156-162

Abstract | HTML Full Text | PDF | Citation

16. CYANOBACTERIA ASSISTED BIO-REDUCTION OF SILVER NANOPARTICLE CONJUGATES AND STUDY ON THEIR CHARACTERIZATION AND ANTIBACTERIAL ACTIVITY AGAINST PATHOGENIC BACTERIA

1143 476 0

Green nanotechnology has recently emerged as an area of research involving more eco-friendly and energy-efficient approaches for the synthesis of inorganic nanoparticles. The point of the present investigation is to evaluate the capacity of selected strains of freshwater Cyanobacteria (Microalgae) for their capability to biosynthesize silver nanoparticles by utilizing both live biomass of microalg...

G. Kuraganti, S. Edla * and T. Dasari
*Government College of Pharmacy, Amravati, Maharashtra, India.*
DOI: 10.13040/IJPSR.0975-8232.11(1).163-72
163-172

Abstract | HTML Full Text | PDF | Citation

17. STABILITY INDICATING METHOD DEVELOPMENT AND VALIDATION FOR THE ESTIMATION OF ERTUGLIFLOZIN AND METFORMIN IN BULK AND PHARMACEUTICAL DOSAGE FORM BY ULTRA PERFORMANCE LIQUID CHROMATOGRAPHY

1425 539 0

A simple, accurate, precise method was developed for the simultaneous estimation of the Ertugliflozin and Metformin in Tablet dosage form. For the method development, Chromatogram was run through HSS C18 (100 × 2.1 mm, 1.7µ) column at a flow rate of 0.3 ml/min. and buffer used in this method was Ortho Phosphoric Acid buffer. The temperature was maintained at 30 °C. The optimized wavelength sele...

V. M. Goud and G. Swapna *
*Department of Pharmaceutical Analysis, Joginpally B. R. Pharmacy College, Yenkapally, Moinabad, Ranga Reddy, Hyderabad, Telangana, India.*
DOI: 10.13040/IJPSR.0975-8232.11(1).173-78
173-178

Abstract | HTML Full Text | PDF | Citation

18. EFFECTIVENESS OF PROBIOTICS USE IN POULTRY FARMING

1092 488 1

A bird is often subjected to dysbacteriosis with a low quality of feed. As a result, live weight gain and livability are reduced in broilers. This problem has become particularly acute now when most countries have abandoned the use of feed antibiotics. Significant assistance in this situation is provided by new regulators of intestinal biosynthesis - probiotics. In our research, we used biosporin ...

S. Y. Smolentsev *, L. E. Matrosova, F. N. Chekhodaridi, R. K. Gadzaonov, S. G. Kozyrev, M. S. Gugkaeva and A. K. Kornaeva
*Agrarian Institute of Technology, Mari State University, Lenin Square 1, Yoshkar-Ola City, Russia.*
DOI: 10.13040/IJPSR.0975-8232.11(1).179-82
179-182

Abstract | HTML Full Text | PDF | Citation

19. STANDARDIZATION, FORMULATION DEVELOPMENT AND CHARACTERIZATION OF ANTIULCER DRUG: MUKTA BHASMA

1187 620 0

Ayurveda is the holistic approach towards life, health, disease management through medicinal herbs minerals, diet and lifestyle leads to the great need for standardization of herbal medicine to maintain its safety and efficacy. Mukta bhasma is used in the treatment of bone metabolic disorders associated with calcium deficiency. It was prepared by Shodhana, Marana and Sharava samputa and the Standa...

M. C. Utikar *, R. S. Pentewar, S. S. Thonte, P. H. Bhosale and M. T. Narhare
*Department of Pharmaceutics, Channabasweshwar Pharmacy College, Latur, Maharashtra, India.*
DOI: 10.13040/IJPSR.0975-8232.11(1).183-91
183-191

Abstract | HTML Full Text | PDF | Citation

20. DRUG DEVELOPMENT AND OPTIMIZATION FORMULA OF RANITDIN HCl GASTRORETENTIVE MUCCOADHESIVE FLOATING SYSTEM TABLET

1003 473 0

Ranitidine hydrochloride (RHCl) is a histamine H2 receptor antagonist, it's widely in active duodenum ulcers, gastric ulcers, Zollinger-Ellison syndrome, gastroesophageal reflux disease, and erosive esophagitis. Ranitidine HCl has a short biological half-life of drug 2 - 3 h, has 50% absolute bioavailability, colonic metabolism of ranitidine HCl was partly responsible for the poor bioavailabilit...

A. N. Putri * and D. Forestryana
*Department of Pharmacy, Sekolah Tinggi IlmuKesehatan Borneo Lestari, Banjarbaru, South Kalimantan, Indonesia.*
192-197
DOI: 10.13040/IJPSR.0975-8232.11(1).192-97

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21. ANTIOXIDANT ACTIVITY OF A NEW FLAVONE GLYCOSIDE FROM THE STEMS OF GMELINA ARBOREA ROXB. — 1164 | 480 | 0

Gmelina arborea Roxb. belongs to the Verbenaceae family, commonly known as Gambhar. It is distributed throughout India, Ceylon, Malayan and Philippine Islands. Its roots have anthelmintic properties. Its flowers are useful in the treatment of leprosy and blood diseases. Its fruit has diuretic properties and aphrodisiac. It is also used in anemia leprosy and vaginal discharges. Leaves have shown an...

R. N. Yadava and J. Raghuvansi *
*Department of Chemistry, Dr. H. S. Gour Vishwavidyalaya (A Central University), Sagar, Madhya Pradesh, India.*
198-203
DOI: 10.13040/IJPSR.0975-8232.11(1).198-03

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22. STABILITY INDICATING RP-HPLC METHOD FOR ESTIMATION OF TWO SYNTHETIC ANTIBIOTICS, AMOXICILLIN AND ENROFLOXACIN, SIMULTANEOUSLY — 1217 | 483 | 0

This work proposes a precise, accurate, sensitive and selective stability indicating RP-HPLC method for the simultaneous quantification of amoxicillin and enrofloxacin in bulk powder and oral suspension formulations. Chromatographic separation was performed on the reverse phase C18 analytical column using 0.1M potassium dihydrogen orthophosphate–methanol (65:35, v/v) as mobile phase and with det...

S. Anwar * and P. M. A. A. Khan
*Department of Analytical Research and Development, Mylan Laboratories Limited, Hyderabad, Telangana, India.*
204-211
DOI: 10.13040/IJPSR.0975-8232.11(1).204-11

Abstract | HTML Full Text | PDF | Citation

23. STRUCTURE ELUCIDATION AND THERAPEUTIC APPLICATIONS OF ENDOPHYTIC FUNGI DERIVED BIOACTIVE COMPOUNDS OBTAINED FROM XIMENIA AMERICANA WESTERN GHATS OF KARNATAKA INDIA — 1635 | 3646 | 8

The objective of the present investigation was the bioprospection of pharmaceutically vital bioactive compounds from endophytic Thielaviopsis basicola with antagonistic and antioxidant activity isolated from Ximenia americana, Western Ghats of Karnataka, India. The fresh and healthy leaves and roots of Ximenia americana were collected from the forests of Western Ghats of Karnataka, India and subme...

R. S. Mane and A. B. Vedamurthy *
*Department of Biotechnology and Microbiology, Karnatak University, Dharwad, Karnataka, India.*
212-225
DOI: 10.13040/IJPSR.0975-8232.11(1).212-25

Abstract | HTML Full Text | PDF | Citation

24. ANALYTICAL METHOD DEVELOPMENT AND VALIDATION FOR SIMULTANEOUS ESTIMATION OF ERTUGLIFLOZIN AND METFORMIN HCl IN BULK AND PHARMACEUTICAL DOSAGE FORM BY HPLC — 1684 | 585 | 0

Analytical method for simultaneous estimation of Ertugliflozin (ERT) and Metformin hydrochloride (MET) was developed and validated by high-performance liquid chromatography (HPLC) as per ICH guidelines. The drugs were injected into the inertsil C18 (250 × 4.6 mm) maintained at room temp and wavelength 220 nm. The mobile phase consists of buffer (potassium dihydrogen pH 4.0) and methanol (65:35 v/...

S. W. Shafaat *, A. Ahmed, G. J. Khan, S. Anas and A. A. Qureshi
*Department of Quality Assurance, Ali-Allana College of Pharmacy, Akkalkuwa, Nandurbar, Maharashtra, India.*
226-232
DOI: 10.13040/IJPSR.0975-8232.11(1).226-32

Abstract | HTML Full Text | PDF | Citation

25. PHYTOCHEMICAL STUDIES, FTIR AND GC-MS ANALYSIS OF HARDWICKIA BINATA ROXB. (FABACEAE / CAESALPINIACEAE) — 1335 | 545 | 0

Hardwickia binata belongs to family Fabaceae / Caesalpiniaceae and commonly known as 'Anjan'. The present study includes phytochemical screening, FTIR and GC-MS analysis. Shade dried powdered leaves, seed and

husk of H. binata extracted in petroleum ether, chloroform, ethyl acetate, acetone, methanol, ethanol, distilled water using Soxhlet apparatus and used for phytochemical analysis. Crude p...

S. V. Deshmukh * and N. A. Ghanawat
*Department of Botany, Yashavantrao Chavan Institute of Science, Satara, Maharashtra, India.*
233-240
DOI: 10.13040/IJPSR.0975-8232.11(1).233-40

Abstract | HTML Full Text | PDF | Citation

26. EFFECT OF PLANT GROWTH REGULATORS ON SECONDARY METABOLITES ACCUMULATION AND ANTIOXIDANT ACTIVITY OF CATHARANTHUS ROSEUS L.



Secondary metabolites not only play a vital role in plant defense but also had shown various medicinal properties which provide a scientific base for using herbs and different plants as alternative medicines that were used by ancient communities. Many of the drugs today are simple synthetic modifications of the natural compounds. The developing commercial requirements of secondary metabolites in r...

B. A. J. Sidkey
*Department of Biology, College of Science, University of Baghdad, Iraq.*
241-245
DOI: 10.13040/IJPSR.0975-8232.11(1).241-45

Abstract | HTML Full Text | PDF | Citation

27. ANTIPLASMODIAL ACTIVITY OF AGANOSMA CYMOSA



Ethylacetate leaf extract of Aganosma cymosa was screened for antimalarial activities in-vivo in rats inoculated with red blood cells parasitized with Plasmodium falciparum using 4-day Suppressive test and Rane's test. The result of mean parasitemia by 4-day Suppressive test for the Group AC600, AC400 & AC200 was 4.62 ± 3.63, 13.34 ± 2.42, 19.29 ± 3.23 and percentage suppression were 80.1...

M. S. Reddy and B. R. Kuber *
*Department of Pharmacognosy, Institute of Pharmaceutical Technology, Sri Padmavathi Mahila Visvavidyalayam, Tirupathi, Andhra Pradesh, India.*
246-254
DOI: 10.13040/IJPSR.0975-8232.11(1).246-54

Abstract | HTML Full Text | PDF | Citation

28. CHEMOMETRIC APPROACH FOR RP-HPLC DETERMINATION OF DRONEDARONE USING RESPONSE SURFACE METHODOLOGY



The present study depicts the assessment of class III antiarrhythmic drug dronedarone in its drug substance and drug product. Response surface randomized central composite quadratic design has been employed for the optimization of method parameters using reverse-phase high-performance liquid chromatography (RP-HPLC) on Kromasil C18 250 × 4.6 mm, 5 µ with UV detection at 289 nm. The ranges of the...

D. V. Devi *, D. Swarnalatha and G. V. S. Reddy
*Annamacharya College of Pharmacy, Rajampeta, Andhra Pradesh, India.*
255-263
DOI: 10.13040/IJPSR.0975-8232.11(1).255-63

Abstract | HTML Full Text | PDF | Citation

29. EFFECT OF POLYHERBAL COMBINATIONS AND ESSENTIAL OILS AGAINST BIOFILM OF STREPTOCOCCUS MUTANS



Background: Herbal extracts have been used in dental products for many years owing to their anti-adherence effect on Streptococcus mutans (S. mutans) in the biofilm formation. Dental caries are developed by the colonization of oral bacteria on the surface of teeth and adherence is the first step in the colonization process. Objective: The objective of the present study was to explore the anti-biof...

S. G. Krishna, K. A. Reddy, M. S. Kumar, G. Ramu, B. U. Rajeswari and M. Kiranmai *
*Department of Pharmaceutical Chemistry, St Pauls College of Pharmacy, Hyderabad, Telangana, India.*
264-267
DOI: 10.13040/IJPSR.0975-8232.11(1).264-67

Abstract | HTML Full Text | PDF | Citation

30. ADSORPTION OF CIPROFLOXACIN FROM AQUEOUS SOLUTION ONTO FE3O4/GRAPHENE OXIDE NANOCOMPOSITE



In this research, ciprofloxacin adsorption (CIP) onto graphene oxide synthesized with Fe3O4 (Fe3O4-GO) was applied via various adsorbent dose, contact time, temperature and initial CIP concentration. The results showed that the percentage removal of CIP decreases from 98.1 to %77.4, as the CIP concentration increases from 25 to 200 mg/L. Also, the amount of CIP adsorbed per unit mass of adsorbent...

D. Balarak, M. Zafariyan and K. Chandrika *
*Department of Biotechnology, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, Andhra Pradesh, India.*
268-274
DOI: 10.13040/IJPSR.0975-8232.11(1).268-74

Abstract | HTML Full Text | PDF | Citation

31. HIGH-THROUGHPUT STRUCTURE BASED VIRTUAL SCREENING TARGETING CNS FOR INHIBITED ACETYLCHOLINESTERASE REACTIVATION

1044 413 0

Organophosphorus (OP) nerve agents blocks acetylcholinesterase and do not allow the degradation of acetylcholine. Post-treatment of organophosphate poisoning involves the treatment with oxime reactivators as an antidote, which will dephosphorylate the phosphate bond between enzyme and nerve agent. Due to CNS permeability failure of these oximes, the introduction of low molecular non-oximes has bec...

N. Darmwal and B. K. Singh *
*Department of Pharmaceutical Sciences, Kumaun University Campus, Bhimtal, Nainital, Uttarakhand, India.*
275-281
DOI: 10.13040/IJPSR.0975-8232.11(1).275-81

Abstract | HTML Full Text | PDF | Citation

32. FORMULATION AND STABILITY EVALUATION OF CREAM CONTAINING CHROMOLAENA ODORATA AND CENTELLA ASIATICA LEAF EXTRACTS

2245 1066 0

Chromolaena odorata was extracted by ethanol/water. Centella asiatica was extracted by methanol. A cream containing C. odorata and C. asiatica extracts was formulated and evaluated for its physicochemical properties and stability. C. odorata and C. asiatica were extracted and their respective active compounds scutellarein tetramethyl ether and asiaticoside were determined as bioactive compounds us...

S. Sawatdee * and A. Atipairin
*Drug and Cosmetics Excellence Center, Walailak University, Thaiburi, Thasala, Nakhon Si Thammarat, Thailand.*
282-287
DOI: 10.13040/IJPSR.0975-8232.11(1).282-87

Abstract | HTML Full Text | PDF | Citation

33. USE OF ELECTRON MICROSCOPY IN STUDY OF STEROIDOGENIC CELLS OF NORMAL, REGRESSING AND PREGNANT CAPRINE CORPORA LUTEA

820 389 0

Electron microscopic studies revealed variations in different cell organelles in steroidogenic cells of normal, regressing and pregnant caprine corpora lutea. Corpus luteum was comprised of two types of steroidogenic cells viz. small theca luteal cells and large granulosa luteal cells. In granulosa luteal cells, rough endoplasmic reticulum was most abundant in corpus luteum of pregnancy. The numbe...

S. Batra
*Department of Zoology, S. D. College (Lahore), Ambala Cantt, Haryana, India.*
288-291
DOI: 10.13040/IJPSR.0975-8232.11(1).288-91

Abstract | HTML Full Text | PDF | Citation

34. METHOD DEVELOPMENT FOR ESTIMATION OF DICLOFENAC SODIUM IN A CHOCOLATE DOSAGE FORM

1724 565 0

A simple, rapid, precise, sensitive and reproducible Reverse Phase High-Performance Liquid Chromatography (RP-HPLC) method has been developed for the quantitative analysis of Diclofenac sodium in the chocolate dosage form. Chromatographic separation of Diclofenac sodium was achieved on waters alliance-e2695, by using waters symmetry C18, 150 mm × 4.6 mm, 3.5 µm, column and the mobile phase conta...

J. L. Prasanna *, A. M. S. S. Babu, C. H. N. Jyothi and T. M. Rao
*A. M. Reddy Memorial College of Pharmacy, Narasaraopet, Andhra Pradesh, India.*
292-296
DOI: 10.13040/IJPSR.0975-8232.11(1).292-96

Abstract | HTML Full Text | PDF | Citation

35. HPLC METHOD DEVELOPMENT AND VALIDATION FOR ESTIMATION OF RIFABUTIN IN BULK AND CAPSULE DOSAGE FORM

1373 436 0

A selective, accurate, HPLC method was developed by this study for the determination of rifabutin in bulk and capsule dosage form. This method was developed by SHIMADZU LC-2010 HT using C18 column in solvents methanol: acetonitrile: ammonium acetate buffer (50: 45: 05) as mobile phase. At 1.0 ml/min flow rate the mobile phase was pumped, and the sample was detected at 278 nm. For standard rifabuti...

R. J. Sajini *, S. Prema, S. Niveditha, S. Nithya, G. M. Pavithra and V. Nivetha
*Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai, Tamil Nadu, India.*
297-300
DOI: 10.13040/IJPSR.0975-8232.11(1).297-00

Abstract | HTML Full Text | PDF | Citation

36.

DESIGN, OPTIMIZATION AND EVALUATION OF BUCCAL DRUG DELIVERY SYSTEM OF PROPRANOLOL FOR HYPERTENSION TREATMENT

1139 444 0

The main objectives of the present study were to design, optimization and evaluation of buccal drug delivery system of propranolol for hypertension treatment. Propranolol is non-selective β-adrenergic blockers. It shows first-pass metabolism so its bioavailability is decreased and its absolute bioavailability is only about 26%. The buccal tablets of propranolol formulated, by using different muco...

P. Sharma * and M. Tailang
*Institute of Post Graduate Ayurvedic Education and Research, Kolkata, West Bengal, India.*
301-311
DOI: 10.13040/IJPSR.0975-8232.11(1).301-11

Abstract | HTML Full Text | PDF | Citation

37. STANDARDIZATION OF THE HYDRO-ALCOHOLIC EXTRACT OF AYURVEDIC VAGINAL FORMULATION (NA) BY USING CHROMATOGRAPHY (HPTLC, HPLC) AND SPECTROSCOPY (UV-VIS & FTIR & GC-MS) METHODS

1145 533 0

The research herbal formulation prepared by mixing dried stem barks of Azadirachta indica A. Juss. and Saraca asoca Roxb. in equal amounts is standardized through pharmacognostic and phytochemical studies for assessing its efficacy in the treatment of leucorrhoea/vaginitis/ excessive white discharge. Pharmacognostical analysis revealed total ash value of 9.43% having 1.89% acid insoluble ash, 4.62...

M. Gupta *, S. T. Sasmal and D. Riya
*Institute of Post Graduate Ayurvedic Education and Research, Kolkata, West Bengal, India.*
312-327
DOI: 10.13040/IJPSR.0975-8232.11(1).312-27

Abstract | HTML Full Text | PDF | Citation

38. WOUND HEALING ACTIVITY OF METHANOLIC EXTRACT OF ARNEBIA BENTHAMII

971 494 0

Arnebia benthamii (synonym - Microtomia benthamii) commonly known as Ratanjot or Laljari found in western Himalayan region and used as wound healer roots by local vaids and tribes. The roots of Arnebia benthamii contain a red dye that is used in various health disorders like fungal infection, inflammation, fever and coloring/flavoring agent in Indian curries. To estimate wound healing potential of...

N. Kumar *, A. Singh, D. K. Sharma and K. Kishore
*Dr. R. M. L. Institute of Pharmacy, Kunwarpur Badagaon, Powayan, Shahjahanpur, Uttar Pradesh, India.*
328-333
DOI: 10.13040/IJPSR.0975-8232.11(1).328-33

Abstract | HTML Full Text | PDF | Citation

39. ESTIMATION OF WITHAFERIN – A FROM ASHWAGANDHADI LEHYA USING HPLC

1537 433 0

Ashwagandhadi lehya is an Ayurveda formulation, official in Ayurvedic Formulary of India and used as aphrodisiac, tonic, rejuvenating agents etc. It is one of the major components of Ashwagandhadi lehya is Withania somnifera which contain Withaferin –A. The study was undertaken to develop an analytical method using HPLC to estimate Withaferin - A, being a marker from, methanolic extract of Ashwa...

A. R. Manan *, G. G. Kanan, Y. V. Niraj and D. P. Nishit
*Ramanbhai Patel College of Pharmacy, Charusat Campus, Changa, Petlad, Anan, Gujarat, India.*
334-342
DOI: 10.13040/IJPSR.0975-8232.11(1).334-42

Abstract | HTML Full Text | PDF | Citation

40. PHYTOCHEMICAL ANALYSIS AND ANTIOXIDANT ACTIVITY STUDIES OF LEAF OF BRASSICA JUNCEA VAR RUGOSA THROUGH SEQUENTIAL SOLVENT EXTRACTION

1583 539 0

Objectives: To find out different qualitative and quantitative phytochemical properties, it's in-vitro antioxidant properties and peroxidase activity of Brassica juncea var. Rugosa (record tro- 50197928) with fresh and sequential solvent extracts. Methods: The leaf sample of Brassica juncea var. rugosa was collected from Manipur and the sample was dried. The dried powder was extracted using Soxh...

L. Moirangthem * and N. Praveen
*Department of Life Science, CHRIST (Deemed to be University), Hosur Road, Bangalore, Karnataka, India.*
343-351
DOI: 10.13040/IJPSR.0975-8232.11(1).343-51

Abstract | HTML Full Text | PDF | Citation

41. SYNTHESIS AND ANTICONVULSANT ACTIVITY OF SOME NOVEL BENZOTRIAZOLE DERIVATIVES

999 499 0

The vast investigations on the derivatives of 1, 2, 3-benzotriazole explore wide applicability for tagging and delivering a number of other heterocyclic nuclei with benzotriazole. In the present work, several derivatives of 1-(substituted)-5- [(N-benzotriazolo-methyl)-1, 3, 4-thiadiazolyl]- imidazole-2-thione have been synthesized and are evaluated for their anticonvulsant activity. The anticonvul...

V. K. Singh *, P. Rishishwar, P. Bharadwaj and S. Alok
*School of Pharmacy, Monad University, Panchsheel Nagar, Hapur, Uttar Pradesh, India.*
352-357
DOI: 10.13040/IJPSR.0975-8232.11(1).352-57

Abstract | HTML Full Text | PDF | Citation

42. DESIGN AND CHARACTERIZATION OF CHRONOPHARMACEUTICAL DRUG DELIVERY OF PROPRANOLOL HYDROCHLORIDE

1153 478 0

Objectives: In the present study, an effort was made to develop a novel pulsatile dosage form for the treatment of hypertension using Propranolol hydrochloride as a model drug. A time-delayed capsule was prepared by sealing the pellets inside the insoluble hard gelatin capsule body with an erodible hydrogel plug. Methods: The pellets were prepared by the Fluidized Bed Wurster (bottom spray) techni...

B. V. Krishan *, C. B. Rao and V. Saikishore
*University College of Pharmaceutical Sciences, Acharya Nagarjuna University, Guntur, Andhra Pradesh, India.*
358-364
DOI: 10.13040/IJPSR.0975-8232.11(1).358-64

Abstract | HTML Full Text | PDF | Citation

43. SENSITIVE AND RAPID ESTIMATION OF SARECYCLINE, AN ANTIBIOTIC DRUG IN SPIKED HUMAN PLASMA BY LC-MS/MS

1174 465 0

Sarecycline, a narrow spectrum tetracycline-derived antibiotic, is used to treat moderate to severe Acne vulgaris. The current study is aimed at developing a simple, sensitive and accurate liquid chromatography-tandem mass spectrometric (LC/MS/MS) method and validating the same for determination of sarecycline in human plasma. Zorbax, SB C18, 4.6 mm × 75 mm, 3.5 µm, 80 Å column, 10 mM ammonium ...

B. S. Prasad * and S. J. Kumari
*Department of Pharmacognosy, School of Pharmaceutical Sciences, Vel's Institute Science, Technology & Advanced Studies (VISTAS), Pallavaram, Chennai, Tamil Nadu, India.*
365-370
DOI: 10.13040/IJPSR.0975-8232.11(1).365-70

Abstract | HTML Full Text | PDF | Citation

44. FORMULATION AND EVALUATION OF SOLID LIPID NANOPARTICLES LOADED WITH BACOSIDE RICH EXTRACT

1418 728 0

The treatment of neurodegenerative disorders such as Alzheimer's disease (AD) becomes much more difficult due to the presence of the blood-brain barrier (BBB). Various synthetic drugs are used for the treatment of Alzheimer's disease, but the use of herbal products has increased tremendously nowadays. An important medicinal plant widely used therapeutically is Bacopa monnieri (Brahmi), a well-kn...

R. Kumar and R. Garg *
*Amar Shaheed Baba Ajit Singh Jujhar Singh Memorial (ASBASJSM) College of Pharmacy, Bela, Ropar, Punjab, India.*
371-377
DOI: 10.13040/IJPSR.0975-8232.11(1).371-77

Abstract | HTML Full Text | PDF | Citation

45. ANTIOXIDATIVE AND HYPOLIPIDEMIC EFFECT OF PUERARIA TUBEROSA WATER EXTRACT (PTWE) IN RATS WITH HIGH FAT DIET INDUCED NON-ALCOHOLIC FATTY LIVER DISEASE (NAFLD)

980 443 0

Non-alcoholic fatty liver disease (NAFLD) is chronic liver diseases ensuing from excessive fat accumulation in liver attributed to high dietary fat and carbohydrate and lower hepatic activity. It is associated with obesity and high BMI (body mass index). The excess carbohydrate-rich diet activates its conversion to TG (triglycerides), which gets accumulated in adipose and non-adipose tissues in th...

P. Aditi and Y. B. Tripathi *
*Department of Medicinal Chemistry, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India.*
378-386
DOI: 10.13040/IJPSR.0975-8232.11(1).378-86

Abstract | HTML Full Text | PDF | Citation

46. ENHANCEMENT OF SOLUBILITY AND DISSOLUTION RATE OF ERLOTINIB HYDROCHLORIDE BY SOLID DISPERSION TECHNIQUE WITH POLOXAMER 188: PREPARATION AND IN-VITRO EVALUATION

1284 487 0

Solid dispersions (SDs) of Erlotinib hydrochloride (ETN) were prepared to enhance the solubility by solvent evaporation (SE) and Melting (MM) method using poloxamer 188 (PL 188) in the ratio of 1:1, 1:3 and 1:5 (w:w). The solubility of the drug was increased in a concentration-dependent manner of polymer and follow linearity order. The solid dispersion was characterized by Fourier transform infrar...

M. K. Meena, D. Choudhary, M. Chouhan, P. Shukla and S. K. Sinha *
*Department of Pharmaceutical Sciences, Mohanlal Sukhadia University, Udaipur, Rajasthan, India.*
387-393

DOI: 10.13040/IJPSR.0975-8232.11(1).387-93

Abstract | HTML Full Text | PDF | Citation

47. THE EVALUATION OF VITAMIN C SUPPLEMENTATION ON NUTRITIONAL STATUS OF PATIENTS WITH ACUTE MYELOID LEUKEMIA UNDERGOING CHEMOTHERAPY

1165 422 0

Background: Leukemia is the seventh common cancer in Iran, and AML is considered as the most common type. Malnutrition is common among patients with cancer. Vitamin C deficiency has a high prevalence among patients with cancer, which may influence a patient's survival chance. This study was aimed to evaluate the effect of vitamin C supplementation on nutritional status and serum albumin in patient...

A. Hosseini, S. M. Jalali, M. Ajami *, M. Abdollahi, H. Ranjbar and M. Badeli
*Department of Food and Nutrition Policy and Planning Research, National Nutrition and Food Technology Research Institute, Shahid Beheshti University of Medical Sciences, Tehran, Iran.*
394-400
DOI: 10.13040/IJPSR.0975-8232.11(1).394-00

Abstract | HTML Full Text | PDF | Citation

48. PHARMACOLOGICAL EVALUATION OF THE IN-VIVO ANALGESIC AND ANTI-INFLAMMATORY ACTIVITIES OF THE ESSENTIAL OIL FROM CYMBOPOGON OLIVIERI (BOISS.) BOR.

1017 459 0

Cymbopogon olivieri (Poaceae) is a native plant to the south of Iran and is used for the treatment of some inflammative based disorders and as a pain killer. Regarding the presence of volatile terpenoids in the aerial parts, we were prompted to investigate the analgesic and anti-inflammatory activities of the essential oil from C. olivieri in animal models. The oil was also analyzed by GC and GC&#65533;...

A. M. Davoudi, M. Avarseji, Z. Mousavi and J. Asgarpanah *
*Faculty of Pharmacy and Pharmaceutical Sciences, Tehran Medical Sciences, Islamic Azad University, Yakhchal Ave, Shariati Ave., Tehran, Iran.*
401-406
DOI: 10.13040/IJPSR.0975-8232.11(1).401-06

Abstract | HTML Full Text | PDF | Citation

49. DESIGN AND CHARACTERIZATION OF SOME NEW NON-SYMMETRIC SUBSTITUTED TRIAZINES AND TRIAZINE DERIVATIVES

894 650 0

Attempts were made to carry out the laboratory synthesis of non-symmetric mono-, di- and tri- substituted 1, 3, 5-triazines by the action of the electron-donating substituent on 2, 4, 6-trichloro-1, 3, 5-triazines by aromatic nucleophilic substitution reaction mechanism (SNAr reaction) by temperature controlled. The introduction of the amino group (-NH-), ether (-O-) and thiol (-S-) Linker Bridge ...

S. S. Thakare * and S. N. Dhote
*Rajarshee Shahu Science College, Chandur Rly, Amravati, Maharashtra, India.*
407-412
DOI: 10.13040/IJPSR.0975-8232.11(1).407-12

Abstract | HTML Full Text | PDF | Citation

50. ANTIFUNGAL ACTIVITY OF AMPHOTERICIN-B ETHOSOMAL GEL AGAINST CANDIDA ALBICANS: A COMPARATIVE STUDY

1390 480 0

Amphotericin B is among the gold standard antifungal agents used for the treatment of the wide range of fungal infections. Work aimed to formulate the amphotericin B (AmB) ethosomal gel (EF), evaluate its antifungal activity against fungal isolates of human origin and compare its antifungal activity with marketed liposomal gel (MLG). AmB ethosomal gel (EF) was formulated and characterized for thei...

C. Kaur * and P. Maurya
*Department of Pharmaceutics, School of Pharmaceutical Sciences, Jaipur National University, Jaipur, Rajasthan, India.*
413-419
DOI: 10.13040/IJPSR.0975-8232.11(1).413-19

Abstract | HTML Full Text | PDF | Citation

51. THE PROTECTIVE ROLE OF RAPHANUS SATIVUS ROOTS IN REVERSING THE RENAL ALTERATIONS AND OXIDATIVE DAMAGE AGAINST STREPTOZOTOCIN INDUCED DIABETES IN RATS

1115 561 0

Oxidative stress and hyperglycemia are two major factors implicated in the development of renal damage. Roots of Raphanus sativus have been reported to possess both ant diabetic and antioxidant activities. So, the present study was aimed to investigate whether aqueous root extract of Raphanus sativus (ARRS) is effective in reversing the renal alterations and oxidative damage against streptozotocin...

P. S. Priya * and N. Jayshree
*Institute of Pharmacology, Madras Medical College, Chennai, Tamil Nadu, India.*
420-431
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Abstract | HTML Full Text | PDF | Citation

observational study where newly diagnosed patients with ADRs reporting to OPD of Dermatology, K.G.M.U, Lucknow and satisfying inclusion criteria were enrolled. The various stud...

S. Jain, P. Katiyar *, S. Suvirya, P. Verma, A. K. Sachan, R. Nath, R. Pal, S. Barua and R. K. Dixit
*University Institute of Health Sciences, Kanpur, Uttar Pradesh, India.*
DOI: 10.13040/IJPSR.0975-8232.11(1).474-88

474-488

Abstract | HTML Full Text | PDF | Citation

58. THE EVALUATION OF VITAMIN C SUPPLEMENTATION ON NUTRITIONAL STATUS OF PATIENTS WITH ACUTE MYELOID LEUKEMIA UNDERGOING CHEMOTHERAPY

762 392 0

Background: Leukemia is the seventh common cancer in Iran, and AML is considered as the most common type. Malnutrition is common among patients with cancer. Vitamin C deficiency has a high prevalence among patients with cancer, which may influence a patient's survival chance. This study was aimed to evaluate the effect of vitamin C supplementation on nutritional status and serum albumin in patient...

A. Hosseini, S. M. Jalali, M. Ajami *, M. Abdollahi, H. Ranjbar and M. Badeli
*Department of Food and Nutrition Policy and Planning Research, National Nutrition and Food Technology Research Institute, Shahid Beheshti University of Medical Sciences, Tehran, Iran.*
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489-495

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# PREPARATION AND CHARACTERIZATION OF ATENOLOL-β-CYCLODEXTRIN ORALLY DISINTEGRATING TABLETS

Karina Citra Rani *, Nani Parfati and Stephanie

Department of Pharmaceutics, Faculty of Pharmacy, University of Surabaya, Surabaya, East Java, 60293, Indonesia.

**Keywords:**

Atenolol,
Inclusion complex, β-cyclodextrin,
Orally disintegrating tablets

**Correspondence to Author:**
**Karina Citra Rani**

Department of Pharmaceutics,
Faculty of Pharmacy, University of Surabaya, Surabaya, East Java, 60293, Indonesia.

**E-mail:** karinabellamy89@gmail.com

**ABSTRACT:** Atenolol is a hypertension drug that has a low solubility characteristic in water and gastric fluid. The rate of absorption of the drug with poor solubility characteristics is determined by the dissolution process. In this study, an attempt has been conducted to increase the dissolution of atenolol by increasing its solubility. The solubility of atenolol has been enhanced by the inclusion complex using β-cyclodextrin made by several methods (physical mixing, kneading, and solvent evaporation). Evaluation and characterization of atenolol-β-cyclodextrin inclusion complex consist of drug content, dissolution test, Fourier Transformed Infrared analysis (FT-IR), Differential Scanning Calorimetry (DSC), X-ray Diffraction (XRD) and Scanning Electron Microscope (SEM). The results of the drug content analysis, dissolution test, and characterization showed that atenolol- β-cyclodextrin inclusion complex, which has been made by the solvent evaporation method was the best approach. Therefore, a solvent evaporation method was chosen to formulate orally disintegrating tablets of atenolol-β-cyclodextrin using direct compression technique. Orally disintegrating tablets of atenolol-β-cyclodextrin were prepared using crospovidone as disintegrant. The results of pre-compression test and the post-compression test revealed that orally disintegrating tablets of atenolol-β-cyclodextrin inclusion complex disintegrate within 8.17 ± 0.41 sec. *In-vitro* dispersion time in simulated saliva was found to be 45.33 ± 0.58 sec and the percentage of atenolol dissolved from this formula was 92.22% in 30 min. Hence, this formula shows good physicochemical characteristics and fulfill pharmaceutical quality requirements of orally disintegrating tablet.

**INTRODUCTION:** Atenolol is a drug to treat high blood pressure and has been widely used in hypertension therapy [1]. Atenolol is slightly soluble in water.

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The solubility of atenolol in water (25 °C) is approximately 13.3 mg/ml[2]. Low solubility characteristic of atenolol in water and gastric fluid caused the bioavailability of atenolol is about 50% following oral administration [1]. The rate of absorption of the drugs which have low solubility characteristics determined by the rate of dissolution [3].

The rate of dissolution can be increased by several methods such as decrease the particle size using micronization and nanoparticle techniques, solid

dispersion, salt formation, co-crystal, inclusion complex, *etc*. [4, 5] Inclusion complex is one of the approaches which has been used in the pharmaceutical field to improve the dissolution of poorly soluble drugs, taste masking of bitter drugs, and enhance the stability of several drugs [6, 7]. Cyclodextrins are commonly used in the inclusion complex system because of its structure. Cyclodextrins are cyclic oligosaccharides consist of a macrocyclic ring of glucose subunits joined by α-1, 4 glycosilic bonds [8]. Cyclodextrins have several types regarding the number of glucopyranose units. In general, Cyclodextrins which consist of 6 (αCD), 7 (βCD), or 8 (ϒCD) (α-1,4) -linked D-glucopyranose units are widely used as host molecules in inclusion complex approach [9]. Cyclodextrins in the three-dimensional structure described as a truncated cone with a hydrophilic exterior. The interior structure of cyclodextrins molecules consists of carbon groups of glucopyranose units; therefore the interior is more hydrophobic compared to the exterior part [9, 10]. Regarding its structure, cyclodextrins can induce poorly soluble drugs in their cavity. While the exterior part contact with the medium, cyclodextrins will reveal the drugs which are entrapped in their cavity. Through an inclusion complex approach, cyclodextrins molecules can convert poorly soluble crystalline drugs into water-soluble amorphous drug/cyclodextrins complexes

The results from the previous research revealed that β-cyclodextrins was the most commonly employed in inclusion complex formation. The size cavity of β-cyclodextrins are suitable for the majority of drugs; therefore β-cyclodextrins can entrap the hydrophobic drugs well. Another reason for the use of β-cyclodextrins is the ease of its production and low cost [10]. The big molecular cavity of β-cyclodextrins increases the possibilities of the drug to be entrapped in the cavity. In general, one molecule of cyclodextrins will trap one molecule of the drug in their cavity [11]. The ability of β-cyclodextrins to form inclusion complex is influenced by the size, molecular weight, shape, and the characteristics of the drug [11]. The inclusion complex of drug molecules with β-cyclodextrins can affect several pharmacokinetic characteristics of the drug, including (i) enhancement of the dissolution process for poorly soluble drugs, therefore improves the bioavailability of these drugs, (ii) reducing the toxicity of the drugs through application of the lower doses, and (iii) control the release of the drugs [12].

The interaction between cyclodextrins as host molecules and the drugs as guest molecules are mainly through hydrophobic interactions, electronic effects, van der Walls forces, and steric factors. Hydrogen bonds also play a significant role in the cylclodextrins cavity to entrap the drug molecules [13]. An inclusion complex of atenolol and β-cyclodextrins is promising to develop in order to increase the solubility of atenolol, hence the dissolution rate of atenolol will be enhanced. Moreover, an inclusion complex of atenolol with β-cyclodextrinsis also giving opportunities for pre gastric absorption of atenolol [14]. An inclusion complex of atenolol with β-cyclodextrin in 1:1 ratio was the best ratio, based on the evidence from previous studies [15]. In this study, an inclusion complex of atenolol with β-cyclodextrins was prepared using a 1:1 ratio. The preparation method to produce inclusion complex determines the characteristics of the obtained inclusion complex, hence it must be studied to find the most appropriate method.

The objective of this study is to prepare inclusion complexes of atenolol-β-cyclodextrins by different methods such as physical mixture, kneading, and solvent evaporation method. The inclusion complexes which are obtained from each method are then characterized to evaluate the thermal characteristic by differential scanning calorimetry (DSC). The crystallographic state of these inclusion complexes is also observed by X-ray powder diffractometry (XRD). Fourier transform infrared (FT-IR) apply to predict the possible interaction between atenolol and β-cyclodextrins.

The morphology of the inclusion complex is evaluated by Scanning Electron Microscopy (SEM). The inclusion complex, which performs the best characteristics, then formulated into orally disintegrating tablets to increase patient compliance, especially in geriatric patients. Orally disintegrating tablets are characterized by high porosity, low density, and low hardness. When administered, an *in-situ* suspension is created in the oral cavity as the tablet disintegrates and is subsequently swallowed.

Tablets were prepared by using crospovidone as a disintegrant, aspartam, mannitol direct compress, Avicel PH 102®, mint flavor, magnesium stearate, and Aerosil®. Crospovidone was added to facilitate drug release and consequently improve the solubility of the drugs [16]. Tablets were prepared by using a direct compression technique. The direct compression method is chosen because this method is simple and cost-effective [17].

## MATERIALS AND METHODS:

**Materials:** Materials that were used in this study consists of atenolol pharmaceutical grade(p.g) (Refarmed Chemicals, Lugono Switzerland), β-cyclodextrin (Roquette, France), ethanol (EtOH)pro analysis (p.a) (Merck), crospovidone (Kollidon® CL) p.g (BASF South East Asia Pre-Ltd), magnesium stearate p.g (Faci Asia Pacific PTE LTD), aspartame f.g (Ajinomoto Co. Inc.), aqua demineralisata (Laboratorium of qualitative chemistry University of Surabaya), manitol DC p.g (Roquette Freses, France), aerosil p.g (Brataco), mint flavor f.g (KH Roberts), sodium dihydrogen phosphate ($NaH_2PO_4.2H_2O$) p.a (Merck), disodium hydrogen phosphate ($Na_2HPO_4.12H_2O$) p.a (Merck), natrium acetate trihidrate ($CH_3COONa$) p.a. (Riedel), acetic acid glacial ($CH_3COOH$) p.a (Merck), methanol (MeOH) pro-HPLC (Mallinckrodt Chemicals), Avicel PH 102® p.g (Mingtai Chemical Co. LTD), talk (Brataco), and filter paper No 41 (Whatmann®)

### Methods:

**Preparation of atenolol-β-cyclodextrin Inclusion Complex:** The Inclusion complex of an atenolol-β-cyclodextrin was prepared using a 1:1 ratio. Three different methods (physical mixture, kneading, and solvent evaporation method) have been utilized to prepare these inclusion complexes.

**Physical Mixture:** The physical mixture of atenolol and β-cyclodextrin was prepared by mixing individual components using a mortar and a stamper until a homogeneous mixture was obtained. This mixture then stored in airtight containers.

**Kneading Method:** Kneading method was the first method to prepare the inclusion complex of atenolol-β-cyclodextrin. A homogeneous mixture of atenolol and β-cyclodextrin is kneaded by ethanol to obtain the slurry mass. The slurry mass was grinding for 1 h until the solvent evaporated to produce a paste-like mass. This paste then dried at 50 °C in a tray dryer for 4 h. The dried inclusion complex powder, then sieved using sieve No. 60 and stored in airtight containers [18].

**Solvent Evaporation Method:** The initial step to prepare the inclusion complex by this method was dissolved atenolol in ethanol, continuing with the addition of β-cyclodextrin into this solution. This mixture was stirred for 2 h using a magnetic stirrer, then this mixture was placed in a water bath (90 °C) to evaporate the solvent. The inclusion complexes were obtained as a crystalline powder pulverized. The inclusion complexes were sieved by using siever no. 60 and stored in airtight containers until further use [18].

### Characterization of atenolol-β-cyclodextrin Inclusion Complex:

**Fourier Transform Infrared Spectrophotometry (FT-IR):** The interaction between atenolol and β-cyclodextrin was observed by the FT-IR transmission spectrum of atenolol, β-cyclodextrin, and inclusion complex using the potassium bromide (KBr) disc technique [2, 14]. All the spectrum acquired were scanned between 400 and 4000 $cm^{-1}$.

**Differential Scanning Calorimetry:** Thermal characteristics of atenolol, β-cyclodextrin, and an inclusion complex of atenolol-β-cyclodextrin were studied using Mettler Toledo differential scanning calorimeter. The scanning rate was 10°C/min and the scanning was conducted between 40°C until 200 °C [18].

**Powder X-Ray Diffraction (XRD):** The crystallographic state of atenolol, β-cyclodextrin, and an inclusion complex of atenolol-β-cyclodextrin was investigated using X-ray diffractometer (Phillips) in the range 2Θ (5-50°) at room temperature [14].

**Scanning Electron Microscopy (SEM):** The surface morphology of atenolol, β-cyclodextrin, and an inclusion complex of atenolol-β-cyclodextrin was observed by a scanning electron microscope. The samples were coated with gold to provide a conductive layer for observing images at 15 KV.

**Drug Content Analysis of atenolol-β-cyclodextrin Inclusion Complex:** The drug content in the atenolol-β-cyclodextrin inclusion complex was determined by preparing the inclusion complex powder equivalent to 25 mg of atenolol. The powder then was dissolved and extracted by acetate buffer pH 4,6 in a 100 ml volumetric flask. The solution then filtrated through the Whatman no. 41 filter paper. 10 ml of the filtrate was pipette and transferred into a 25 ml volumetric flask, diluted with acetate buffer pH 4.6. The concentration of atenolol was determined by measuring the absorbance λ 274 nm, using a UV-Visible double beam spectrophotometer (Shimadzu UV-1800).

**Dissolution Test of atenolol-β-cyclodextrin Inclusion Complex:** Dissolution test of inclusion complex was studied the USP apparatus II (Paddle method) in the Hanson® dissolution apparatus at 50 rpm for 60 min. Dissolution studies were carried out using 900 ml of acetate buffer pH 4.6 as a dissolution medium. The dissolution medium was maintained at 37 ± 0.5 °C. The samples of dissolution medium (10 ml) were withdrawn at specified time intervals (2, 4, 6, 8, 10, 15, 30, 45 and 60 min). The concentration of atenolol in the samples of the dissolution medium was analyzed using UV-visible, double beam spectrophotometer (Shimadzu UV-1800) at λ 274 nm. The dissolution parameters were calculated from this test.

**TABLE 1: FORMULA OF ATENOLOL-β-CYCLO-DEXTRIN ORALLY DISINTEGRATING TABLETS**

| Components | Total per tablet (mg) |
|---|---|
| Atenolol-β-cyclodextrin | 133.41 |
| Crospovidone | 30 |
| Avicel PH 102® | 94.88 |
| Manitol DC | 23.88 |
| Aspartame | 9 |
| Mint flavor | 3 |
| Magnesium stearate | 1.5 |
| Talk | 3 |
| Aerosil 200® | 1.5 |
| Total | 400 |

**Preparation of Powder Mixture of Orally Disintegrating Tablets of atenolol-β-cyclodextrin:** The powder mixture was prepared by mixing several components such as atenolol-β-cyclodextrin inclusion complex, Aerosil®, Avicel® PH 102, crospovidone, aspartame, manitol DC, and mint flavor for 10 min in tumbling mixer. The composition of an orally disintegrating tablet of atenolol-β-cyclodextrin tabulated in **Table 1**. The powder mixture then was evaluated before the compression step (pre-compression test).

**Pre Compression Evaluation of the Powder Mixture:** The powder mixture of orally disintegrating tablets of atenolol was evaluated by several parameters such as bulk density, tapped density, compressibility, Hausner ratio, flowability, angle of repose, and moisture content.

**Bulk Density:** Bulk density of powder mixture calculates by dividing the total mass of powder mixture (m) and the bulk volume of the powder (Vb). Bulk density was measured by pouring 40 grams of powder mixture into a measuring cylinder. The volume of the powder mixture was recorded, then the bulk density was calculated using equation [19]:

$$\text{Bulk density} = m / Vb$$

Where m is the mass of powder mixture, Vb is the bulk volume of the powder.

**Tapped Density:** Tapped density of the powder mixture was determined using the tapping machine. The powder mixture was poured into a measuring cylinder and transferred into the tapping machine to evaluate the volume of the powder (Vt) after being tapped 500 times in tapping machine [20]. The tapped volume (Vt) was noted and the tapped density was determined by this formula

**Flowability and Angle of Repose:** The powder mixture (± 100 g) was poured through a wide funnel that raised vertically to determine the angle of repose and flow speed of the powder mixture.

The height of the heap (h) and the radius of the base (r) were recorded, then the angle of repose was determined according to this formula:

$$\text{Tan } \theta = h / r$$

Where θ is the angle of repose, h is the height of the heap, and r is the radius of the heap in cm.

Time for the powder mixture to fall down through a funnel was used to calculate the flow speed of the powder mixture.

**Compressibility Index and Hausner Ratio:** The determination of the compressibility index and Hausner ratio are performed to evaluate the flowability of the powder. The compressibility index can be calculated by comparing the bulk density (Db) and tapped density (Dt) of the powder [21]. The calculation of the compressibility index has been performed utilizing this equation:

$$\text{Compressibility index} = Dt - Db / Dt \times 100$$

Where Dt is the tapped density of the powder and Db is the bulk density of the powder.

Hausner ratio is an indirect index to predict powder flow [20]. Hausner ratio can be calculated by the following formula.

$$\text{Hausner ratio} = Dt / Db$$

Where Dt is the tapped density of the powder and Db is the bulk density of the powder.

**Moisture Content:** The moisture content of the powder was determined by analyzing approximately 5 g of the powder. This evaluation was done by using the moisture content analyzer. The moisture content of the powder can be calculated using this equation:

$$\% MC = W - Wo / Wo \times 100\%$$

Where W is the weight of wet mass and Wo is the weight of dry mass

**Preparation of Atenolol Orally Disintegrating Tablets:** The powder mixture was lubricated and then prepared for the compression process. The compression process was conducted by compress the powder mixture using the Erweka® tablet compression machine. The powder was compressed into 300 mg tablet using 11 mm flat punches.

**Post Compression Evaluation:** Orally disintegrating tablets of atenolol-β-cyclodextrin tablets were evaluated for organoleptic, dimension, hardness, friability, wetting time, water absorption ratio, *in-vitro* dispersion time, disintegration, drug content, and dissolution.

**Organoleptic:** The orally disintegrating tablets were inspected in several parameters such as color, shape and taste.

**Dimension:** The dimension of the tablets was evaluated by vernier caliper to measure the thickness and diameter of 10 tablets. Evaluation of the tablet dimension was conducted to ensure the uniformity of tablet size and predict the problem during the compression process.

**Hardness:** The hardness or crushing strength of the tablets was determined using a Monsanto hardness tester. The force required to break a tablet in the diametric axis was recorded as the hardness of the tablets [21].

**Friability:** Weighed amount of dedusted tablets equal to 6.5 grams were subjected to the rotating drum of ERWEKA® rolling and impact durability tester. These tablets were placed in the rolling and impact durability tester at 25 rpm for 4 min [22]. % Friability was calculated by this following equation:

$$\% \text{ Friability} = W_1 - W_2 / W_1 \times 100$$

Where $W_1$ was the weight of the tablet before the tablets subjected to the friability test and $W_2$ was the weight of the tablet after the friability test.

**Wetting Time and Water Absorption Ratio:** Wetting time test was conducted to predict the hydrophilicity and the penetration rate of water into the structure of the tablets. Orally disintegrating tablet of atenolol-β-cyclodextrin was placed carefully on the surface of filter paper containing 10 ml eosin solutions. The time of eosin solution to reach the surface of the tablets was determined [23]. The water absorption ratio was also determined during this test through the amount of the water which is penetrating into the inner structure of the tablet. Water absorption ratio (R) was determined using this equation:

$$R = Wa - Wb / Wb \times 100$$

Where Wb and Wa were tablet weight before and after the water absorption test

In-vitro **dispersion time:** In-vitro dispersion time test was conducted to evaluate the ability of orally disintegrating tablets to disperse in the small amount volume of saliva. One tablet was placed in a tube containing 10 ml of simulated saliva solutions (phosphate buffer pH 6.8 with

temperature 37 ± 0.5 °C). The time for the tablets dispersed completely was determined [24].

***In-vitro* Disintegration Time:** The disintegration test was performed using the method which has been stated in the compendia. Six tablets were placed in each tube of the USP disintegration apparatus. The apparatus was equipped with 900 ml distilled water maintained at 37 ± 0.5 °C as the immersion fluid. *In-vitro* disintegration time of the tablets was determined and recorded [25].

**Drug Content:** Twenty tablets were powdered using a mortar and a stamper. The powder sample (equivalent to 25 mg of atenolol) was weighed accurately and dissolved in 10 ml of methanol. This solution then extracted using acetate buffer pH 4.6 in a 100 ml volumetric flask. The filtrate of this solution then was transferred in a 25 ml volumetric flask and diluted using acetate buffer pH 4.6. The concentration of atenolol in this solution was assayed by a UV-Visible double beam spectrophotometer, then the drug content in each tablet was calculated [19, 26].

**Dissolution Test:** The dissolution test was performed using USP dissolution testing apparatus II at 50 rpm for 120 min. The dissolution medium was acetate buffer pH 4.6 and the temperature was maintained at 37 ± 0.5 °C. An aliquot (10 ml) of the dissolution medium was sampled at a specific time interval. The aliquot was replaced with fresh acetate buffer pH 4.6 in each sampling interval. The amount of atenolol dissolved in each time interval was analyzed by UV-visible, double beam spectrophotometer (Shimadzu UV-1800) at λ 274 nm. The dissolution parameters of the tablets were determined [26].

## RESULTS AND DISCUSSION:

**Characterization of atenolol-β-cyclodextrin Inclusion Complex:** The atenolol-β-cyclodextrin inclusion complex was found to be white powders and no odor**.**

**Fourier Transform Infrared (FT-IR) Spectrophotometry:** Fourier transform infrared (FT-IR) study was conducted to evaluate the interaction between atenolol and β-cyclodextrin. This study also predicted the formation of a new bond between atenolol and β-cyclodextrin in the inclusion complex. An infrared spectrum of atenolol, β-cyclodextrin, physical mixture of atenolol-β-cyclodextrin, and an inclusion complex of atenolol- β-cyclodextrin can be seen in **Fig. 1**.

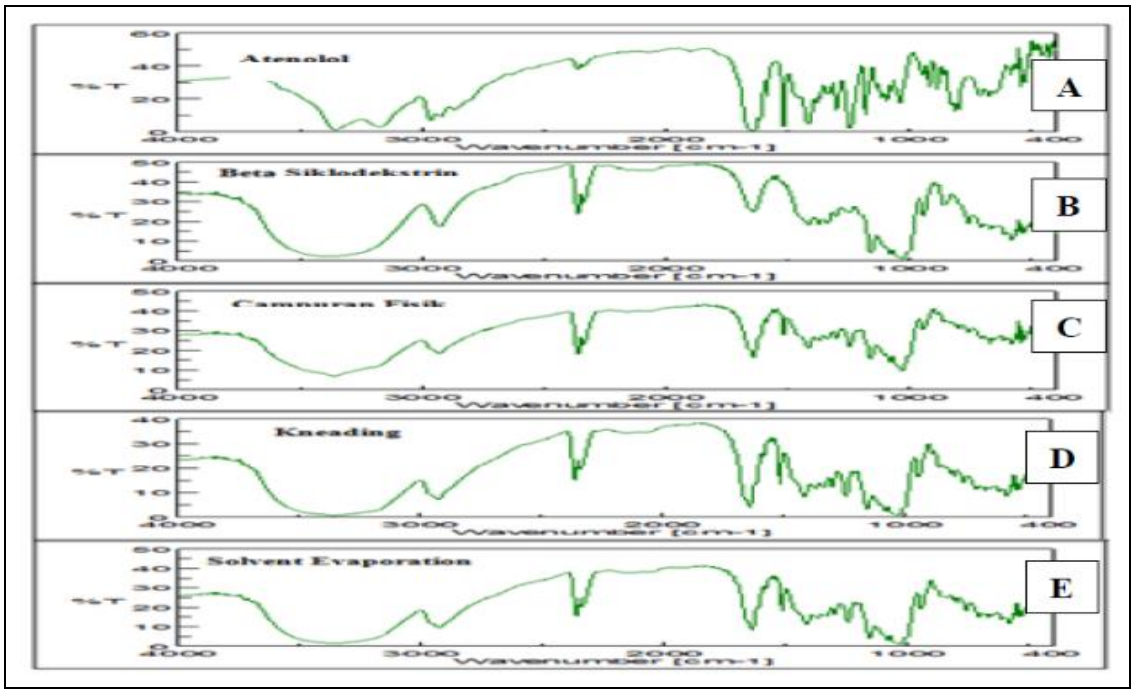


**FIG. 1: INFRARED SPECTRUM OF INCLUSION COMPLEXES OF ATENOLOL-β-CYCLODEXTRIN (A) INFRARED SPECTRUM OF ATENOLOL (B) INFRARED SPECTRUM OF β-CYCLODEXTRIN (C) INFRARED SPECTRUM OF PHYSICAL MIXTURE OF ATENOLOL-B-CYCLODEXTRIN (D) INFRARED SPECTRUM OF AN INCLUSION COMPLEX ATENOLOL-β-CYCLODEXTRIN BY KNEADING METHOD (E) INFRARED SPECTRUM OF AN INCLUSION COMPLEX ATENOLOL-β-CYCLODEXTRIN BY SOLVENT EVAPORATION METHOD**

Infrared spectrum of pure atenolol showed peaks in 3354.57 $cm^{-1}$ and 3173.29 $cm^{-1}$ indicated -CO-NH group, 2964.05 $cm^{-1}$ (=CH), 1636.03 $cm^{-1}$ (-C=O, NH primer) and 1515,78 $cm^{-1}$ (-N-C=O, NH secondary). As shown in the figure, atenolol had a carbonyl band of 1725-1685 $cm^{-1}$. Atenolol also showed the carbonyl band in 1725-1685 $cm^{-1}$. The infrared spectrum of the physical mixture revealed no significant change regarding the specific peaks of atenolol. Whereas, the inclusion complex, which is prepared by kneading and a solvent evaporation method performed a significant decrease of the carbonyl band intensity. This phenomenon can be predicted because of the intermolecular hydrogen bonds between atenolol and β-cyclodextrin. This condition caused by the restriction of atenolol packing in cyclodextrin cavity [27]. Moreover, in inclusion complexes that had been prepared by kneading and solvent evaporation method, two functional groups (-CO-NH) had been bounded by functional OH groups of β-cyclodextrin through hydrogen bonding [27]. The sharp peak of atenolol at 3354 $cm^{-1}$ broadened in the inclusion complex spectrum. Moreover, peak in wavelength 3174$cm^{-1}$, resulting from -NH vibrations in atenolol structure was disappeared in the atenolol-β-cyclodextrin inclusion complex spectrum. This condition caused by a complex interaction with β-cyclodextrin

**Differential Scanning Calorimetry (DSC):** Thermal behavior of atenolol, physical mixture of atenolol-β-cyclodextrin, and an inclusion complex of atenolol-β-cyclodextrin were studied in order to analyze the complex formation. The DSC thermogram of atenolol, physical mixture of atenolol-β-cyclodextrin, and an inclusion complex of atenolol-β-cyclodextrin are shown in **Fig. 2**.

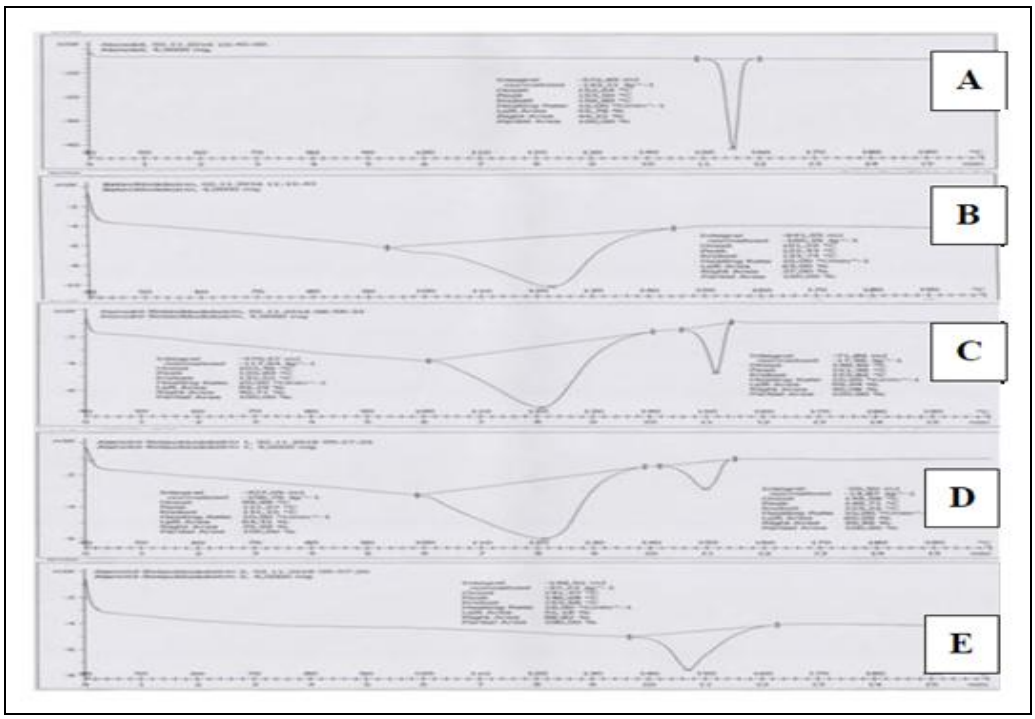


**FIG. 2: DSC THERMOGRAM OF (A) DSC THERMOGRAM OF ATENOLOL (B) DSC THERMOGRAM OF β-CYCLODEXTRIN (C) DSC THERMOGRAM OF PHYSICAL MIXTURE OF ATENOLOL-β-CYCLODEXTRIN (D) DSC THERMOGRAM OF INCLUSION COMPLEX ATENOLOL-β-CYCLODEXTRIN BY KNEADING METHOD (E) DSC THERMOGRAM OF AN INCLUSION COMPLEX ATENOLOL-β-CYCLODEXTRIN BY SOLVENT EVAPORATION METHOD**

The DSC thermogram of atenolol showed that this molecule has an endothermic peak at 153.50 °C, according to its melting point. The β-cyclodextrin showed a broad endothermic peak, which is approximately located at 122.43 °C due to the release of water molecules from the structure. Physical mixture showed two endothermic peaks at 120.89 ºC and 151.46 ºC.

Inclusion complex, which was prepared by kneading method showed two endothermic peaks at 121.27 ºC and 149.71 ºC, while the solvent evaporation method produces the inclusion complex which revealed one endothermic peak at 146.68 ºC. The complete disappearance of atenolol indicates that the inclusion complex is formed with optimum condition [18].

**Powder X-Ray diffraction (XRD):** The X-ray diffraction patterns of pure atenolol, as well as the atenolol-β-cyclodextrin inclusion complexes obtained by using kneading method and solvent evaporation method, are represented in **Fig. 3**.

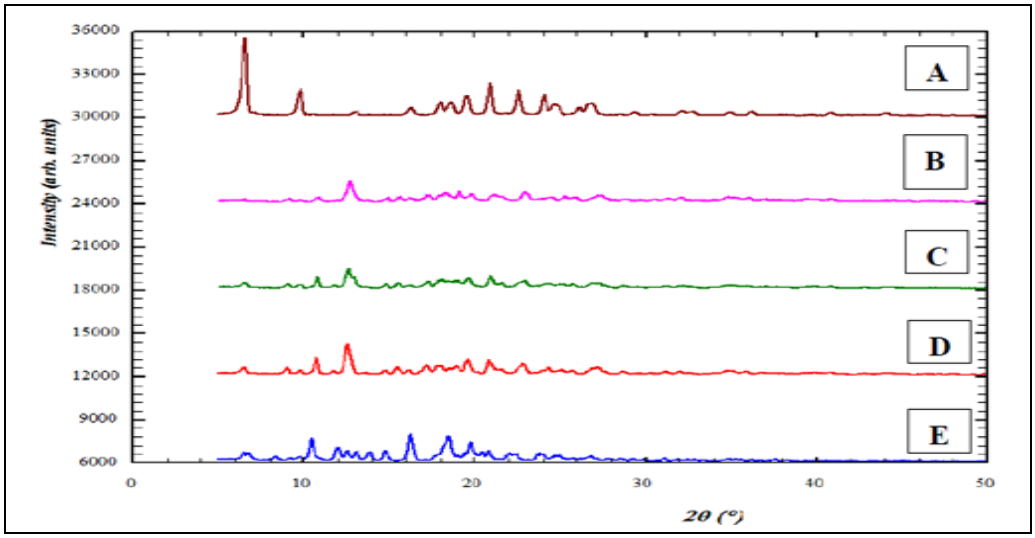


**FIG. 3: X-RAY DIFFRACTION PATTERN OF (A) ATENOLOL (B) β-CYCLODEXTRIN (C) PHYSICAL MIXTURE OF ATENOLOL-β-CYCLODEXTRIN (D) INCLUSION COMPLEX OF ATENOLOL-β-CYCLODEXTRIN BY KNEADING METHOD (E) INCLUSION COMPLEX OF ATENOLOL-β-CYCLODEXTRIN BY THE SOLVENT EVAPORATION METHOD**

Analysis of the crystallographic aspect was conducted to determine the difference of the crystal structure of the inclusion complex compare to pure drug. The results showed that there was a decrease in the peak intensity of atenolol in inclusion complex formation. The highest reduction of the peak intensity of atenolol showed by the inclusion complex, which was prepared using the solvent evaporation method. Inclusion complex characterized as a new solid phase with lower crystallinity compared to the pure drug.

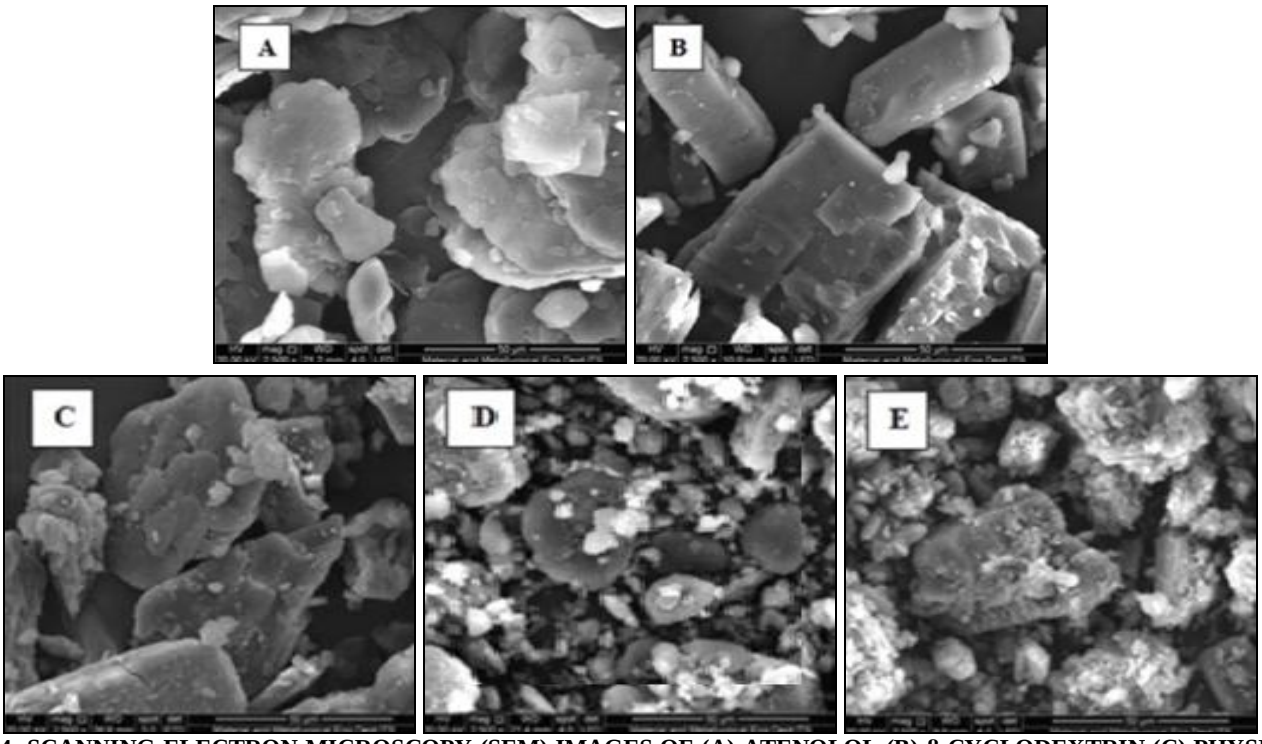


**FIG. 4: SCANNING ELECTRON MICROSCOPY (SEM) IMAGES OF (A) ATENOLOL (B) β-CYCLODEXTRIN (C) PHYSICAL MIXTURE OF ATENOLOL-β-CYCLODEXTRIN (D) INCLUSION COMPLEX OF ATENOLOL-β-CYCLODEXTRIN BY KNEADING METHOD (E) INCLUSION COMPLEX OF ATENOLOL-β-CYCLODEXTRIN BY THE SOLVENT EVAPORATION METHOD**

**Scanning Electron Microscopy (SEM):** The SEM study showed the morphology and microscopy photography of the drug and its inclusion complex. The representative images are shown in **Fig. 4**.

The shape of pure drug particles was irregular. The physical mixture images showed that only a small amount of atenolol which was attached to the surface of β-cyclodextrin. The inclusion complex, which is prepared by the kneading method observed that the drug particles attach at the surface of β-cyclodextrin. Moreover, the inclusion complex, which is prepared by the solvent evaporation method showed that atenolol particles attached and incorporated into β-cyclodextrin. The solvent evaporation inclusion complex was poor of crystal structure, lack distinct crystal faces, and incorporated completely in β-cyclodextrin structure [28].

**Drug Content:** UV spectrophotometry was used to determine the drug content of the inclusion complex of atenolol-β-cyclodextrin. The results showed that the drug content of physical mixture was 91.47 ± 1.22%, the inclusion complex, which was produced by kneading method was 92.59 ± 0.90%, and the inclusion complex, which was produced by solvent evaporation method was 95.40 ± 0.97%.

**Dissolution Test of atenolol-β-cyclodextrin Inclusion Complex:** Dissolution profile of inclusion complex, which was prepared by physical mixing, kneading method, and solvent evaporation method. The dissolution profiles are as shown in **Fig. 5**.

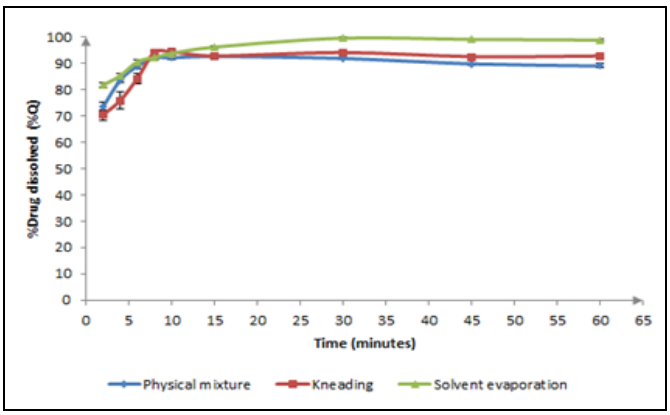


**FIG. 5: DISSOLUTION PROFILE OF INCLUSION COMPLEX ATENOLOL-β-CYCLODEXTRIN WHICH MADE BY PHYSICAL MIXING, KNEADING METHOD, AND SOLVENT EVAPORATION METHOD**

The Dissolution parameter of the inclusion complex shown in **Table 2**.

**TABLE 2: DISSOLUTION PARAMETER OF INCLUSION COMPLEX**

| Method | %Q (30 min) | TQ% (min) | AUC (0-60 min) | %ED | Kr (min) |
|---|---|---|---|---|---|
| Physical mixture | 91.96% ± 0.00 | 4.49 ± 0.34 | 5321.93 ± 13.75 | 88.70% ± 0.23 | 0.0046 ± 0.00 |
| Kneading | 94.05 ± 0.45 | 7.61 ± 1.65 | 5400.46 ± 25.72 | 90.01% ± 0.43 | 0.0138 ± 0.00 |
| Solvent evaporation | 99.56 ± 0.45 | 5.19 ± 1.62 | 5710.12 ± 14.54 | 95.17% ± 0.24 | 0.0537 ± 0.01 |

The dissolution profiles of physical mixture and inclusion complexes showed that the solvent evaporation method exhibited a little faster dissolution rate than the physical mixture and produced by the kneading method. An Inclusion complex of atenolol-β-cyclodextrin prepared by the solvent evaporation method is promising to develop into orally disintegrating tablets. The inclusion complex, which was produced by the solvent evaporation method was continued to develop into orally disintegrating tablets.

**Pre Compression Evaluation:** Precompression evaluation was conducted to predict the ability of powder mixture to be compressed into an orally disintegrating tablet. The ability of the powder to flow was a parameter that was evaluated during this test. The flowability of the powder blend also must be determined to predict the ability of powder blend to fulfill the dies during the compression stage. The flow properties of the powder mixture can be determined by analyzing the compressibility index (%) and Hausner ratio [28]. The results of the compressibility index and Hausner ratio revealed that the powder mixture had poor flow character.

The results of flow velocity and angle of repose were found that the powder can not flow well in a glass funnel. This was due to the high percentage of fines in the powder mixture. The powder mixture which had a high percentage of fines, was more adhesive or cohesive. The flow of the powder in this situation was not influenced by gravitation force [28]. This problem can be solved by decreasing the fines percentage and controlling the particle size distribution.

Moisture content evaluation of powder mixture was conducted to determine that the powder mixture had sufficient moisture content to be compressed. The results showed that the powder mixture had a high moisture content (6.21% ± 0.23). The high moisture content of powder mixture probably caused by the excipient which was hygroscopic, such as β-cyclodextrin, crospovidone, and Avicel® PH 102. The powder mixture which had high humidity will be more cohesive so that this mixture did not flow well. Therefore the weighing process, the mixing process, and the tableting process must be conducted in a room in which the humidity and temperature are controlled well. The results of the pre-compression evaluation are tabulated in **Table 3**.

**TABLE 3: THE RESULTS OF PRE COMPRESSION EVALUATION OF ATENOLOL-β-CYCLODEXTRIN ORALLY DISINTEGRATING TABLETS**

| Parameters | Result |
|---|---|
| Compressibility index (%) | 33.67 ± 0.00% |
| Hausner Ratio | 1.508 ± 0.000 |
| Moisture content (%) | 6.21 ± 0.23% |

**Post Compression Evaluation:** Atenolol orally disintegrating tablets were white, round shape, no odor, sweet and mint flavor. Tablet means thickness and diameter were almost uniform in the formula. Orally disintegrating tablets of atenolol-β-cyclodextrin performed good mechanical strength during hardness test. The hardness of orally disintegrating tablets of atenolol-β-cyclodextrin was 2.49 ± 0.41 kg. The specification of tablet hardness in orally disintegrating tablets is 2.0-4.0 kg [29]. Friability and abrasion values of orally disintegrating tablets of atenolol were below 1%. This result indicating that orally disintegrating tablets of atenolol-cyclodextrin have good mechanical resistance. The results of the post-compression evaluation are tabulated in **Table 4**.

**TABLE 4: POST COMPRESSION PARAMETERS OF ATENOLOL-β-CYCLODEXTRIN ORALLY DISINTE-GRATING TABLETS**

| Parameter | Result |
|---|---|
| Organoleptic | White, round shape, no odor, sweet and mint flavor |
| Drug content | 100.01 ± 1.1% |
| Diameter | 1.10 ± 0.00 cm |
| Thickness | 0.41 ± 0.00 cm |
| Hardness | 2.49 ± 0.41 kg |
| Disintegration time | 8.17 ± 0.41 sec |
| Dispersion time | 45.33 ± 0.58 sec |
| Friability | 0.26 ± 0.21% |

The wetting time for orally disintegrating tablets of atenolol-β-cyclodextrin was 124.67 ± 3.79 sec. The faster the wetting time of the tablets, the faster the tablets will be disintegrated when contact with the media. The water absorption ratio test was conducted to predict the amount of water that can be absorbed by orally disintegrating tablets. Orally disintegrating tablets which have lower water absorption ratio were more preferable to develop. This was due to the orally disintegrating tablets only need a small amount of water to disperse in the media [30]. Orally disintegrating tablets of atenolol-β-cyclodextrin posses appropriate wetting time and water absorption ratio.

The disintegration time of atenolol-β-cyclodextrins tablets was 8.17 ± 0.41 seconds. These results showed that orally disintegrating tablets of atenolol-β-cyclodextrins fulfill the specification which has been stated in compendia (<1 min) [31]. *In-vitro* dispersion time was also conducted to predict the ability of orally disintegrating tablets to be dispersed in a small amount of saliva in the oral cavity. Orally disintegrating tablets of atenolol-β-cyclodextrins dispersed in 45.33 ± 0.58 seconds. Crospovidone characteristic which promotes capillary activity and hydration enhances the tablets to disperse rapidly without forming gel formation on the surface of the tablets [32].

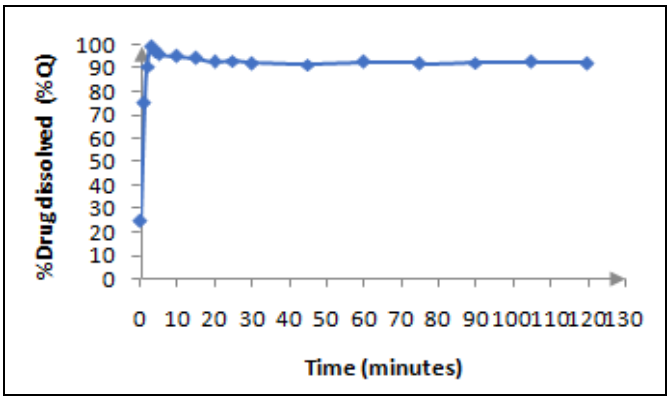


**FIG. 6: DISSOLUTION PROFILE OF ORALLY DISINTEGRATING TABLETS OF ATENOLOL-β-CYCLODEXTRIN**

The dissolution profile of orally disintegrating tablets of atenolol-β-cyclodextrin showed in **Fig. 6**. The results from the dissolution study showed that orally disintegrating tablets atenolol-β-cyclodextrin meet the specification of compendia. The specification stated that the minimum amount of drug dissolved in 30 min is 85%.

The amount of drug dissolved from this formula was 92.22%, so it can be concluded that this orally disintegrating tablet met the specification.

**CONCLUSION:** The results from this study showed that the solvent evaporation method produces the best physicochemical characteristics of the inclusion complex of atenolol-β-cyclodextrin. Consequently, the solvent evaporation method was chosen to produce the inclusion complex of atenolol-β-cyclodextrin which further developed into orally disintegrating tablets. Orally disintegrating tablets of atenolol-β-cyclodextrin with sufficient mechanical strength, fast dispersion and disintegration time, and the acceptable taste was produced from this study.

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**CONFLICTS OF INTEREST:** There is no conflict of interest during this research.

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