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# Isolation and Identification of Freshwater Microalgae Potentially as Antibacterial From Talago Biru, Koto Baru, West Sumatera

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## ABSTRACT

*Microalgae have potential as antibacterial compounds, the content of microalgae which has the activity of amino acids, terpenoids, florotanins, steroids, phenolics, acrylic acids and halogenated ketones can be used as an antimicrobial. In this research, screening and isolation of microalgae which can be used as antibacterial has been done at Talago Biru, Koto Baru, West Sumatera and the content of secondary metabolites were identified. The isolation was done by using agar plate and serial dilution methods. Isolates were identified morphological and molecular, it is known as a type of Chlorella sp. Best harvest time was determined by Spectrophotometric method at 450 nm is obtained in day 20 on the stationary phase. Based on phytochemical test, this isolate positively contain phenolics, saponins, steroids and triterpenoids, then the antibacterial activity of microalgae extracted with methanol was tested. It is known that the isolates has potential as an antibacterial, were seen from the test results provided by the zone of inhibition against four isolates of bacteria test with extract concentrations of 10 mg / mL, 100 mg / mL and 500 mg / mL respectively E .Coli 8 mm, 10 mm and 12 mm, Salmonella bacteria typhii 10.5 mm, 9 mm, 9 mm, Staphylococcus aureus 9 mm, 10 mm and 10 mm as well as the bacteria Bacillus cereus 10 mm, 10.5 mm, and 11 mm with a comparator amoxycillin as a positive control and 0.1% DMSO as a negative control.*

***Keywords****:* Talago Biru, *Chlorella sp*., secondary metabolite, antibacterial

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## INTRODUCTION

Microalgae have been used in the production of biomass, energy production, bioaccumulation of specific compounds as well as a variety of biotransformation processes. The products produced by microalgae is intracellular and extracellular, ranging from simple metabolites to antibiotic complex, toxin pigments as well as a number of other useful products [1].Has many biological active substance that has been extracted from microalgae such as antialga, antiviral activity, and antimicrobial activity such as antibacterial and antifungal.[2]

Antimicrobials are biologically active molecules which are increasingly being used for animal and human health to prevent or treat infections caused by microbes [3]. The content of microalgae which has the activity of amino acids, terpenoids, florotanin, steroids, phenolic, acrylic acid and halogenated ketones can be used as an antimicrobial and anticancer [4]. *Chlorella vulgaris* and *Chlamydomonas pyrenoidosa* has been shown to have antibacterial activity in vitro against gram positive and negative [5].

Other microalgae that has been investigated as antibacterial are*Pithophora oedogonium* extracted using ethanol can inhibit the growth of bacteria *Salmonella and Staphylococcus*sp [6].*Sargassum wightii, Chaetomorpha linum, Padina Gymnospora.* with methanol and acetone extracts can inhibit the growth of bacteria *P. aeruginosa,S. typhi*-B,*Erwinia amylovora, Proteus vulgaris, E. coli*and *S. aureus* [7].*Chlorella sp.*with ethanol extract can inhibit the growth of bacteria *Staphylococcus aureus, Bacillus cereus,Escherichia coli,Pseudomonas aeruginosa, Salmonella typhimurium*and *Yersinia enterocolitica* [8].In this research was conducted to obtain a superior kind of freshwater microalgae derived from Talago Biru, Koto Baru, West Sumatera and observe the antimicrobial capabilities possessed by microalgae which have been isolated.

## MATERIALS AND METHODS

### Materials and Equipment

The materials were used in this study are water samples of microalgae from Talago Biru, Koto Baru, Gram-positive bacteria (*Staphylococcus aureus* and *Bacillus cereus*) and Gram-negative bacteria (*Escherichia coli* and *Salmonella typhii*), Medium BBM ($NaNO_3$(Merck) , $MgSO_4.7H_2O$ (Merck), NaCl(Merck), $K_2HPO_4$ (Merck), $KH_2PO_4$ (Merck), $CaCl_2.2H_2O$ (Merck), $ZnSO_4.7H_2O$ (Merck), $MnCl_2.4H_2O$ (Merck), $MoO_3$ (Merck), $CoSO_4$ $.5H_2O$ (Merck), $Co(NO_3)_2.6H_2O$ (Merck), Qiagen kits for the isolation of DNA, loading dye, DMSO, $H_2SO_4$,technical methanol,Dragendorff reagents, meyer reagents, chloroform, ethanol 70%, $FeCl_3$ 5%, magnesium powder, 37% HCl, 1 N NaOH, Mueller-Hinton agar, Nutrient Agar, discs, *amoxycillin.*

The tools were used are 30 micron filter plankton net, a light microscope (Olympus CX41), Incubators, aerator, autoclave, UV-Vis spectrophotometer (Genesys 20), PCR tools (Polymerase Chain Reaction), electrophoresis apparatus, centrifuges, low temperature refrigerator, micropipette, Eppendorf tubes, vortex.

### Research procedure

### Sampling Microalgae

Samples microalgae were collected from three withdrawal points with a depth of ± 1 meter from the surface of the water collected into onefrom Talago Biru, Koto Baru using a plankton net with 30 micron hole size.[9]

### Isolation and Purification of Microalgae

*Bold Basal Medium*(BBM) was autoclaved at a pressure of 1.2 atm, temperature 121$^o$C. 10 mL water sample was inoculated into 200 ml of medium in a 500-ml bottle, and then incubated with aeration administration. Every two days, the samples that had been grown were checked to see the growth of microalgae using a light microscope, and the dilution series had been done to see the growth. [10]

### Morphological Identification of Microalgae

Morphological identification of microalgae which has been isolated is done microscopically. Observations were carried out regularly under the microscope to make sure that had gotten a single cell.

**Observation of Microalgae Growth**
Isolated microalgae growth is determined by Optical Density (OD) and measured using a spectrophotometer at a wavelength of 450 nm. [10]

**Molecular Identification**
Cells were harvested from 10 mL of liquid culture and DNA was isolated using a Qiagen DNA isolation kit. DNA isolation results were amplificated using PCR amplificationwith 2 mL of genomic DNA, 0.2 mM deoxynucleotide trifospat, 1.25 units of Taq DNA Polymerase and use forward primerChloroF 5'-CCT TGG TGT ATC TTG TTG GTC-3 ' and reverse primer ChloroR 5'-GAA TCA ACC TGA CAA GGC AAC-3 '. For CHLORO amplification, program PCR consisted of 94°C for 3 min followed by 35 cycles of 94°C for 1 min, 59°C for 1 minute, and 72°C for 1 minute, with the cycles of the 10-minute extra at 72°C.DNA amplification product was electrophoresed with 1% agarose gel with a voltage of 101 V using 1x TAE buffer was detected by staining using aloading dye. PCR products were purified with the additionGeneaid Gel / PCR DNA Fragments Extraction Kit [11] and sequencing was done in Macrogen, Korea.

**Phytochemical analysis**
Phytochemical analysis was conducted on the test alkaloids, triterpenoids and steroids, phenols, flavonoids and saponins. The analytical method used is based on Harborne (1987).

**Biomass collection and Making Microalgae Extract**
Liquid cultures of microalgae are dried on a predetermined harvesting, dry by the wind until all the water is gone. Dry biomass was added by ten parts technical methanol, then sonicated for 45 minutes. The filtrate obtained is filtered, the filtering is done several times until methanol is relatively colorless. Methanol was evaporated to obtain a dry extract of microalgae.

**Making suspension Bacteria**
Test bacterias (*E. coli, Staphylococcus aureus, Salmonella typhii, Bacillus cereus*) were cultured on a nutrient agar medium for 24 hours at 37°C, then taken a loopful and suspended into 5 mL LB medium.[12]

**Testing the antibacterial activity**
SterilizedMueller-Hinton agar liquid put into petri dishes 20 mLper each and allowed to solidify at room temperature. Media drip with 200µL test bacterial suspension. Sterile paper disc with a diameter of 5 mm was dropped extract with a volume of 20 mL with a concentration of 10 mg / mL, 100 mg / mL and 500 mg / mL, and then placed on medium and incubated at room temperature for 24 hours. *Amoxycillin* 10 mg/mL was used as positive controland a negative control using DMSO 0.1%. Diameter of inhibition zone measured horizontally and vertically using a scale ruler. [12]

## RESULTS AND DISCUSSION

**Microalgae Morphology and Molecular Identification Results Isolation**
Microalgae isolated from Talago Biru, Koto Baru, West Sumatera and obtained a single dominant isolates live in medium BBM. Isolates were identified morphological and molecular. Results of morphological identification of single isolates are then compared with the morphological data contained on the website Algabase.org data which gathering microalgae that have been studied worldwide in Figure 1.

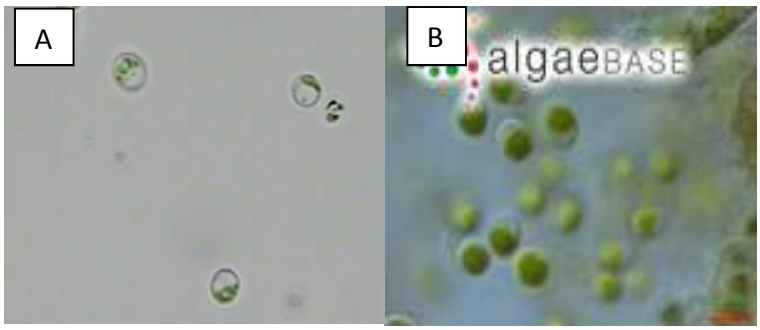


**Figure 1. (A) Morphology of the isolated microalgae 1000x magnification, (B) Morphology Chlorella sp. of Algabase.org**

Judging from their morphological similarity, it can be said that the superior microalgae have been successfully isolated is a type of microalgae *Chlorella sp. Chlorella sp.* is a kind of green microalgae, In Figure 1 (A) it can be seen that the color of isolates is green. The green color signifies *Chlorella sp.* have chlorophyll. *Chlorella sp.* have a size of 3-15 microns and round, a eukaryotic organism which means that already have a cell nucleus and also *Chlorella sp.* does not have flagell [13]. From the result of morphological test we can state that single isolates of microalgae which has been isolated is the type *Chlorella sp.*, The results of morphological identification is confirmed by the results of existing molecular identification. Where the results of the identification of molecular phylogenetic trees obtained stating closest kinship microalgae isolation results can be seen in Figure 2.

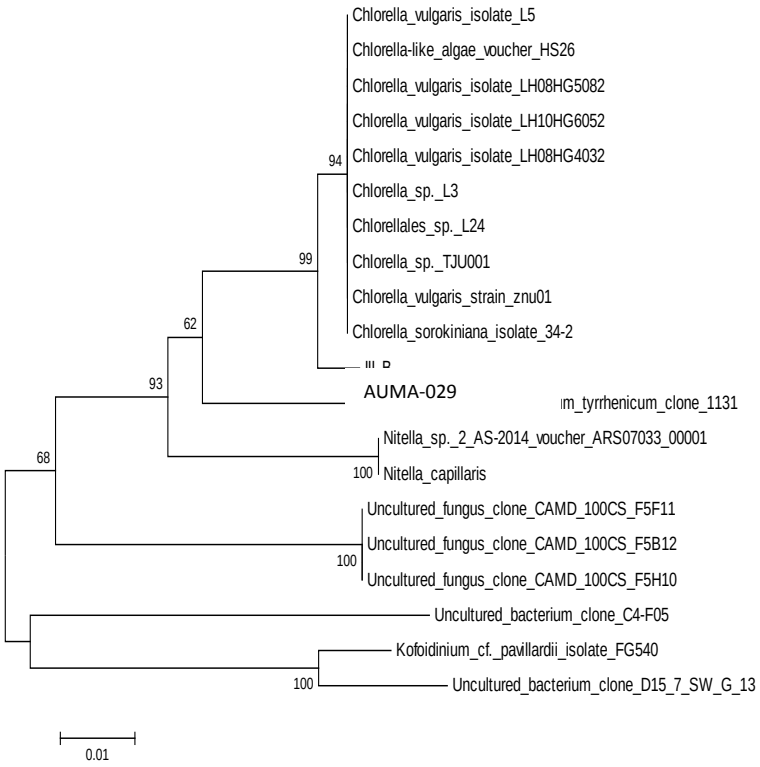


**Figure 2. Results of analysis of phylogenetic trees with MEGA5.1**

Phylogenetic trees obtained from it is seen that isolates AUMA-029 has the closest kinship with *Chlorella sp*. where the similaritypercentage that obtained from Figure 2 is equal to 99%. The percentage of similarity is so great that it can be said that isolates AUMA-029 which was isolated from Talago Biru, Koto Baru is a type of *Chlorella sp* ..

If the results of the identification of this molecular was compared with the result of morphological testit is proved that the isolates AUMA-029 is a group of *Chlorella sp* .. In the morphological testwas seen many similarities between isolates AUMA-029 with microalgae *Chlorella sp*.morphology which contained in the Algaebasedata.The more the similar characteristic, then the closer kinship.[15]

**Microalgae Growth Curve**

Growth is defined as an increase in cell mass and size accompanied by the synthesis of macromolecules that generate new structures[15]. Microalgae growth curve can be seen in Figure 3.

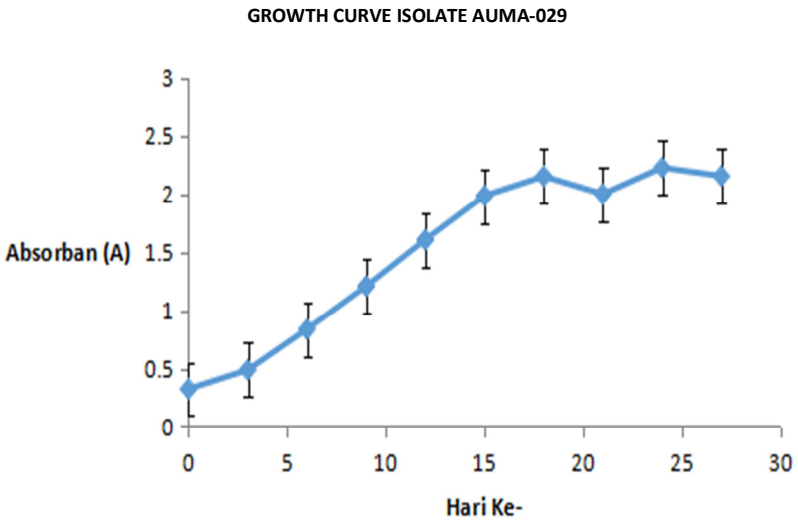


**Figure 3. Isolate growth curve AUMA-029 (SD = 0.64573, n = 3)**

During cultivation, the culture colour of isolated microalgae (AUMA-029) is green. The more dense the number of cell the more green that it looks, it means the microalgae have a lot of green pigment (chlorophyll) [16] in accordance with the results of morphological identification stating isolates AUMA-029 is a type of green alga *Chlorella sp.*

The isolates growth pattern possessed by AUMA-029 starting from the lag phase(adaptation) on days 0-3, followed by a log phase on days 4-15. Metabolism charactheristic during log phase is a high photosynthetic activity for protein formation and the composition of the plasma cells needed for growth. This condition is characterized byincreasing the culture green color than at the start of culture.[15]

Stationary phase cultures experienced at the age of day 16was marked by the increase of cell relatively fixed. In this phase harvesting is done because in this phase secondary metabolites such as organic carbon most commonly produced. Stationary phase that occurs at day 16-24 phase interspersed with the growth rate decreased on day 21, the phase of growth rate decline usually occurs when nutrients, pH, and $CO_2$ contained in the medium began to reach its limits. [17]

Culture began to reach a phase towards death that is on day 25, seen in this phase the amount of precipitation and culture change color to yellow. The cell death caused by nutrient exhaustion and accumulation of specific metabolic or toxic materials.[15]

**Phytochemicals profile**

Phytochemical test against these secondary metabolites are performed for samples that have antimicrobial effects.The samples are containing hydrogen peroxide, terpenoids and bromo ether and according to previous studiesof *Enhalus acoroides*, the compounds were significantly identified as antimicrobial compounds are fatty acid, acrylic acid, halogen aliphatic , terpenes and phenols [18]. When compared with the test results of phytochemical that has been done against the microalgae *Chlorella sp.*whichextracted with methanolin Table 1.

**Table 1. Phytochemicals Test Results Isolate AUMA-029 and *Chlorella vulgaris* (Adhoni et al, 2016)**

| No. | Secondary metabolites | isolates Microalgae AUMA-029 | *chlorella vulgaris* (Adhoni et al, 2016) |
|---|---|---|---|
| 1 | flavonoids | - | + |
| 2 | phenolic | + | + |
| 3 | saponin | + | + |
| 4 | steroids | + | + |
| 5 | triterpenoids | + | + |
| 6 | alkaloids | - | - |

There are differences in the results of flavonoids which in previous studies [19]was detected the presence of flavonoid compounds in microalgae *Chlorella sp.* while in this study flavonoid compound was expressed negative. This difference could have occurred because of secondary metabolites are not always shared by all organisms. Environmental conditions and the stage of development of an organism will induce the formation of secondary metabolites. Secondary metabolites are not directly involved in the growth and development of an organism or the reproductive system. Secondary metabolites appear and work in defense of life and the process of adaptation of an organism. [20]

Bacterial resistance mechanism by phenolic secondary metabolites can be toxic protoplasm, damage and penetrate the cell wall of bacterial cells and precipitate protein. Causing damage to the bacterial cell ends bacterial death. Triterpenoids as antibacterials can react with Porin (transmembrane protein) in the outer membrane of the cell walls of bacteria, forming a strong bond polymer resulting in damage Porin. Damaging Porin which is the doorway to the compound would reduce the permeability of cell walls of bacteria and bacteria will result in nutritional deficiencies, so that bacterial growth is inhibited and even death. Steroids inhibit the growth of bacteria by destroying the bacterial cell membrane [21]. While saponins inhibit bacterial growth by lowering the surface tension of the cell wall and when interacting with the bacterial wall, the wall will be broken. When disturbed surface tension, saponin will enter the cell easily and will disrupt bacterial metabolism and eventually death. [22]

**Antibacterial activity**

Antibacterial activity test performed against Gram-positive bacteria such as *Staphylococcus aureus* and *Bacillus cereus* as well as Gram-negative bacteria, namely *Escherichia coli* and *Salmonella typhii.* The results are presented in Table 2.Observations were made after incubation for 24 hours.

**Table 2, The antibacterial activity of isolates AUMA-029 with methanol**

| Concentration of Extracts | Inhibition Zones | | | |
|---|---|---|---|---|
| | *E.coli* | *Salmonella typhi* | *Staphylococcus aureus* | *Bacillus cereus* |
| 10µg / mL | 8 mm | 10.5 mm | 9 mm | 10 mm |
| 100µg / mL | 10 mm | 9 mm | 9 mm | 10 mm |
| 500µg / mL | 12 mm | 9 mm | 10 mm | 11 mm |
| control + (Amoxycillin 10µg / mL) | 10 mm | 9 mm | 10 mm | 10 mm |
| control - | 7 mm | 0 mm | 7 mm | 6 mm |

From the measurement results shows that the clear zone on the test bacteria *E. coli*, *S. aureus* and *B.cereus*give the greatest inhibition zone is shown at a concentration of 500 ug / mL while on *S.typhii*the largest inhibition zone has been seen at a concentration of 10 ug / mL. Differences in increasing and decreasing zones of inhibition against the concentration of the extract is due to the component substances that contained in medicinal plants can be mutually weaken, strengthen, improve or change at all. Giving concentrations lower or higher than the concentration required to kill bacteria can also inhibit the antibacterial activity against the antibiotics given so that the bacteria will be resistence.This vulnerability is caused due to bacteria can produce enzymes that can perform antimicrobial inactivation and disruption of cell membrane permeability thus not achieving an effective antimicrobial concentrations in the cell as well as the modification of the molecules in the cell which is the target of antimicrobials. [23]

When compared with previous studies that have been conducted on microalgae *Chlorella vulgaris* were extracted by using methanol in Table 3 shows that the bacteria that form potential barriers are relatively low.

**Table 3. Results of Antibacterial Activity of *Chlorella vulgaris* with Solvent Methanol[18,28]**

| No. | Bacteria Test | Inhibition Zones By *Chlorella vulgaris* |
|---|---|---|
| 1 | *E.coli (Syed, 2015)* | 15 mm |
| 2 | *S.aureus (Salem, 2014)* | 17 mm |
| 3 | *B.cereus (Salem, 2014)* | 17.5 mm |

This low potency can be caused by the extract which has been obtained is crude extracts and effectiveness are small. This smalleffectiveness presumably because least of the content from active compound has a similar structure to the antibiotics commonly used to inhibit the growth of the test bacteria used, the age of the bacteria and environmental conditions. [6]

Isolates AUMA-029which is a microalgae *Chlorella sp.* has potential as an antibacterial, because the content of metabolites contained in them either the content of primary and secondary metabolites. The most important antibacterial compounds owned by *Chlorella sp.* which is a mixture of fatty acids known as *chlorellin*, this compound is able to inhibit the growth of Gram positive and Gram negative. The methanol extract of *Chlorella sp*. can inhibit the growth of bacteria *Bacillus cereus* and *E. coli*[24]. The mechanism of inhibition of bacterial growth by a fatty acid that is by attacking and destroying the cell membrane of the bacteria causing the lysis of the bacterial cell, and also these fatty acids will reduce nutrient and inhibits cellular respiration. [25]

Besides containing *chlorellin* as an antibacterial agent, *Chlorella sp.*also containing secondary metabolites such as phenolic , terpenoids, steroids and saponins as an antibacterial agent. Chlorophyll that contained in *Chlorella sp*. can also act as an antibacterial compound. Chlorophyll does not have a bactericidal effect (kill microorganisms) but chlorophyll has the ability bacteriostatic (inhibits the growth of microorganisms), but that under the suitable environmental conditions chlorophyll can also have a bactericidal effect. [24]

In Table 3 shows that the negative control also provides an inhibitory effect on *E. coli*, *Staphylococcus aureus* and *Bacillus cereus.* This is because DMSO is toxic to bacteria.*Dimethyl sulfoxide* (DMSO) is an aprotic solvent that can dissolve both polar and non-polar compounds, therefore it is widely used as a solvent on antimicrobial testing [26]. DMSO 1%can kill 2-10% bacteria, therefore it is recommended to use DMSO in low concentrations at the time of dissolving the antibacterial test extract, to not give effect against bacteria inhibition test. Recommended concentration of DMSO is 0.01% - 0.5% . [27]

## CONCLUSION

The research shown the dominant type of microalgae that live in medium BBMwhich was isolated from Talago Biru, Koto Baru, West Sumatera is a genus *Chlorella sp.* and the best harvesting time for this microalgae is on the day 20 in the stationary phase. Profile phytochemicals result shown the contained in this isolate are positive phenolic, saponin, steroids and triterpenoid, while alkaloids and flavonoids give negative results. The isolate have potential as a an antibacterial, seen from the test results provided by the zone of inhibition against four bacterial isolates tested, but the activity is low.

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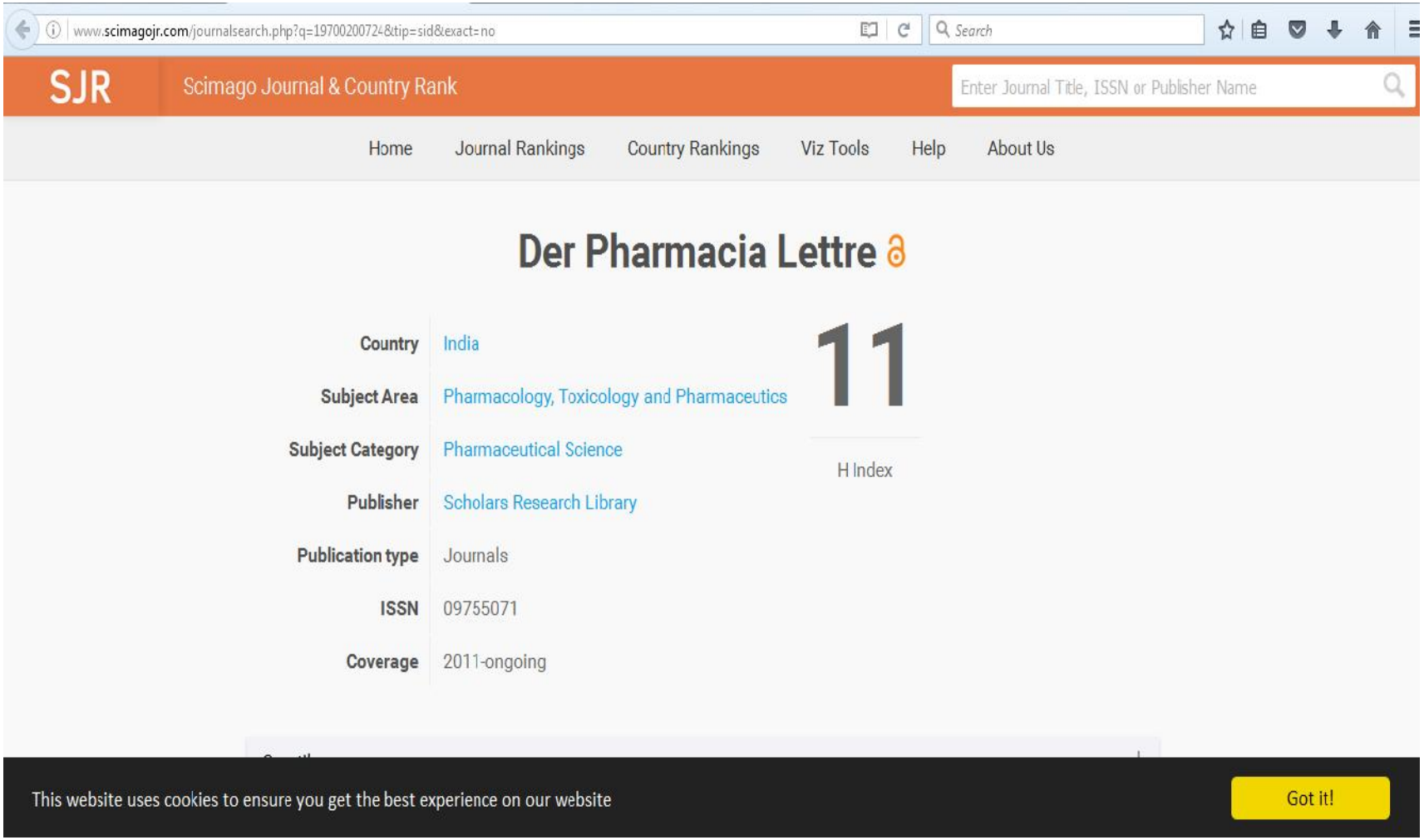
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| 30 | Bioorganic and Medicinal Chemistry Letters | journal | ISSN 14643405, 0960894X | 0.952 | Q1 | 112 | 1175 | 4051 |
| 31 | Drug Design, Development and Therapy | journal | ISSN 11778881 | 0.931 | Q1 | 26 | 525 | 435 |
| 32 | Drug Testing and Analysis | journal | ISSN 19427611, 19427603 | 0.804 | Q1 | 28 | 191 | 461 |
| 33 | Drug metabolism and pharmacokinetics | journal | ISSN 13474367 | 0.78 | Q1 | 49 | 69 | 239 |

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| 34 | Current Pharmaceutical Biotechnology | journal | ISSN 13892010 | 0.769 | Q1 | 59 | 132 | 538 |
| 35 | Therapeutic delivery | journal | ISSN 20416008, 20415990 | 0.768 | Q1 | 20 | 124 | 385 |
| 36 | Journal of Drug Targeting | journal | ISSN 1061186X, 10292330 | 0.749 | Q1 | 69 | 95 | 272 |
| 37 | BioImpacts | journal | ISSN 22285660, 22285652 | 0.721 | Q1 | 11 | 31 | 90 |
| 38 | International Journal of Genomics | journal | ISSN 23144378, 2314436X | 0.721 | Q1 | 7 | 68 | 89 |
| 39 | AAPS PharmSciTech | journal | ISSN 15221059, 15309932 | 0.718 | Q1 | 54 | 219 | 497 |
| 40 | Biopharmaceutics and Drug Disposition | journal | ISSN 1099081X, 01422782 | 0.715 | Q1 | 44 | 65 | 163 |
| 41 | Pharmaceutics | journal | ISSN 19994923 | 0.707 | Q1 | 16 | 37 | 106 |
| 42 | Drug Delivery and Translational Research | journal | ISSN 2190393X, 21903948 | 0.703 | Q1 | 15 | 52 | 148 |
| 43 | Planta Medica | journal | ISSN 00320943, 14390221 | 0.702 | Q1 | 89 | 210 | 697 |
| 44 | Cancer Nanotechnology | journal | ISSN 18686966, 18686958 | 0.701 | Q1 | 9 | 3 | 30 |
| 45 | Journal of Pharmacy and Pharmacology | journal | ISSN 00223573 | 0.686 | Q1 | 89 | 206 | 574 |
| 46 | Journal of Pharmacy and Pharmaceutical Scienc | journal | ISSN 14821826 | 0.682 | Q1 | 59 | 49 | 139 |
| 47 | Drug Delivery | journal | ISSN 10717544 | 0.662 | Q1 | 40 | 170 | 155 |
| 48 | Biological and Pharmaceutical Bulletin | journal | ISSN 09186158, 13475215 | 0.644 | Q1 | 88 | 265 | 967 |
| 49 | Archiv der Pharmazie | journal | ISSN 15214184, 03656233 | 0.628 | Q1 | 43 | 112 | 302 |
| 50 | Research in Social and Administrative Pharmacy | journal | ISSN 15517411 | 0.62 | Q1 | 25 | 130 | 244 |
| 51 | Journal of Natural Medicines | journal | ISSN 13403443, 18610293 | 0.602 | Q2 | 28 | 57 | 333 |
| 52 | Journal of Texture Studies | journal | ISSN 00224901 | 0.578 | Q2 | 40 | 55 | 143 |
| 53 | Journal of Liposome Research | journal | ISSN 15322394, 08982104 | 0.575 | Q2 | 35 | 38 | 110 |
| 54 | International Journal of Clinical Pharmacy | journal | ISSN 22107703, 22107711 | 0.575 | Q2 | 43 | 138 | 455 |
| 55 | Recent Patents on Drug Delivery and Formulatic | journal | ISSN 18722113 | 0.574 | Q2 | 24 | 24 | 65 |
| 56 | IEEE Transactions on Nanobioscience | journal | ISSN 15361241 | 0.572 | Q2 | 46 | 86 | 149 |
| 57 | Saudi Pharmaceutical Journal | journal | ISSN 13190164 | 0.552 | Q2 | 20 | 154 | 202 |
| 58 | Pharmaceutical Biology | journal | ISSN 17445116, 13880209 | 0.543 | Q2 | 43 | 262 | 632 |
| 59 | International Journal of Cosmetic Science | journal | ISSN 01425463, 14682494 | 0.534 | Q2 | 41 | 96 | 245 |
| 60 | Journal of Pharmaceutical Innovation | journal | ISSN 18725120 | 0.524 | Q2 | 17 | 25 | 91 |
| 61 | Journal of Microencapsulation | journal | ISSN 14645246, 02652048 | 0.511 | Q2 | 59 | 89 | 260 |
| 62 | Pharmaceutical Development and Technology | journal | ISSN 10979867, 10837450 | 0.508 | Q2 | 43 | 123 | 361 |
| 63 | Current Drug Delivery | journal | ISSN 15672018 | 0.506 | Q2 | 45 | 83 | 220 |
| 64 | Acta Pharmaceutica | journal | ISSN 13300075 | 0.485 | Q2 | 41 | 40 | 120 |
| 65 | Statistics in Biopharmaceutical Research | journal | ISSN 19466315 | 0.482 | Q2 | 6 | 34 | 103 |
| 66 | Asian Journal of Pharmaceutical Sciences | journal | ISSN 18180876 | 0.464 | Q2 | 11 | 57 | 117 |
| 67 | Open Drug Delivery Journal | journal | ISSN 18741266 | 0.458 | Q2 | 5 | 0 | 1 |
| 68 | Die Pharmazie | journal | ISSN 00317144 | 0.428 | Q2 | 47 | 122 | 514 |
| 69 | International Journal of Pharmacy Practice | journal | ISSN 09617671 | 0.428 | Q2 | 28 | 88 | 198 |
| 70 | Journal of Advanced Pharmaceutical Technology | journal | ISSN 09762094, 01105558 | 0.427 | Q2 | 15 | 40 | 104 |

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| 71 | Pharmacy Practice | journal | ISSN 1885642X, 18863655 | 0.422 | Q2 | 12 | 33 | 102 |
| 72 | Clinical Pharmacology in Drug Development | journal | ISSN 21607648, 2160763X | 0.406 | Q2 | 7 | 67 | 145 |
| 73 | Results in Pharma Sciences | journal | ISSN 22112863 | 0.404 | Q2 | 7 | 1 | 22 |
| 74 | Pharmacognosy Magazine | journal | ISSN 09764062, 09731296 | 0.376 | Q2 | 19 | 78 | 241 |
| 75 | Molecular and Cellular Pharmacology | journal | ISSN 19381247 | 0.372 | Q2 | 15 | 0 | 23 |
| 76 | Journal of Nanomedicine and Nanotechnology | journal | ISSN 21577439 | 0.372 | Q2 | 10 | 0 | 109 |
| 77 | Indian Journal of Pharmaceutical Sciences | journal | ISSN 19983743, 0250474X | 0.371 | Q2 | 40 | 120 | 305 |
| 78 | Pharmaceutical patent analyst | journal | ISSN 20468962 | 0.369 | Q2 | 7 | 13 | 130 |
| 79 | Scientia Pharmaceutica | journal | ISSN 00368709 | 0.367 | Q2 | 23 | 40 | 210 |
| 80 | Journal of Asian Natural Products Research | journal | ISSN 14772213, 10286020 | 0.356 | Q2 | 28 | 194 | 528 |
| 81 | Applied and Translational Genomics | journal | ISSN 22120661 | 0.355 | Q2 | 3 | 42 | 55 |
| 82 | Journal of Excipients and Food Chemicals | journal | ISSN 21502668 | 0.347 | Q2 | 9 | 11 | 53 |
| 83 | Letters in Drug Design and Discovery | journal | ISSN 15701808 | 0.338 | Q2 | 20 | 102 | 396 |
| 84 | Acta Poloniae Pharmaceutica | journal | ISSN 00016837 | 0.335 | Q2 | 26 | 147 | 439 |
| 85 | Journal of Pharmaceutical Investigation | journal | ISSN 20936214, 20935552 | 0.331 | Q2 | 6 | 64 | 146 |
| 86 | Asian Journal of Pharmaceutical and Clinical Re | journal | ISSN 09742441 | 0.326 | Q2 | 16 | 453 | 1222 |
| 87 | Pakistan Journal of Pharmaceutical Sciences | journal | ISSN 1011601X | 0.316 | Q2 | 28 | 334 | 628 |
| 88 | Drug Metabolism Letters | journal | ISSN 18723128 | 0.312 | Q2 | 20 | 18 | 72 |
| 89 | Dissolution Technologies | journal | ISSN 1521298X | 0.3 | Q2 | 14 | 32 | 95 |
| 90 | Journal of Liquid Chromatography and Related T | journal | ISSN 1520572X, 10826076 | 0.299 | Q2 | 41 | 216 | 670 |
| 91 | Artificial Cells, Nanomedicine and Biotechnology | journal | ISSN 21691401, 2169141X | 0.297 | Q2 | 28 | 52 | 169 |
| 92 | Open Medicinal Chemistry Journal | journal | ISSN 18741045 | 0.294 | Q2 | 11 | 3 | 14 |
| 93 | Current Nanoscience | journal | ISSN 15734137 | 0.283 | Q2 | 30 | 104 | 397 |
| 94 | International Journal of Pharmacy and Pharmac | journal | ISSN 09751491 | 0.282 | Q2 | 24 | 939 | 3740 |
| 95 | PDA Journal of Pharmaceutical Science and Tec | journal | ISSN 10797440 | 0.276 | Q2 | 28 | 0 | 177 |
| 96 | Canadian Pharmacists Journal | journal | ISSN 17151635 | 0.276 | Q2 | 12 | 61 | 265 |
| 97 | Tropical Journal of Pharmaceutical Research | journal | ISSN 15965996 | 0.268 | Q2 | 20 | 308 | 573 |
| 98 | Journal of Drug Delivery Science and Technolog | journal | ISSN 17732247 | 0.254 | Q2 | 31 | 116 | 257 |
| 99 | Journal of Pharmacy Research | journal | ISSN 09746943, 00974694 | 0.253 | Q2 | 8 | 0 | 313 |
| 100 | Annales Pharmaceutiques Francaises | journal | ISSN 00034509 | 0.248 | Q2 | 17 | 63 | 145 |
| 101 | Journal of Exercise Science and Fitness | journal | ISSN 1728869X | 0.238 | Q3 | 14 | 17 | 47 |
| 102 | International Journal of PharmTech Research | journal | ISSN 09744304 | 0.23 | Q3 | 28 | 365 | 745 |
| 103 | International Journal of Green Pharmacy | journal | ISSN 19984103, 09738258 | 0.229 | Q3 | 13 | 30 | 163 |
| 104 | Procedia in Vaccinology | journal | ISSN 1877282X | 0.226 | Q3 | 7 | 0 | 21 |
| 105 | Current Pharmaceutical Analysis | journal | ISSN 15734129 | 0.225 | Q3 | 18 | 41 | 128 |
| 106 | Dhaka University Journal of Pharmaceutical Scie | journal | ISSN 18161839, 18161820 | 0.225 | Q3 | 8 | 16 | 87 |
| 107 | International Journal of Drug Delivery Technolog | journal | ISSN 09754415 | 0.216 | Q3 | 4 | 20 | 40 |

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| 108 | Pharmaceutical Engineering | journal | ISSN 02738139 | 0.215 | Q3 | 11 | 53 | 180 |
| 109 | Turkish Journal of Pharmaceutical Sciences | journal | ISSN 1304530X | 0.215 | Q3 | 8 | 22 | 117 |
| 110 | American Pharmaceutical Review | journal | ISSN 10998012 | 0.212 | Q3 | 17 | 66 | 218 |
| 111 | Journal of Pharmaceutical Negative Results | journal | ISSN 09769234, 22297723 | 0.196 | Q3 | 3 | 8 | 25 |
| 112 | Clinical Medicine Insights: Therapeutics | journal | ISSN 1179559X | 0.195 | Q3 | 5 | 8 | 39 |
| 113 | International Journal of Applied Pharmaceutics | journal | ISSN 09757058 | 0.194 | Q3 | 5 | 8 | 28 |
| 114 | International Journal of Pharmaceutical Science | journal | ISSN 0976044X | 0.193 | Q3 | 16 | 596 | 1483 |
| 115 | International Journal of Drug Delivery | journal | ISSN 09750215 | 0.192 | Q3 | 8 | 9 | 106 |
| **116** | **Der Pharmacia Lettre** | **journal** | **ISSN 09755071** | **0.19** | **Q3** | **11** | **539** | **807** |
| 117 | Pharmaceutical Care Espana | journal | ISSN 11396202 | 0.189 | Q3 | 8 | 30 | 107 |
| 118 | Farmacevtski Vestnik | journal | ISSN 00148229 | 0.189 | Q3 | 4 | 68 | 164 |
| 119 | Pharmaceutical Care and Research | journal | ISSN 16712838 | 0.189 | Q3 | 6 | 149 | 477 |
| 120 | Korean Journal of Pharmacognosy | journal | ISSN 02533073 | 0.185 | Q3 | 12 | 51 | 101 |
| 121 | Journal of Chinese Pharmaceutical Sciences | journal | ISSN 10031057 | 0.184 | Q3 | 6 | 108 | 265 |
| 122 | Journal of Pharmaceutical Sciences and Resear | journal | ISSN 09751459 | 0.169 | Q3 | 15 | 257 | 233 |
| 123 | International Journal of Green Nanotechnology | journal | ISSN 19430906, 19430892 | 0.167 | Q3 | 1 | 0 | 13 |
| 124 | Pharmacy Education | journal | ISSN 14772701, 15602214 | 0.165 | Q3 | 13 | 43 | 51 |
| 125 | International Journal of Current Pharmaceutical | journal | ISSN 0976822X | 0.165 | Q3 | 5 | 43 | 37 |
| 126 | Acta Farmaceutica Bonaerense | journal | ISSN 03262383 | 0.162 | Q3 | 18 | 271 | 765 |
| 127 | International Journal of Research in Ayurveda ar | journal | ISSN 22774343, 22293566 | 0.162 | Q3 | 4 | 3 | 512 |
| 128 | Journal of Generic Medicines | journal | ISSN 17411343 | 0.16 | Q3 | 11 | 12 | 85 |
| 129 | Jordan Journal of Pharmaceutical Sciences | journal | ISSN 19957157 | 0.157 | Q3 | 6 | 18 | 63 |
| 130 | Ceska a Slovenska Farmacie | journal | ISSN 12107816 | 0.155 | Q3 | 13 | 20 | 122 |
| 131 | Open Vaccine Journal | journal | ISSN 18750354 | 0.154 | Q3 | 7 | 0 | 6 |
| 132 | Farmatsija | journal | ISSN 04280296 | 0.149 | Q3 | 4 | 16 | 51 |
| 133 | Journal of Bioequivalence and Bioavailability | journal | ISSN 09750851 | 0.147 | Q3 | 6 | 0 | 120 |
| 134 | Pharmaceutical Technology | journal | ISSN 15432521 | 0.145 | Q3 | 30 | 140 | 532 |
| 135 | Open Pharmacology Journal | journal | ISSN 18741436 | 0.144 | Q3 | 4 | 0 | 9 |
| 136 | Chinese Pharmaceutical Journal | journal | ISSN 10012494 | 0.143 | Q3 | 17 | 417 | 1420 |
| 137 | International Journal of Pharmaceutical Science | journal | ISSN 09754725 | 0.14 | Q3 | 6 | 0 | 66 |
| 138 | Current Trends in Biotechnology and Pharmacy | journal | ISSN 09738916 | 0.138 | Q3 | 8 | 33 | 131 |
| 139 | Systematic Reviews in Pharmacy | journal | ISSN 09758453 | 0.136 | Q3 | 7 | 1 | 14 |
| 140 | International Journal of Pharmaceutical Compou | journal | ISSN 10924221 | 0.135 | Q3 | 6 | 48 | 229 |
| 141 | Journal of Bioanalysis and Biomedicine | journal | ISSN 1948593X | 0.135 | Q3 | 6 | 0 | 66 |
| 142 | Journal of Chemical and Pharmaceutical Resear | journal | ISSN 09757384 | 0.135 | Q3 | 21 | 2 | 3533 |
| 143 | Revista de Ciencias Farmaceuticas Basica e Ap | journal | ISSN 18084532 | 0.131 | Q3 | 10 | 1 | 238 |
| 144 | Chinese Traditional and Herbal Drugs | journal | ISSN 02532670 | 0.13 | Q3 | 10 | 565 | 1836 |

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| 145 | International Journal of Green Nanotechnology: | journal | ISSN 1943085X, 19430906 | 0.13 | Q3 | 7 | 0 | 64 |
| 146 | Indian Drugs | journal | ISSN 0019462X | 0.123 | Q3 | 29 | 0 | 147 |
| 147 | Journal of Pharmacy Technology | journal | ISSN 87551225 | 0.123 | Q3 | 8 | 42 | 116 |
| 148 | Journal of Chemical and Pharmaceutical Scienc | journal | ISSN 09742115 | 0.123 | Q3 | 3 | 520 | 241 |
| 149 | European Journal of Parenteral and Pharmaceu | journal | ISSN 17406277, 09644679 | 0.121 | Q4 | 3 | 0 | 68 |
| 150 | Pharmazeutische Industrie | journal | ISSN 0031711X, 16167074 | 0.12 | Q4 | 16 | 267 | 726 |
| 151 | Journal of China Pharmaceutical University | journal | ISSN 10005048 | 0.12 | Q4 | 12 | 101 | 307 |
| 152 | Revista Cubana de Farmacia | journal | ISSN 00347515, 15612988 | 0.119 | Q4 | 5 | 64 | 168 |
| 153 | BioPharm International | journal | ISSN 1542166X | 0.118 | Q4 | 21 | 96 | 370 |
| 154 | SA Pharmaceutical Journal | journal | ISSN 10151362 | 0.116 | Q4 | 3 | 100 | 348 |
| 155 | Klinicka Farmakologie a Farmacie | journal | ISSN 12127973, 18035353 | 0.115 | Q4 | 3 | 38 | 114 |
| 156 | International Journal of Pharmaceutical and Clin | journal | ISSN 09751556 | 0.115 | Q4 | 4 | 60 | 108 |
| 157 | Bulletin of Pharmaceutical Sciences | journal | ISSN 11100052 | 0.115 | Q4 | 4 | 0 | 18 |
| 158 | Farmaceutski Glasnik | journal | ISSN 00148202 | 0.113 | Q4 | 5 | 56 | 227 |
| 159 | Ars Pharmaceutica | journal | ISSN 00042927 | 0.112 | Q4 | 14 | 25 | 93 |
| 160 | Actualites Pharmaceutiques Hospitalieres | journal | ISSN 17697344 | 0.112 | Q4 | 2 | 0 | 3 |
| 161 | Thai Journal of Pharmaceutical Sciences | journal | ISSN 01254685 | 0.112 | Q4 | 8 | 21 | 194 |
| 162 | Orphan Drugs: Research and Reviews | journal | ISSN 22306161 | 0.112 | Q4 | 1 | 10 | 2 |
| 163 | Anales de la Real Academia Nacional de Farma | journal | ISSN 16974271, 1697428X | 0.111 | Q4 | 7 | 39 | 102 |
| 164 | Pharmakeftiki | journal | ISSN 11054999 | 0.111 | Q4 | 2 | 8 | 39 |
| 165 | Eurasian Journal of Analytical Chemistry | journal | ISSN 13063057 | 0.111 | Q4 | 3 | 15 | 38 |
| 166 | U.S. Pharmacist | journal | ISSN 01484818 | 0.11 | Q4 | 5 | 181 | 459 |
| 167 | Journal of International Pharmaceutical Researc | journal | ISSN 16740440 | 0.11 | Q4 | 6 | 152 | 447 |
| 168 | Yakugaku Zasshi | journal | ISSN 00316903 | 0.109 | Q4 | 32 | 188 | 375 |
| 169 | Iranian Journal of Pharmaceutical Sciences | journal | ISSN 17352444 | 0.109 | Q4 | 5 | 0 | 83 |
| 170 | Pharmaceutical Journal | journal | ISSN 00316873 | 0.107 | Q4 | 24 | 347 | 1135 |
| 171 | Journal de Pharmacie de Belgique | journal | ISSN 00472166 | 0.107 | Q4 | 11 | 21 | 95 |
| 172 | Acta Pharmaceutica Hungarica | journal | ISSN 00016659 | 0.106 | Q4 | 10 | 13 | 52 |
| 173 | Open Bioactive Compounds Journal | journal | ISSN 18748473 | 0.106 | Q4 | 5 | 0 | 4 |
| 174 | Pharmaceutical Outsourcing | journal | ISSN 19453337, 19453345 | 0.106 | Q4 | 4 | 15 | 119 |
| 175 | Clinical Research and Regulatory Affairs | journal | ISSN 10601333, 15322521 | 0.105 | Q4 | 12 | 15 | 24 |
| 176 | Revista Mexicana de Ciencias Farmaceuticas | journal | ISSN 10273956 | 0.105 | Q4 | 4 | 0 | 68 |
| 177 | Ankara Universitesi Eczacilik Fakultesi Dergisi | journal | ISSN 10153918 | 0.104 | Q4 | 6 | 0 | 6 |
| 178 | Farmaceutico Hospitales | journal | ISSN 02144697 | 0.104 | Q4 | 3 | 0 | 10 |
| 179 | EBR - European Biopharmaceutical Review | journal | ISSN 13690663 | 0.103 | Q4 | 3 | 0 | 165 |
| 180 | Journal of Global Pharma Technology | journal | ISSN 09758542 | 0.103 | Q4 | 7 | 0 | 52 |
| 181 | Manufacturing Chemist | journal | ISSN 02624230 | 0.102 | Q4 | 5 | 16 | 364 |

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| 182 | Pharmazie in Unserer Zeit | journal | ISSN 00483664, 16151003 | 0.102 | Q4 | 9 | 0 | 78 |
| 183 | Journal of Pharmacy of Istanbul University | journal | ISSN 03677524 | 0.102 | Q4 | 4 | 0 | 10 |
| 184 | Pharmaceutical biotechnology | journal | ISSN 10780467, 10058915 | 0.101 | Q4 | 21 | 0 | 310 |
| 185 | Anales de la Real Academia Nacional de Medici | journal | ISSN 00340634 | 0.101 | Q4 | 6 | 0 | 36 |
| 186 | Pharmaceutical Technology Europe | journal | ISSN 01646826 | 0.101 | Q4 | 14 | 146 | 284 |
| 187 | Fabad Journal of Pharmaceutical Sciences | journal | ISSN 13004182 | 0.101 | Q4 | 10 | 0 | 23 |
| 188 | PZ Prisma | journal | ISSN 09455566 | 0.1 | Q4 | 5 | 30 | 105 |
| 189 | Drug Topics | journal | ISSN 00126616 | 0.1 | Q4 | 7 | 288 | 742 |
| 190 | EPC - European Pharmaceutical Contractor | journal | ISSN 1364369X | 0.1 | Q4 | 2 | 19 | 176 |
| 191 | Farmaceuticky Obzor | journal | ISSN 00148172 | 0.1 | Q4 | 6 | 0 | 77 |
| 192 | S.T.P. Pharma Pratiques | journal | ISSN 11571497 | 0.1 | Q4 | 10 | 0 | 104 |
| 193 | Arhiv za Farmaciju | journal | ISSN 00041963 | 0.1 | Q4 | 2 | 0 | 107 |
| 194 | Drug Delivery System | journal | ISSN 09135006 | 0.1 | Q4 | 2 | 53 | 90 |

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| 24836 | 7585 | 436 | 15.97 | 118.83 | Netherlands |
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| 2405 | 839 | 270 | 3.29 | 41.47 | United States |
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| 17478 | 3292 | 751 | 4.13 | 54.62 | Netherlands |
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| 9874 | 2561 | 761 | 3.24 | 42.74 | United States |
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| 5249 | 320 | 152 | 1.94 | 30.88 | United Kingdo |
| 8846 | 1677 | 932 | 1.68 | 33.38 | Japan |
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| 943 | 116 | 99 | 1.07 | 28.58 | Spain |
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| 599 | 33 | 47 | 0.5 | 35.24 | China |
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| 908 | 69 | 161 | 0.4 | 30.27 | India |
| 0 | 14 | 21 | 0 | 0 | Netherlands |
| 1380 | 84 | 125 | 0.9 | 33.66 | Netherlands |
| 301 | 19 | 86 | 0.14 | 18.81 | Bangladesh |
| 509 | 17 | 40 | 0.33 | 25.45 | India |

| | | | | | |
|---|---|---|---|---|---|
| 515 | 32 | 156 | 0.17 | 9.72 | United States |
| 746 | 47 | 114 | 0.21 | 33.91 | Turkey |
| 782 | 67 | 203 | 0.28 | 11.85 | United States |
| 141 | 12 | 25 | 0.48 | 17.63 | India |
| 684 | 17 | 39 | 0.65 | 85.5 | New Zealand |
| 202 | 15 | 28 | 0.67 | 25.25 | India |
| 16708 | 454 | 1483 | 0.32 | 28.03 | India |
| 207 | 43 | 106 | 0.44 | 23 | United States |
| **13602** | **354** | **807** | **0.44** | **25.24** | **India** |
| 459 | 8 | 85 | 0.1 | 15.3 | Spain |
| 1397 | 8 | 152 | 0.08 | 20.54 | Slovenia |
| 1329 | 37 | 476 | 0.07 | 8.92 | China |
| 1396 | 38 | 101 | 0.38 | 27.37 | South Korea |
| 2745 | 97 | 260 | 0.35 | 25.42 | China |
| 5712 | 76 | 233 | 0.28 | 22.23 | India |
| 0 | 5 | 11 | 0.5 | 0 | United Kingdo |
| 945 | 16 | 51 | 0.29 | 21.98 | Netherlands |
| 1384 | 11 | 37 | 0.24 | 32.19 | India |
| 6158 | 232 | 757 | 0.31 | 22.72 | Argentina |
| 107 | 85 | 512 | 0.18 | 35.67 | India |
| 217 | 14 | 74 | 0.14 | 18.08 | United Kingdo |
| 505 | 13 | 63 | 0.17 | 28.06 | Jordan |
| 511 | 26 | 115 | 0.24 | 25.55 | Czech Republ |
| 0 | 3 | 5 | 0 | 0 | Netherlands |
| 627 | 8 | 51 | 0.17 | 39.19 | Bulgaria |
| 0 | 46 | 88 | 0.56 | 0 | United States |
| 611 | 41 | 499 | 0.07 | 4.36 | United States |
| 0 | 3 | 8 | 0 | 0 | Netherlands |
| 7277 | 247 | 1420 | 0.2 | 17.45 | China |
| 0 | 16 | 66 | 0 | 0 | India |
| 968 | 25 | 131 | 0.15 | 29.33 | India |
| 31 | 3 | 14 | 0.29 | 31 | India |
| 0 | 55 | 223 | 0.24 | 0 | United States |
| 0 | 16 | 44 | 0.27 | 0 | United States |
| 207 | 943 | 3532 | 0.2 | 103.5 | India |
| 24 | 45 | 238 | 0.16 | 24 | Brazil |
| 4845 | 273 | 1663 | 0.14 | 8.58 | China |

| | | | | | |
|---|---|---|---|---|---|
| 0 | 25 | 63 | 0 | 0 | United States |
| 0 | 19 | 147 | 0.08 | 0 | India |
| 908 | 16 | 113 | 0.14 | 21.62 | United States |
| 6617 | 31 | 241 | 0.11 | 12.73 | India |
| 0 | 6 | 56 | 0.11 | 0 | United Kingdo |
| 1997 | 16 | 705 | 0.03 | 7.48 | Germany |
| 2397 | 50 | 307 | 0.16 | 23.73 | China |
| 1533 | 8 | 157 | 0.05 | 23.95 | Cuba |
| 418 | 35 | 347 | 0.07 | 4.35 | United States |
| 795 | 18 | 223 | 0.05 | 7.95 | South Africa |
| 672 | 6 | 99 | 0.06 | 17.68 | Czech Republ |
| 1596 | 19 | 108 | 0.16 | 26.6 | Australia |
| 0 | 3 | 17 | 0 | 0 | Egypt |
| 296 | 4 | 186 | 0.02 | 5.29 | Croatia |
| 777 | 5 | 90 | 0.03 | 31.08 | Spain |
| 0 | 0 | 2 | 0 | 0 | Netherlands |
| 513 | 16 | 192 | 0.13 | 24.43 | Thailand |
| 924 | 0 | 2 | 0 | 92.4 | New Zealand |
| 1536 | 3 | 84 | 0.03 | 39.38 | Spain |
| 509 | 1 | 34 | 0 | 63.63 | Greece |
| 357 | 7 | 38 | 0.15 | 23.8 | Turkey |
| 3006 | 24 | 375 | 0.07 | 16.61 | United States |
| 3912 | 34 | 445 | 0.09 | 25.74 | China |
| 3959 | 60 | 309 | 0.19 | 21.06 | Japan |
| 0 | 10 | 82 | 0.14 | 0 | Iran |
| 787 | 15 | 466 | 0.03 | 2.27 | United Kingdo |
| 0 | 15 | 85 | 0.29 | 0 | Belgium |
| 276 | 6 | 52 | 0.11 | 21.23 | Hungary |
| 0 | 1 | 4 | 0.25 | 0 | Netherlands |
| 123 | 4 | 101 | 0.04 | 8.2 | United States |
| 767 | 9 | 20 | 0.42 | 51.13 | United States |
| 0 | 4 | 60 | 0.1 | 0 | Mexico |
| 0 | 0 | 6 | 0 | 0 | Turkey |
| 0 | 0 | 6 | 0 | 0 | Spain |
| 0 | 2 | 158 | 0.02 | 0 | United Kingdo |
| 0 | 1 | 52 | 0 | 0 | India |
| 51 | 1 | 324 | 0 | 3.19 | United Kingdo |

| | | | | | |
|---|---|---|---|---|---|
| 0 | 4 | 66 | 0 | 0 | Germany |
| 0 | 0 | 10 | 0 | 0 | Turkey |
| 0 | 9 | 310 | 0.04 | 0 | United States |
| 0 | 0 | 36 | 0 | 0 | Spain |
| 747 | 1 | 221 | 0.01 | 5.12 | United States |
| 0 | 1 | 23 | 0 | 0 | Turkey |
| 492 | 0 | 93 | 0 | 16.4 | Germany |
| 79 | 2 | 75 | 0.03 | 0.27 | United States |
| 75 | 0 | 162 | 0 | 3.95 | United Kingdo |
| 0 | 1 | 67 | 0.03 | 0 | Slovakia |
| 0 | 0 | 101 | 0 | 0 | France |
| 0 | 0 | 106 | 0 | 0 | Serbia |
| 622 | 0 | 63 | 0 | 11.74 | Japan |

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| Rank | Title | Type | Issn | SJR | JR Quarti | H index | l Docs. (2 |
|---|---|---|---|---|---|---|---|
| 1 | Drug metabolism and pharmacokinetics | journal | ISSN 13474367 | 0.78 | Q1 | 49 | 69 |
| 2 | Biological and Pharmaceutical Bulletin | journal | ISSN 09186158, 1347 | 0.644 | Q1 | 88 | 265 |
| 3 | Asian Journal of Pharmaceutical Sciences | journal | ISSN 18180876 | 0.464 | Q2 | 11 | 57 |
| 4 | Journal of Advanced Pharmaceutical Technolog | journal | ISSN 09762094, 0110 | 0.427 | Q2 | 15 | 40 |
| 5 | Pharmacognosy Magazine | journal | ISSN 09764062, 0973 | 0.376 | Q2 | 19 | 78 |
| 6 | Indian Journal of Pharmaceutical Sciences | journal | ISSN 19983743, 0250 | 0.371 | Q2 | 40 | 120 |
| 7 | Asian Journal of Pharmaceutical and Clinical Re | journal | ISSN 09742441 | 0.326 | Q2 | 16 | 453 |
| 8 | Pakistan Journal of Pharmaceutical Sciences | journal | ISSN 1011601X | 0.316 | Q2 | 28 | 334 |
| 9 | International Journal of Pharmacy and Pharmac | journal | ISSN 09751491 | 0.282 | Q2 | 24 | 939 |
| 10 | Journal of Pharmacy Research | journal | ISSN 09746943, 0097 | 0.253 | Q2 | 8 | 0 |
| 11 | Journal of Exercise Science and Fitness | journal | ISSN 1728869X | 0.238 | Q3 | 14 | 17 |
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| 13 | International Journal of Green Pharmacy | journal | ISSN 19984103, 0973 | 0.229 | Q3 | 13 | 30 |
| 14 | Dhaka University Journal of Pharmaceutical Sci | journal | ISSN 18161839, 1816 | 0.225 | Q3 | 8 | 16 |
| 15 | International Journal of Drug Delivery Technolo | journal | ISSN 09754415 | 0.216 | Q3 | 4 | 20 |
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| Docs. (3y | Total Refs | Cites (3ye | Docs. (3 | / Doc. (2y | Ref. / Doc | Country |
|---|---|---|---|---|---|---|
| 239 | 2477 | 519 | 203 | 1.88 | 35.9 | Japan |
| 967 | 8846 | 1677 | 932 | 1.68 | 33.38 | Japan |
| 117 | 1527 | 175 | 117 | 1.89 | 26.79 | China |
| 104 | 761 | 133 | 85 | 1.26 | 19.03 | India |
| 241 | 2192 | 253 | 235 | 0.9 | 28.1 | India |
| 305 | 2940 | 317 | 301 | 1.01 | 24.5 | India |
| 1222 | 12216 | 740 | 1221 | 0.48 | 26.97 | India |
| 628 | 6751 | 506 | 628 | 0.73 | 20.21 | Pakistan |
| 3740 | 27837 | 1963 | 3729 | 0.49 | 29.65 | India |
| 313 | 0 | 247 | 313 | 0.79 | 0 | India |
| 47 | 599 | 33 | 47 | 0.5 | 35.24 | China |
| 745 | 10850 | 335 | 745 | 0.37 | 29.73 | India |
| 163 | 908 | 69 | 161 | 0.4 | 30.27 | India |
| 87 | 301 | 19 | 86 | 0.14 | 18.81 | Bangladesh |
| 40 | 509 | 17 | 40 | 0.33 | 25.45 | India |
| 25 | 141 | 12 | 25 | 0.48 | 17.63 | India |
| 28 | 202 | 15 | 28 | 0.67 | 25.25 | India |
| 1483 | 16708 | 454 | 1483 | 0.32 | 28.03 | India |
| ***807*** | ***13602*** | ***354*** | ***807*** | ***0.44*** | ***25.24*** | ***India*** |
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| 101 | 1396 | 38 | 101 | 0.38 | 27.37 | South Korea |
| 265 | 2745 | 97 | 260 | 0.35 | 25.42 | China |
| 233 | 5712 | 76 | 233 | 0.28 | 22.23 | India |
| 37 | 1384 | 11 | 37 | 0.24 | 32.19 | India |
| 512 | 107 | 85 | 512 | 0.18 | 35.67 | India |
| 1420 | 7277 | 247 | 1420 | 0.2 | 17.45 | China |
| 66 | 0 | 16 | 66 | 0 | 0 | India |
| 131 | 968 | 25 | 131 | 0.15 | 29.33 | India |
| 14 | 31 | 3 | 14 | 0.29 | 31 | India |
| 3533 | 207 | 943 | 3532 | 0.2 | 103.5 | India |
| 1836 | 4845 | 273 | 1663 | 0.14 | 8.58 | China |
| 147 | 0 | 19 | 147 | 0.08 | 0 | India |
| 241 | 6617 | 31 | 241 | 0.11 | 12.73 | India |

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|---|---|---|---|---|---|---|
| 307 | 2397 | 50 | 307 | 0.16 | 23.73 | China |
| 194 | 513 | 16 | 192 | 0.13 | 24.43 | Thailand |
| 447 | 3912 | 34 | 445 | 0.09 | 25.74 | China |
| 375 | 3959 | 60 | 309 | 0.19 | 21.06 | Japan |
| 52 | 0 | 1 | 52 | 0 | 0 | India |
| 90 | 622 | 0 | 63 | 0 | 11.74 | Japan |

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