

Proceeding Paper

The Biological Properties and Medical Importance of *Cassia fistula*: A Mini Review [†]

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[†] Presented at the 27th International Electronic Conference on Synthetic Organic Chemistry (ECSOC-27), 15–30 November 2023; Available online: <https://ecsoc-27.sciforum.net/>.

Abstract: Medicinal plant species contain a variety of chemical substances with high medical potential, making these plant species valuable as biomedical sources. This plant is a deciduous plant also known as “Yellow Shower”. The plant *Cassia fistula* is considered for its biological importance in the traditional medication system. This plant is full of different bioactive phytochemicals. In Ayurveda, the plant has also attained medicinal importance. Pharmacological properties like antioxidant, antimicrobial, anti-inflammatory, antidiabetic, antitumor, hepatoprotective, and many more are exhibited by the plant *Cassia fistula*.

Keywords: biological activities; phytochemicals; medicinal system

1. Introduction

In Indian history, various medicinal systems have been used and also lead to better results. Besides the practice of chemical drugs and medicines, mostly traditional and natural sources from medicinal plants are preferred for the betterment of human health [1]. Throughout history, many dreadful diseases have occurred, which have resulting in a great loss for humankind. Accepting the challenge, science has developed various methods to treat such diseases [1]. Natural resources play a significant role in treating infectious health problems which cause major infections in humans as well as in animals. Continuously, traditional medicines have been the focus and hence have found a valuable place in pharmacological sciences [2]. One of the natural resources found with a wide range of medicinal benefits is the plant *Cassia fistula*. *Cassia fistula* is a deciduous flowering plant which is well known for its medicinal importance and nutritional value. This plant is commonly known as “AMALTAS” [3,4]. The Leguminosae family in the Plantae kingdom, especially the plant *Cassia fistula*, was introduced with many medicinal benefits [5]. Traditionally, *Cassia fistula* was used by medical specialists or practitioners for the treatment of numerous diseases such as for various skin diseases, liver problems, tuberculous glands, pruritus, hematemesis, and diabetes, etc. [3]. In the virtue of various medicinal plants, *Cassia fistula* is contemplated as an enormous root of pharmacological molarities, and the composite materials are used in many home remedies against various infectious diseases [1]. Due to its medicinal benefits, *Cassia fistula* is termed ‘Aragvadha’, which means ‘disease killer’ [6]. Different parts of the *Cassia fistula* tree show unique biological activities. It has been observed that the flowers of *Cassia fistula* show antifungal and antibacterial activities, and the dried pulp of *Cassia fistula* shows anti-inflammatory activity. Similarly, the seeds of *Cassia fistula* are used in the investigation of antitumor and anticancer activities [4]. The juice of *Cassia fistula* leaves has bioactivities which treat skin diseases [7,8]. The medicinal behavior of *Cassia fistula* provides beneficial results for public health and somehow improves the lifespan of organisms [9]. The different parts of this plant are full of a variety of functional groups and



Citation: Singh, R.; Khanam, H.; Pandey, J. The Biological Properties and Medical Importance of *Cassia fistula*: A Mini Review. *Chem. Proc.* **2023**, *14*, 95. <https://doi.org/10.3390/ecsoc-27-16149>

Academic Editor: Julio A. Seijas

Published: 15 November 2023



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phytochemicals. So, it has been concluded that the plant *Cassia fistula* has a wide range of bioactive potentials and shows antibacterial, antifungal, antiviral, antitussive, antitumor, anticancer, anti-inflammation, antioxidant, antifeedant, antidiabetic, antihyperglycemic, antineoplastic, nephro-protective, and many more pharmacological properties [10]. The semi-wild plant *Cassia fistula* is abundant in various regions of different countries. The pharmacological profile of this plant shows a better slope in the observed medicinal graph. Each phase of *Cassia fistula* works upon ailments in a unique way. Mostly, the constituents were preferred to be used in the form of their respective extracts, but the parts of the plant also provide a bioactive nature in powders, pulps, oils, mucilage or adhesives, juices, and sometimes raw leaves and flowers, which were administered orally to give health benefits. Each therapeutic agent or drug available shows some side effects or bad impacts. The over-dosage and unbalanced utilization of *Cassia fistula* also exhibits side effects to lower extent [11].

Cassia fistula belongs to the Leguminosae family of the Plantae kingdom, also called 'AMALTAS' in several regions, and is an ornamental tree with its beautiful yellow flowers also known as 'Golden shower' due to its appearance. *Cassia fistula* is a semi-wild plant [3,7,8] that grows throughout many countries, mainly on the roadside [12]. The plant grows up to 20–30 m tall and the leaves are attached in the form of pinnate. The root, bark, and flowers, respectively, of *Cassia fistula* are brownish-red, brown, and bright yellow in color [3,12]. The wood of this plant has high shelf-life and is very strong. The flowers of *Cassia fistula* are of a glowing yellow color and are 40 cm long, and this is the reason why *Cassia fistula* is called "Golden Shower".

2. Biological Properties of *Cassia fistula*

Cassia fistula is a plant full of properties which lead to the numerous medicinal benefits shown in Figure 1. In this review paper, we discuss the biological activities of *Cassia fistula* that deal with the current major problems of human health. In the present scenario, health problems like skin infections, cancers, and diabetes play a major role in medicinal challenges. This plant provides a greener route to come up with natural and non-toxic ideas in the medicinal system. This review paper considers the bioactive plant '*Cassia fistula*' and highlights all its medicinal or biological activities.

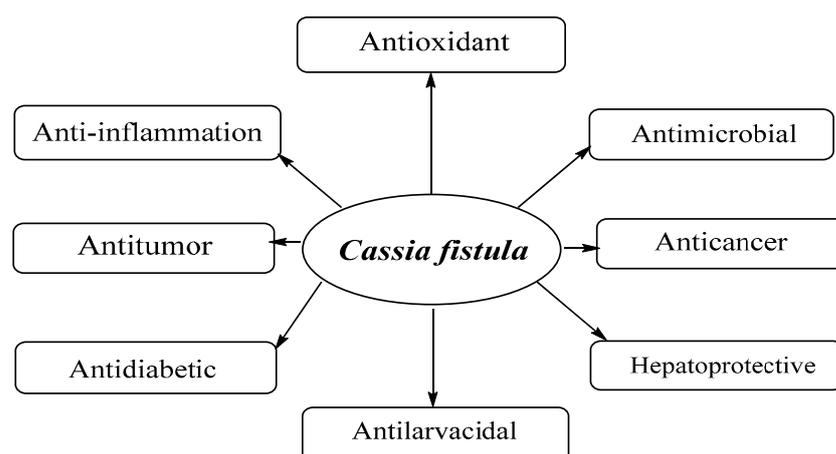


Figure 1. Biological properties of *Cassia fistula*.

2.1. Antioxidant Activity

Each part of this medicinal plant plays an interesting role in treating many dreadful diseases. Previously in the literature, the biological properties have been reported in different styles. This plant possesses strong antioxidant activity due to the presence of high phenolic content. Due to its antioxidant activity, this plant is implemented in treating skin infections, in wound dressings, and is also used in many cosmetic industries as anti-ageing agents. Studies performed by K. Pradeep et al. (2007) reported that the juice extracted from

Cassia fistula leaves acts as a dressing agent in diseases like ringworm and inflammation to relieve irritations, and even in jaundice [13]. The methanolic along with ethanolic extract of *Cassia fistula* leaves is considered to have a good antioxidant nature as compared with other parts of the *Cassia fistula* plant (i.e., stem, bark, flowers, fruits, pulp) [14]. In a previous study, a few techniques were performed on the leaf extracts of selected plants with medical importance, and it was found that a medicinal plant named *Cassia fistula* exhibits antioxidant activity. Amongst the selected plants, the leaf extract of *Cassia fistula* shows the second highest position with approx. 90% antioxidant activity. The phenolic content of the leaf extract deals with the peroxidation process of lipids. This reveals the antioxidant behavior of *Cassia fistula* leaves [15]. Jayachitra et al., in 2014, performed antioxidant activity through the DPPH scavenging of leaf extract silver nanoparticles and found the effective concentration to be 60 µg/mL [16]. The flowers of this plant play an important role in treating skin problems due to their tremendous antioxidant tendency. *Cassia fistula* flowers in methanolic extract show antioxidant activity through DPPH scavenging, and the percentage of antioxidant activity was evaluated to be approximately 84%. The antioxidant behavior of the flower extract in an aqueous medium gives results in favor of antidiabetic bioactivity [17]. The bark extract of the *Cassia fistula* plant shows higher scavenging than the leaf extract. Approximately 90% of bark extract in methanol exhibits antioxidant behavior; hence, it has been estimated that the antioxidant activity is excellent in the bark of the *Cassia fistula* plant. The percentage profile of phenolic content in the bark extract was found to be in the range of 60–70%; this value leads to the excellent antioxidant activity of the bark [18].

2.2. Antidiabetic Activity

As has been noticed in previous studies, *Cassia fistula* flowers and their extract exhibit antifungal, antibacterial, antioxidant, anti-aging, and anticancer properties [19]. *Cassia fistula* flower extract shows antidiabetic activity. The antioxidant behavior of the flower extract in an aqueous medium gives results in favor of antidiabetic bioactivity [17]. This antidiabetic behavior was examined by G. Manonmani et al. (2005) in rats with diabetes. Also, they reported a treatment of 15 days, which was performed on the alloxan diabetic rats with aqueous flower extract (10%), and consequently, it was found that it exhibits antidiabetic activity for diabetic rats [20]. Ali et al., in 2012, prepared the ethyl alcohol extract of *Cassia fistula* bark and further performed an antidiabetic study. The different doses of the ethanolic extract of *Cassia fistula* bark were comparatively studied with the standard drugs and consequently found a positive result. Hence, this clears the picture of antidiabetic behavior of *Cassia fistula* bark with ethanolic extract in different doses [21].

2.3. Antimicrobial Activity

The extract of *Cassia fistula* leaves shows better results in its purified form. Also, it has been suggested, in various studies, that the extract of *Cassia fistula* leaves not only works upon the pathogenic bacteria, but also stops the further growth of infectious bacteria [22]. The hydro-alcohol extract of *Cassia fistula* leaves was reported to exhibit antimicrobial activity against bacteria and fungi [2]. The hydro-alcoholic extract of leaves consists of flavonoids, steroids, carbohydrates, proteins, and amino acids, which have a tendency to work against bacteria and fungi. Bhalodia and Shukla (2011) performed a test for the antimicrobial activity of *Cassia fistula* leaves; some drugs (like ampicillin or norfloxacin) were taken as reference drugs with the help of which the bioactive tendency was measured. Bioactive drugs like norfloxacin, ampicillin, and chloramphenicol were taken as standard drugs to cure infections in the urinary area, pneumonia infections, and typhoid, respectively. An extract was then prepared by using the fresh leaves of *Cassia fistula* and petroleum ether along with an amount of hydro-alcohol and kept for the test of antimicrobial behavior against various bacteria and fungi [2]. Seeds were also found to exhibit antimicrobial activity regarding some bacteria, fungi, and viruses [23]. The powdered form of the seed extract was preferred to test against bacteria, fungi, and other microorganisms. The extract was then prepared in a good content of methyl alcohol and filtered as well as dried. Again,

the dried mixture was dissolved in methyl alcohol and resulted in the formation of the methanolic seed extract of *Cassia fistula*. Some of the microorganisms that were selectively studied were *Bacillus thuringiensis*, *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus*, *Candida albicans*, *Salmonella*, *Micrococcus*, and *Aspergillus niger*. The MIC values regarding the above-mentioned evaluated microorganisms were very low. This shows that the inhibitory concentration of the tested microorganisms with methanolic extract enhances the activity of the seed extract. As a consequence of this, the methanolic extract of *Cassia fistula* seeds possesses antimicrobial activity and helps in the treatment and curing of the health issues of mankind. The antimicrobial activity depends on the dose value of *Cassia fistula* seed extract in an alcoholic solution [24].

3. Medicinal Importance

This tree is full of bioactive properties like antibacterial, antimicrobial, antifungal, anti-inflammatory, antitumor, anticancer, antioxidant, anti-yeast, and many skin-related bioactivities [14]. The phytochemicals which are present in the *Cassia fistula* plant are subjected as carbohydrates, proteins, amino acids, flavonoids, tannins, anthraquinone and its derivatives, glycosides, terpenoids, sugars, alkaloids, saponins, Rhein, mucilage, and many more [4,6,14]. As is already known, the plant *Cassia fistula* is rich in factors like ease of availability, good biodegradability, good economical nature, and most importantly, its low toxic behavior. Due to the presence of these factors, *Cassia fistula* is used in numerous food industries on a large scale. As we have already discussed the properties of *Cassia fistula* seeds, and the extraction of gum from the seeds, it has also been observed that the gum or mucilage that were obtained from the seeds of *Cassia fistula* were applicable in maintaining and balancing the quality and lifetime of food or edible products. From a commercial or economical point of view, it has been concluded that natural gum from *Cassia fistula* seeds is applicable in enhancing the preservation of food products in various food industries. It has been noticed that this characteristic of *Cassia fistula* seemed to be due to its antioxidant biological properties [25].

4. Applications

It has been observed that the therapeutic use of *Cassia fistula* is not new to our knowledge, but has been used as the base of herbal medicines from ancient periods of history. Keeping in mind the wide use of this medicinal plant *Cassia fistula*, numerous applications are listed below. A flowchart in Figure 2 also highlights the applications of this beneficial plant.

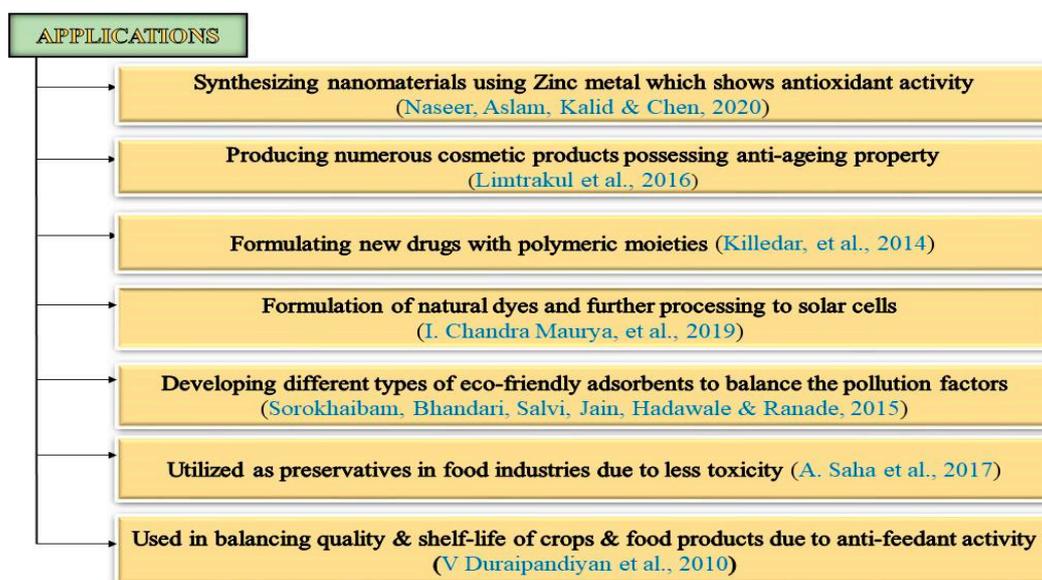


Figure 2. Applications of the *Cassia fistula* plant [25–31].

5. Conclusions

The central metabolites as well as the secondary metabolites of *Cassia fistula* were categorized in accordance with their respective extracts, and the prepared extracts were further tested against various microorganisms and long-term diseases. The studies resulted in the enhancement of human health and gave superior results. Also, this study concludes that the *Cassia fistula* plant shows excellent pharmacological activities, and its therapeutic values have also been predicted. Along with its bioactive behavior, this paper gives information about the low amount of toxicity in the *Cassia fistula* plant. The applications of this plant have been highlighted in different streams, which prove the tendency of this plant to clear and further make many routes in pharmacological sciences.

Author Contributions: R.S. and H.K.: Investigation, data collection, data correction, original draft, editing, communication. J.P.: Supervision, review and editing. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data are contained within the article.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Safwat, G.M.; Hamed, M.M.; Moatamed, S.A. Studies of The Biological Activity of *Cassia fistula*. *Arch. Pharmacol.* **2018**, *1*, 75–85.
2. Bhalodia, N.; Acharya; Nariya, P.; Shukla, V. In Vitro Antibacterial and Antifungal Activities of *Cassia fistula* Linn. fruit pulp extracts. *AYU Pharmacol. Res.* **2012**, *33*, 123–129. [[CrossRef](#)]
3. Pawar, A.V.; Patil, S.J.; Killedar, S.G. Uses of Cassia Fistula Linn as a Medicinal Plant. *Int. J. Adv. Res. Dev.* **2017**, *2*, 85–91.
4. Maqsood, A.; Munir, A.; Shahid, S. A Phytopharmacological Evaluation of *Cassia fistula*. A Comprehensive Review. *Int. J. Pharm. Sci. Rev. Res.* **2020**, *62*, 45–53.
5. Kushwaha, M.; Agrawal, R.C. Preliminary phytochemical screening and in vitro antioxidant potential of seed extract of *Cassia fistula* linn. *Int. J. Biol. Pharm. Res.* **2013**, *4*, 738–742.
6. Sharma, A.; Kumar, A.; Jaitak, V. Pharmacological and Chemical Potential of *Cassia fistula* L- A Critical Review. *J. Herb. Med.* **2020**, *26*, 100407. [[CrossRef](#)]
7. Jothy, S.L.; Zakaria, Z.; Chen, Y.; Lau, Y.L.; Latha, L.Y.; Sasidharan, S. Acute Oral Toxicity of Methanolic Seed Extract of *Cassia fistula* in Mice. *Molecules* **2011**, *16*, 5268–5282. [[CrossRef](#)] [[PubMed](#)]
8. Jothy, S.L.; Zakaria, Z.; Chen, Y.; Lau, Y.L.; Latha, L.Y.; Shin, L.N.; Sasidharan, S. Bioassay-Directed Isolation of Active Compounds with Antiyeast Activity from a *Cassia fistula* Seed Extract. *Molecules* **2011**, *16*, 7583–7592. [[CrossRef](#)]
9. Bahorun, T.; Neergheen, V.; Aruoma, O. Phytochemical constituents of *Cassia fistula*. *Afr. J. Food Agric. Nutr. Dev.* **2011**, *4*. [[CrossRef](#)]
10. Irshad, M.; Mehdi, S.J.; Al-Fatlawi, A.A.; Zafaryab, M.; Ali, A.; Ahmad, I.; Singh, M.; Rizvi, M.M.A. Phytochemical Composition of *Cassia fistula* Fruit Extracts and its Anticancer Activity Against Human Cancer Cell Lines. *J. Biol. Act. Prod. Nat.* **2014**, *4*, 158–170. [[CrossRef](#)]
11. Jothy, S.L.; Zuraini, Z.; Sasidharan, S. Phytochemicals screening, DPPH free radical scavenging and xanthine oxidase inhibitory activities of *Cassia fistula* seeds extract. *J. Med. Plants Res.* **2011**, *5*, 1941–1947. [[CrossRef](#)]
12. Rana, R.; Saklani, K.; Gaurav, N. Phytochemical Analysis and Antimicrobial Activity of Leaf and Seed Extract of *Cassia fistula*. *Int. Ref. Multidiscip. J. Contemp. Res.* **2017**, *5*, 24–30.
13. Pradeep, K.; Mohan, C.V.R.; Gobianand, K.; Karthikeyan, S. Effect of *Cassia fistula* Linn. leaf extract on diethylnitrosamine induced hepatic injury in rats. *Chem. Biol. Interact.* **2007**, *167*, 12–18. [[CrossRef](#)] [[PubMed](#)]
14. Patel, J.S.; Vyas, P.J. Phytochemistry of *Cassia fistula* and Pharmacological Studies of its Leaf extracts: A Review. *Int. J. Chemtech Appl.* **2016**, *5*, 1–10.
15. Kumar, P.S.; Sucheta, S.; Deepa, V.S.; Selvamani, P.; Latha, S. Antioxidant activity in some selected Indian medicinal plants. *Afr. J. Biotechnol.* **2008**, *7*, 1826–1828. [[CrossRef](#)]
16. Indhumathy, J.; Gurupavithra, S.; Ravishankar, K.; Jayachitra, A. Green synthesis of silver nanoparticles using *Cassia fistula* leaf extract and its applications. *MJPMS* **2014**, *3*, 20–25.
17. Khan, B.A. Investigation of the effects of extraction solvent/technique on the antioxidant activity of *Cassia fistula* L. *J. Med. Plants Res.* **2012**, *6*, 500–503. [[CrossRef](#)]

18. Shukla, R.K.; Porval, A.; Painuly, D.; Shukla, A. Physico-chemical characteristics, proximate analysis and total phenolic content of *Cassia fistula* bark. *Nat. Prod. Indian J.* **2013**, *9*, 133–137.
19. Remya, R.; Rajasree, S.R.; Aranganathan, L.; Suman, T. An investigation on cytotoxic effect of bioactive AgNPs synthesized using *Cassia fistula* flower extract on breast cancer cell MCF-7. *Biotechnol. Rep.* **2015**, *8*, 110–115. [[CrossRef](#)]
20. Manonmani, G.; Bhavapriya, V.; Kalpana, S.; Govindasamy, S.; Apparathanam, T. Antioxidant activity of *Cassia fistula* (Linn.) flowers in alloxan induced diabetic rats. *J. Ethnopharmacol.* **2005**, *97*, 39–42. [[CrossRef](#)]
21. Ali, M.A.; Sagar, H.A.; Khatun, M.C.S.; Azad, A.K.; Begum, K.; Wahed, M.I.I. Antihyperglycemic and Analgesic Activities of Ethanolic Extract of *Cassia Fistula* (L.) Stem Bark. *Int. J. Pharm. Sci. Res.* **2012**, *3*, 416–423.
22. Arulpandi, I.; Sangeetha, R. Antibacterial Activity of Fistulin: A Protease Inhibitor Purified from the Leaves of *Cassia fistula*. *ISRN Pharm.* **2012**, *2012*, 584073. [[CrossRef](#)] [[PubMed](#)]
23. Lachumy, S.J.; Zuraini, Z.; Sasidharan, S. Antimicrobial activity and toxicity of methanol extract of *Cassia fistula* seeds. *Res. J. Pharm. Biol. Chem. Sci.* **2010**, *1*, 391–398.
24. Kumar, V.P.; Chauhan, N.S.; Padh, H.; Rajani, M. Search for antibacterial and antifungal agents from selected Indian medicinal plants. *J. Ethnopharmacol.* **2006**, *107*, 182–188. [[CrossRef](#)] [[PubMed](#)]
25. Saha, A.; Tyagi, S.; Gupta, R.K.; Tyagi, Y.K. Natural gums of plant origin as edible coatings for food industry applications. *Crit. Rev. Biotechnol.* **2017**, *37*, 959–973. [[CrossRef](#)] [[PubMed](#)]
26. Naseer, M.; Aslam, U.; Khalid, B.; Chen, B. Green route to synthesize Zinc Oxide Nanoparticles using leaf extracts of *Cassia fistula* and *Melia azadarach* and their antibacterial potential. *Sci. Rep.* **2020**, *10*, 9055. [[CrossRef](#)] [[PubMed](#)]
27. Limtrakul, P.; Yodkeeree, S.; Thippraphan, P.; Punfa, W.; Srisomboon, J. Anti-aging and tyrosinase inhibition effects of *Cassia fistula* flower butanolic extract. *BMC Complement. Altern. Med.* **2016**, *16*, 497. [[CrossRef](#)]
28. Killedar, S.G.; More, H.N.; Nadaf, S.J.; Nale, A.B.; Pawar, A.; Tamboli, U.S. Isolation, characterization and evaluation of *Cassia fistula* linn. seed and pulp polymer for pharmaceutical application. *Int. J. Pharm. Investig.* **2014**, *4*, 215–225. [[CrossRef](#)]
29. Maurya, I.C.; Singh, S.; Srivastava, P.; Maiti, B.; Bahadur, L. Natural dye extract from *Cassia fistula* and its application in dye-sensitized solar cell: Experimental and density functional theory studies. *Opt. Mater.* **2019**, *90*, 273–280. [[CrossRef](#)]
30. Sorokhaibam, L.G.; Bhandari, V.M.; Salvi, M.S.; Jain, S.; Hadawale, S.D.; Ranade, V.V. Development of newer adsorbents: Activated carbons derived from carbonized *Cassia fistula*. *Ind. Eng. Chem. Res.* **2015**, *54*, 11844–11857. [[CrossRef](#)]
31. Duraipandian, V.; Ignacimuthu, S. Antifungal activity of Rhein isolated from *Cassia fistula* L. flower. *Web Med. Cent. Pharmacol.* **2010**, *1*, WMC00687.

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