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Retraction

Retracted: In Vitro Activity of Vernonia cumingiana Benth.

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] K. Wang and Y. Wang, "In Vitro Activity of Vernonia cumingiana Benth.," *Scientific Programming*, vol. 2022, Article ID 4151669, 8 pages, 2022.

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Research Article

In Vitro Activity of *Vernonia cumingiana* Benth.

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To investigate the antioxidant activity and antibacterial activity of *Vernonia cumingiana* Benth, in this study, spectrophotometry assays were used to determine the antioxidant and antibacterial activity indexes in vitro, including 1,1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging capacity and total antioxidant capacity, aiming to understand its pharmacodynamic components. The results showed that different component extracts had high DPPH scavenging ability in vitro, and the highest scavenging rate was obtained when chloroform extract of branches was 0.60 mg·mL^{-1}, ethylene acetate 0.10 mg·mL^{-1}, and 0petroleum ether extraction 0.90 mg·mL^{-1}; maximum clearance of DPPH•, •OH, and O^{2-}• was 104.71%, 99.04%, 93.05%, and 0.90 mg mL^{-1}; 95% ethanol extract had inhibitory effect on *E. coli*, *Bacillus subtilis,* and *Staphylococcus* epidermidis indicating that it had good anti-inflammatory activity.

1. Introduction

Free radicals are unstable and highly reactive atoms/groups and unpaired electrons. They can cause membrane damage, cardiac complications, aging, and cancer; antioxidants can be used to protect the damage caused by free radicals [1]. Natural antioxidants can efficiently improve the stability of drugs, foods, and nutrients and increase anti-inflammatory, antiallergic, and anticancer potential of human body; on the other hand, plants with high phenolic contents are a good source of powerful antioxidants [2].

Vernonia cumingiana Benth. is a plant of the genus *Vernonia* of the Compositae tubular flower subfamily. *Vernonia* is also known as Jingfenghong, Guoshanlong, *Vernonia tenuiflora*, etc. It is widely distributed in China, mainly concentrated in Yunnan, Sichuan, southwestern Guizhou, and western Guangxi. It grows on hillsides, shrubs, sparse forests or forest edges, and climbing vines. There are more than 1,000 kinds of plants in this genus, many of which are available for medicinal purposes, and there are 12 kinds of medicinal plants in China. At present, there are many studies on the chemical composition and biological activity of *Vernonia* plants, and the research shows that its chemical composition is complex and diverse. It has antimalarial [3], antitumor [4, 5], cytotoxic [6], bacteriological [7], anti-inflammatory, and analgesic effects [8, 9]. In addition, many plants in this genus also have insecticidal and antimalarial effects, especially in America, as a plant drug of insect repellent and antimalarial effects; it has a remarkable curative effect [10]. According to records, this kind of dried root or stem vine can treat rheumatism pain, lumbar muscle strain, quadriplegia, etc., and can also be used for cold and fever. Turtledove plants of the genus *Chrysanthemum* in China is rich in resources; the current of poisonous root chemical constituents and pharmacological activities of the turtledove chrysanthemum plants is not enough, there is a broad space for development. In particular, there are fewer studies on the stems and leaves of *Vernonia vulgaris*, so it is necessary to conduct in-depth research on *Vernonia vulgaris* to establish a perfect quality standard for it.

They are normally used as folk medicines for a long time because of their ethnomedicinal properties including rheumatism, pain in the back and legs, injuries from falls, and malaria [10]. *Vernonia* plants have various chemical compositions . It includes steroids, terpenoids, flavonoids, phenylpropanoid, fatty acids, and volatile oils. The chemical

composition of steroid and terpene is more common . There are relatively few studies of the chemical composition of other categories. Because *Vernonia* species contain a variety of chemical constituents, they have many different pharmacological effects. They have good effect on treating diabetes, high cholesterol, and vitiligo by enhancing immunity. They also have antibacterial, anticancer [5, 11, 12], and anti-inflammatory [8, 9] effects. Therefore, finding natural antibacterial, antifungal, and antioxidant agents with similar therapeutic effect could be a promising approach, which is safer and healthier. There are few reports on the antioxidant and antibacterial activities of the flower branches of the genus. Therefore, in order to better develop and utilize the chrysanthemum branch and provide new plant resources for the development of antioxidant and antibacterial drugs, this paper conducted a preliminary study on its antioxidant and antibacterial activities in vitro.

In this study, spectrophotometry assays were used to determine the antioxidant and antibacterial activity indexes in vitro, including 1,1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging capacity and total antioxidant capacity, aiming to understand its pharmacodynamic components. The results showed that different component extracts had high DPPH scavenging ability in vitro, and the highest scavenging rate was obtained when chloroform extract of branches was 0.60 mg·mL-1, ethylene acetate 0.10 mg·mL-1, and petroleum ether extraction 0.90 mg·mL-1; maximum clearance of DPPH•, •OH, and O^{2-}• was 104.71%, 99.04%, 93.05%, and 0.90 mg mL^{-1}; 95% ethanol extract had inhibitory effect on *E. coli*, *Bacillus subtilis,* and *Staphylococcus epidermidis* indicating that it had good anti-inflammatory activity.

1.1. Plant Material. The plants of *Vernonia cumingiana* Benth. were collected in January 2019 in Changjiang Li Autonomous County, Hainan Province, and identified by Professor Zhong Huimin, Qingdao University of Science and Technology, and a voucher specimen (No. 2019DGBJJ) was deposited with the Molecular Medicine and Chemistry Laboratory of Jining Medical University.

2. Experimental

2.1. General Experimental Procedures. DPPH (1,1,1-diphenyl-2-picrylhydrazyl, A.R, Tix Chemical Industrial Development Co., Ltd.); ascorbic acid (A.R, Sinopharm Chemical Reagent Co., Ltd.); methanol (A.R, anhydrous), petroleum ether (A.R, anhydrous), ethyl acetate (A.R, anhydrous), *n*-butanol (A.R, anhydrous), ethanol (A.R, anhydrous), 1 × PBS (phosphate buffered solution, 0.01 M, pH 7.2–7.4, Biochannel), phenanthrene (A.R), $FeSO_4$ (A.R), H_2O_2 (A.R), pyrogallic acid (A.R), hydrochloric acid (A.R), potassium ferricyanide (A.R), trichloroacetic acid (A.R), and ferric chloride (A.R) were all analytically pure (national medicine). The experimental water was distilled water. UV-5000 visible spectrophotometer (Shanghai Yuanqing Instrument Co., Ltd.); electric thermostatic water bath pot (Hebei Huanghua Aerospace Instrument Factory); FA2104 electronic analysis Tianping (Shanghai Tianping Instrument Factory); R-1001vn rotary evaporator (Shanghai Yarong Biochemical Instrument Factory); Dzf-6020 vacuum drying oven (Shandong Longkou Xianke Instrument Co., Ltd.); high-speed universal grinder (Zhejiang Hongjingtian Industry and Trade Co., Ltd.); manual press type pipetting gun (Hai Yi Technology Co., Ltd., Beijing), low speed centrifuge table (Hunan Kaida Scientific Instruments Co., Ltd.), vertical pressure steam sterilizer (Shanghai Shenan Medical Instrument Factory), thermostatic water-jacket incubator (The Jintan City Splendor Equipment Manufacture Co., Ltd.), and thermostatic oscillator (Taicang Experimental Equipment Factory) were used. Nutritional agar (Guangzhou Hongzhou Experimental Equipment Technology Co., Ltd.), Petri dish (Devan Instrument Co., Ltd.), and Oxford cup (Qingdao Haibo Biology) were also used.

2.2. Extracts Preparation. Powdered stems, flowers, and leaves of *Vernonia cumingiana* Benth. were separately extracted with various solvents such as ethyl acetate, methanol, and dichloromethane using maceration method at room temperature for 24 h. In the following, they were filtered through a paper filter and the solvent was evaporated under a vacuum at 45°C to yield crude extracts.

2.2.1. Preparation of Sample Solution with Different Concentrations for Each Polar Part. Dissolve 50 mg of each polar part sample with methanol in a 10 mL volumetric flask and dilute to volume and shake well to obtain a sample stock solution with a concentration of 5.00 mg·mL-1. Draw 0.04, 0.08, 0.12, 0.20, 0.40, 0.80, 1.20, and 1.80 mL of the sample stock solution of each polar part in sequence in a 10 mL volumetric flask, dissolve it with methanol and dilute to volume, shake it, and get the sample solution, the concentrations of which are 0.02, 0.04, 0.06, 0.10, 0.20, 0.40, 0.60, and 0.90 mg mL^{-1}.

2.2.2. Preparation of Vc Standard Solutions with Different Concentrations. Vc 10.00 mg accurately weighed with methanol in a 10 mL volumetric flask is used to obtain the original Vc solution with a concentration of 1.00 mg mL^{-1}. Pipette 0.01, 0.02, 0.04, 0.08, 0.12, 0.16, and 0.20 mL of the original Vc solution in a 10 mL volumetric flask, dissolve it with methanol and dilute to volume, shake well, and store in the dark to obtain a Vc sample solution, the concentrations of which are respectively 0.001, 0.002, 0.004, 0.008, 0.012, 0.016, and 0.020 mg mL^{-1} [13].

2.2.3. Preparation of DPPH Solution. Dissolve the measured DPPH 10.10 mg with methanol in a 25 mL volumetric flask and dilute to the volume, pipette 5.00 mL into a 50 mL volumetric flask to make the volume constant, shake well, and store in the dark to obtain a DPPH solution with a concentration of 40.40 mg mL^{-1}.

2.3. In Vitro Antioxidant Activity Test

2.3.1. Determination of DPPH Clearance Rate. Adjust to zero with methanol and set the measurement wavelength to 517 nm, accurately take 2.00 mL of methanol and an equal volume of DPPH solution in a test tube, avoid light, measure the absorbance A0 after shaking, and then pipette 2.00 mL of sample solutions of different polarities and different concentrations. Put the same volume of methanol in a test tube, shake well, and measure the absorbance Aj [14–16]. Pipette 2.00 mL of sample solutions of different polarities and different concentrations in sequence, and place the same volume of DPPH solution in a test tube. Shake well and store in the dark. Measure the absorbance of 0.02 mg mL^{-1} at each part every 2 minutes and record the value. See Figure 1 to observe that the change is stable [17] and then measure the absorbance Ai of each level. Then, do two parallel experiments to obtain three sets of data. Take the average of the three sets and substitute it into the corresponding clearance rate. The operation method of the control group Vc is the same as above.

Clearance (%) = $[1 - (Ai - Aj)/A_0] \times 100\%$[a].

2.3.2. Determination of OH Clearance Rate. Add 2.00 mL of pH = 7.45 PBS (phosphate buffered solution, 0.01 M) solution and 1.00 mL of distilled water to 1.00 mL of 0.75 mol L^{-1} o-phenanthroline, then add 1.00 mL of 0.75 mmol·L^{-1} $FeSO_4$ solution and 1.00 mL of 0.01% H_2O_2, and shake well. Then, heat it in a 37°C water bath for 1 h. Use 536 nm as the wavelength to measure the absorbance, which is Ap; replace 1.00 mL of H_2O_2 with an equal volume of water, the same as above to measure the absorbance, which is Ab, and use it as a control tube to determine the absorbance of the sample solution; replace 1.00 mL of water with an equal volume of sample solution, the same as above. Measure the absorbance As, and then do two parallel experiments to obtain three sets of data. Take the average of the three sets and substitute them to obtain the corresponding clearance rate. The operation method of the control group Vc is the same as above [18, 19].

Clearance (%)=$(As - Ap)\ (Ab - Ap) \times 100\%$[b].

2.3.3. Determination of O^{2-}· Clearance Rate. Refer to the pyrogallol method [20, 21], take 5.00 mL PBS solution each in a test tube, add 1.00 mL of the sample solution of the concentration gradient of each component, and then add 25.00 mmol·L^{-1} pyrogallol 0.50 mL, shake well at room temperature, let it stand for 4 min, and then use two drops of 8.00 mol·L^{-1} hydrochloric acid to stop the reaction. Use 299 nm as the wavelength to measure the absorbance, that is, A1; the standard tube is 1.00 mol·L^{-1} hydrochloric acid. Use 1.00 mL of distilled water instead of the sample solution as a blank control, and measure the absorbance, which is A0. Replace pyrogallol with 0.50 mL of distilled water, and measure the absorbance as above, which is A2. Do two more parallel experiments to get three sets of data, take the average of the three sets and substitute in to get the corresponding clearance rate, repeat the experiment twice, and take the average. The operation method of the control group Vc is the same as above.

Clearance (%) = $[A_0 - (A_1 - A_2)]/A_0 \times 100\%$[c].

2.3.4. Determination of Total Reducing Power. Refer to the potassium ferricyanide reduction method [22–26]. Add 1.00 mL of sample solution, 2.50 mL of 1% potassium ferricyanide solution, and 2.50 mL PBS to the test tube, shake well, put it in a water bath at 50°C for 30 minutes, quickly cool with cold water, and then add 2.50 mL of 10% trichloroacetic acid, and put in a centrifuge and set 4000 r·min^{-1}; 10 minutes later, take 2.50 mL of the supernatant and place it in a test tube, add 2.50 mL of 0.1% ferric chloride solution and 2.50 mL distilled water, mix the three evenly, and measure the absorbance with 700 nm as the wavelength after standing for 10 min, measured in parallel three times. The operation method of the control group Vc is the same as above (change the above sample solution to distilled water; other operations are the same, as a blank control when measuring absorbance).

3. Study on Antibacterial Activity

3.1. Preparation of Sample Solution. Soak the crushed flower branch powder with 95% ethanol for three times, soak for one week each time, combine the filtrate three times, and spin it into an extract for later use. Soak 200 g of flowering branch powder in 2000 mL of 75% ethanol. After soaking for 24 hours for three times, the three filtrates are combined to spin into an extract for later use. Add 2000 mL of pure water to 200 g of flower branch powder and heat it three times with an electric heating mantle. After each 40 minutes, the filtrate is combined three times and the mixture is rotary steamed to form an extract for later use. The extracts of three different samples were prepared into sample solutions of different concentrations 25.00 mg·mL^{-1}, 20.00 mg·mL^{-1}, 15.00 mg·mL^{-1}, 10.00 mg·mL^{-1}, and 5.00 mg·mL^{-1}.

3.2. Oxford Cup Method Antibacterial Experiment. Four kinds of bacteria including Gram-negative bacteria (*E. coli*, *Bacillus subtilis*, and *Salmonella typhi*), and Gram-positive bacteria (*Staphylococcus epidermidis*) were inoculated into nutrient agar and shaken overnight at 37°C at 100 RPM to obtain four seed bacteria liquid. Mix different bacterial liquids and agar liquids in a certain ratio (*E. coli*:agar liquid = 1 : 2.5, *Staphylococcus epidermidis*:agar liquid = 1 : 5, *Bacillus subtilis*:agar liquid = 1 : 1.5, and *Salmonella typhi;* the required light transmittance can be achieved without mixing with agar solution); at a wavelength of 600 nm, with the blank agar solution as a reference, make the light transmittance $T = 20$. First, pour 10.00 mL agar into a Petri dish to solidify the bottom, add evenly into four Oxford cups, then add 50 μL of the adjusted bacterial solution to 15.00 mL of agar, pour it into the precoagulated agar, and wait for it. After solidification, take out the Oxford cup and add the sample solution and the prepared double antibody. After standing for half an hour, put it in a 37°C oven and observe whether there is a zone of inhibition on the next day.

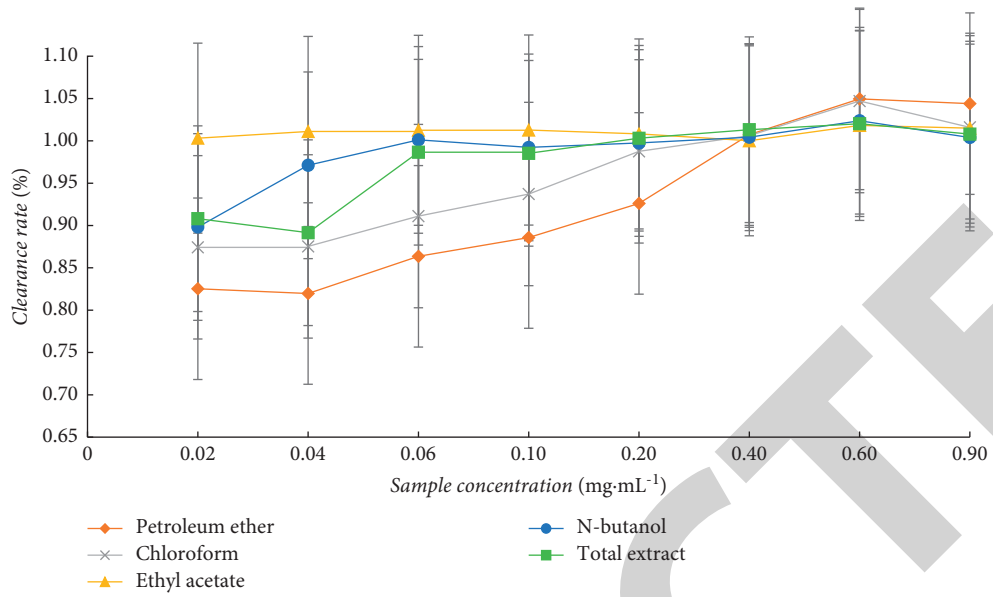

Figure 1: Removal rate curves at different polarity areas.

4. Results and Analysis

4.1. Antioxidant Ability

4.1.1. Research on the Ability to Clear DPPH. After measurement, the absorbance value of the sample solution under the different polar parts all reached a stable level in about 40 minutes. From Figures 1 and 2, the scavenging effect of DPPH free radicals on different polar parts is obviously different. It can be seen that there is a certain linear relationship, and the concentration of each level with the most obvious difference is 0.02 mg·mL^{-1}–0.40 mg·mL^{-1} and 0.40 mg·mL^{-1}–0.90 mg·mL^{-1}, the trend slows down. At the same concentration, it can be seen that the clearance rate of each polar part is ethyl acetate extract > n-butanol extract>95% ethanol extract > chloroform extract > petroleum ether extract, the effect of ethyl acetate is more obvious. It can be seen that the antioxidant capacity of ethyl acetate is stronger than that of Vc compared to Figures 1 and 2. This part is still in the rough extraction stage. If it is further purified and its components are purified, natural antioxidants can be obtained.

4.1.2. The Ability of Scavenging OH. From the overall point of view of Figures 3 and 4, the scavenging rate of hydroxyl radicals of different polar parts basically showed an upward trend. Ethyl acetate has the largest scavenging rate for hydroxyl radicals, and chloroform has the smallest scavenging rate for OH. According to the basic trend, it can be seen that the scavenging rates are as follows: ethyl acetate extract>95% ethanol extract > n-butanol extract > petroleum ether extract > chloroform extract. The removal rate of ethyl acetate, 95% ethanol extract, and n-butanol extract is basically greater than the Vc removal rate of 0.02 mg·mL^{-1}, which proves the antioxidant properties of ethyl acetate, 95% ethanol extract, and n-butanol extract good. The Vc of petroleum ether and chloroform at the concentration of 0.60 mg·mL^{-1} is almost equal to that of 0.02 mg·mL^{-1}, which proves that its antioxidant activity was good in vitro.

4.1.3. Scavenging Ability of O^{2-}·. From Figures 5 and 6, the removal of O^{2-} by samples with different polarities showed an overall upward trend. According to the basic trend, it can be concluded that the clearance rate in descending order is as follows: petroleum ether extract > n-butanol extract > chloroform extract > ethyl acetate extract>95% ethanol extract. The elimination rate of n-butanol, petroleum ether, chloroform, and ethyl acetate to O^{2-} is basically greater than the Vc of 0.02 mg mL^{-1}, which proves that n-butanol, petroleum ether, and chloroform components are antioxidant in vitro. It works well.

4.1.4. Determination of Total Reducing Power. According to Figures 7 and 8, the total reducing force of samples in different polar parts increased with the increase of sample concentration. According to the basic trend, it can be concluded that the total reducing power in descending order is ethyl acetate > chloroform > n-butanol > 95% ethanol extract > petroleum ether. The total reducing power of ethyl acetate, chloroform, n-butanol, and 95% ethanol extract was basically greater than 0.02 mg·mL^{-1} Vc, which proved that ethyl acetate, chloroform, n-butanol, and 95% ethanol extract had good external antioxidant effect.

4.2. Antibacterial Activity Determination. Four kinds of bacteria were used as the research objects to further study the antibacterial effect of *Vernonia cumingiana* Benth. at different concentrations, and the results are shown in Table 1.

As can be seen from the data in Table 1, different concentrations of ethanol extract have different inhibitory abilities on the four kinds of bacteria. All the concentrations

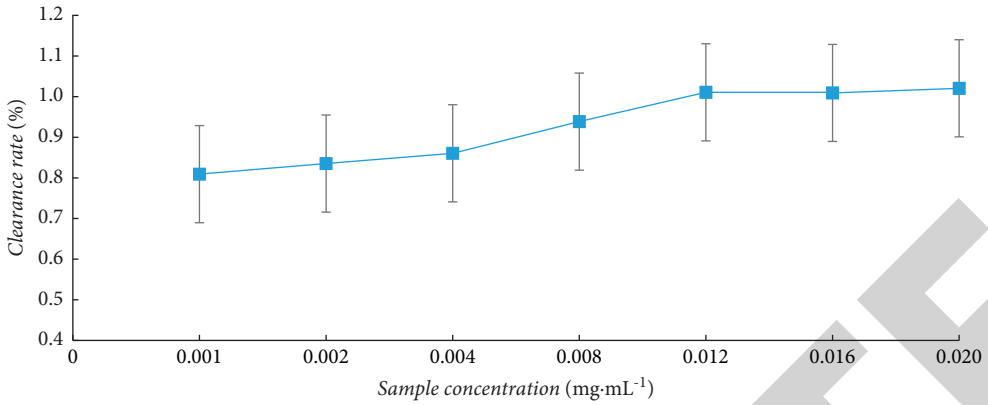

Figure 2: Liquid clearance curves of Vc samples with different concentrations.

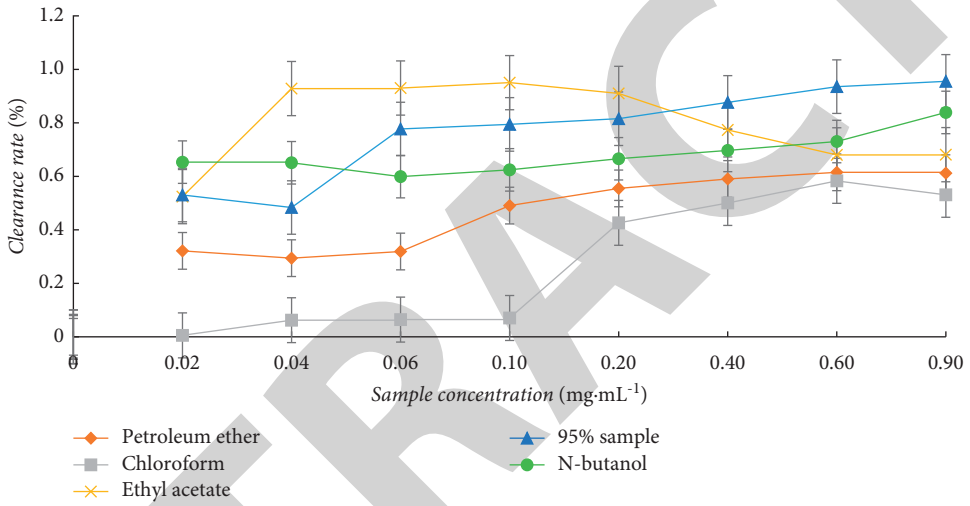

Figure 3: Removal rate curves at different polarity areas.

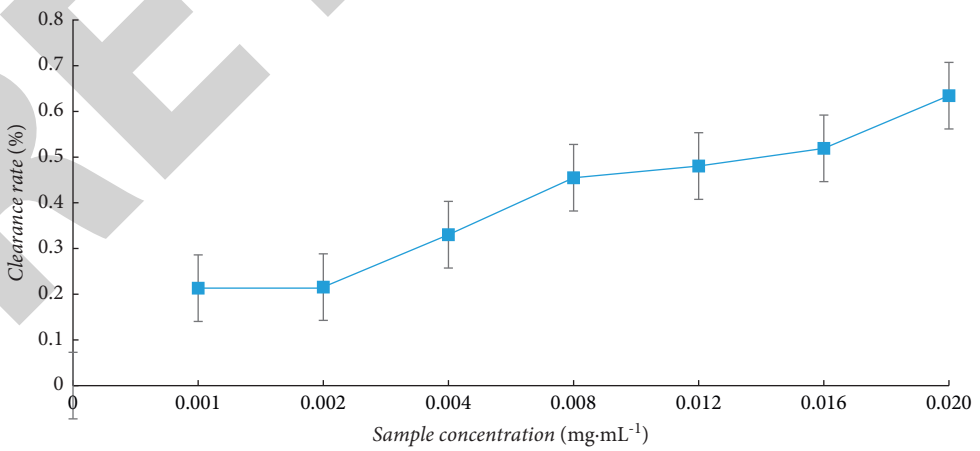

Figure 4: Liquid clearance curves of Vc samples with different concentrations.

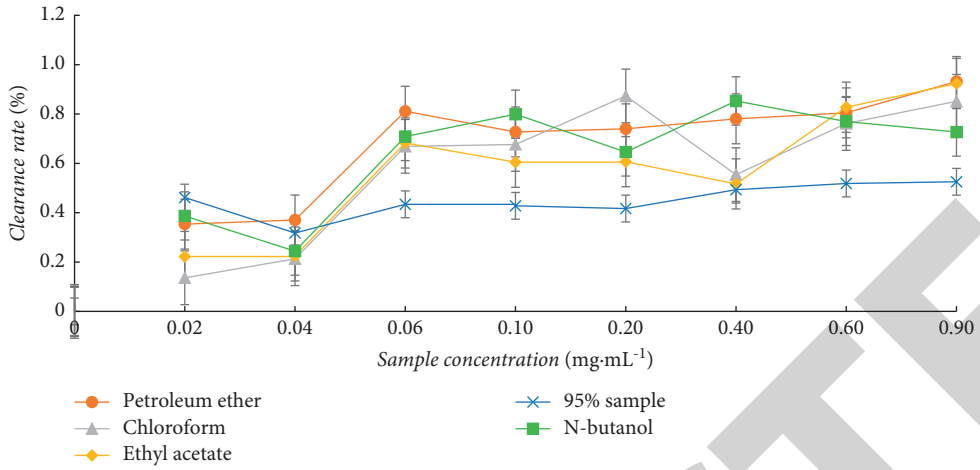

Figure 5: Removal rate curves at different polarity areas.

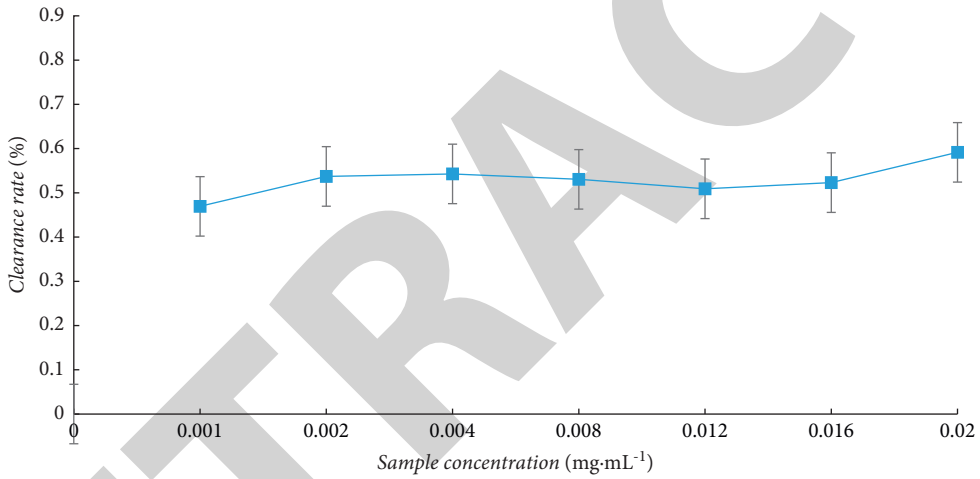

Figure 6: Liquid clearance curves of Vc samples with different concentrations.

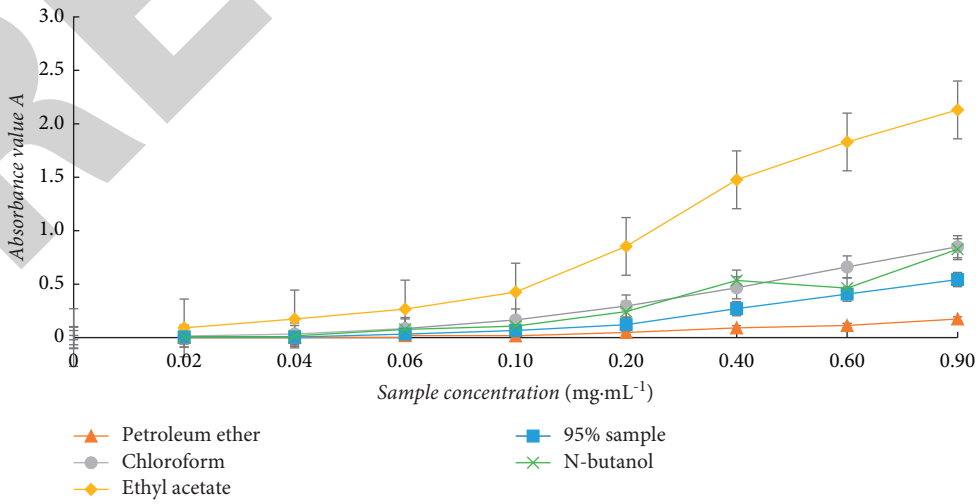

Figure 7: Absorption value curve at different parts of each polarity.

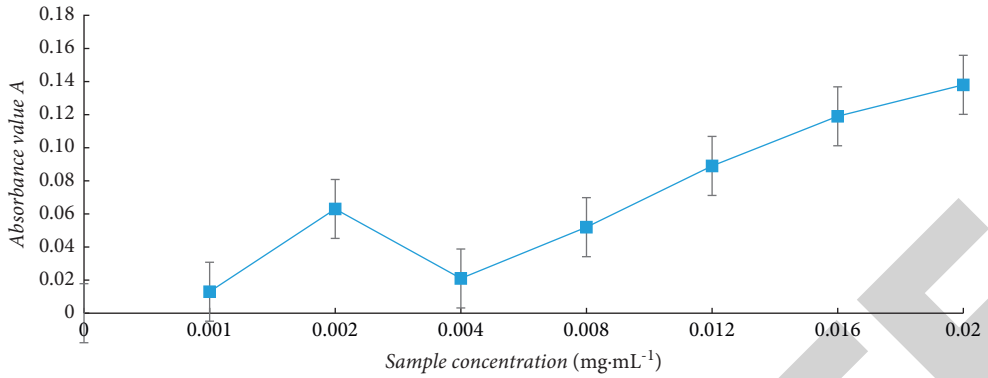

Figure 8: Absorbency curve of Vc sample solution with different concentrations.

Table 1: Antieffect of chrysanthemum branches on four strains.

95% ethyl alcohol (mg mL^{-1})	*Escherichia coli*	*Staphylococcus epidermidis*	*Salmonella typhi*	*Bacillus subtilis*
25	+	+	-	+
20	+	+	-	+
15	+	+	-	+
10	+	+	-	+

had no inhibition on *Salmonella typhi*, but had inhibition on *Staphylococcus epidermidis*, *Bacillus subtilis*, and *Escherichia coli*.

5. Discussion and Conclusion

Screening plant parts for antioxidant and antibacterial activities was performed by extracting different parts of *Vernonia cumingiana* Benth. including leaves, flowers, and stems with various types of solvents (methanol, dichloromethane, and ethyl acetate). Hence, a proper solvent system has to be used for extraction of maximum amounts of potent antioxidant components from typical plant materials. In the antioxidant experiment, the antioxidant activity of *Vernonia cumingiana* Benth. from different polar parts on DPPH•, •OH, and O^{2-}• free radical scavenging rate and total reducing power were determined. The results showed that the three kinds of free radicals were scavengers in different polar parts, and there was a dose-effect relationship between the concentration and the scavenger and antioxidant ability. Different polar parts have different clearance rates in different antioxidant experiments, that is, they have different antioxidant capacity. Taken together, the ethyl acetate component has better antioxidant activity, and its scavenging ability is stronger than that of Vc, especially in the scavenging of DPPH• and •OH, followed by the antioxidant ability of the n-butanol component. Petroleum ether components are generally weak, but its ability to remove O^{2-}• is relatively strong; the total reducing power of chloroform is second only to ethyl acetate, and the removal of 95% ethanol extract •OH is second only to ethyl acetate, but for others, the scavenging ability of free radicals is weak.

In addition, the total reducing power of samples from different polar parts of *Vernonia venomata* is greater than Vc. Therefore, *Vernonia* has a strong antioxidant capacity. In the antibacterial experiment, the alcohol extracts of *Vernonia cumingiana* Benth. with different concentrations have a certain inhibitory effect on Gram-negative bacteria (*Bacillus subtilis* and *Escherichia coli*) and Gram-positive bacteria (*Staphylococcus epidermidis*); all concentrations of alcohol extracts have no inhibitory effect on the Gram-negative bacterium *Salmonella typhi*. The study of antibacterial experiments has laid a certain theoretical foundation for the development of new plant-derived antibacterial drugs.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

No potential conflicts of interest were reported by the authors.

Acknowledgments

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