Cyclic Voltammetric studies of a simple ascidian *Phallusia nigra*

B. Malikka, *S. Sankaravadivu and *D. Shanmuga Priya
Assistant Professor, Department of Chemistry, A.P.C Mahalaxmi College for Women, Thoothukudi

Abstract

Ethanolic extract of *Phallusia nigra* was investigated for its chemical constituents. Cyclic voltammetric technique was used to assess its antioxidant activity. The results show the good antioxidant activity of the extract and the electrochemical behaviour of the constituents in it at glassy carbon electrode.

Keywords: *Phallusia nigra*, Cyclic Voltammetry Electrode

INTRODUCTION

Ascidians are marine sedentary organisms and they belong to biofouling community. They are found in piers, pilings, harbour installations, materials used in aquaculture operations etc. *Phallusia nigra* is a simple ascidian belonging to the family Ascidiidae. Ascidians are consumed as food in many parts of the world and there are coastal aqua farms in Japan as well as Thailand for the culture of ascidians. *Microcosmus sulcatus, Styela plicata* and *Polycarpa pomaria* are taken as food in the Mediterranean.[1] *Halocynthia roretzi* in Japan, is even cultured in the North of Honsyu[2] for human consumption and *Pyura chilensis* is popular in South America[3] as a food source. Margalino and Destefano found that the flesh of *Microcosmus sulcatus* is almost as digestible as whole egg and the protein content higher.[4] Previous studies show that the animal possesses antipyretic[5], analgesic[6], anaesthetic[7] wound healing[8] and antimicrobial activities.[9-13] and Chemical investigation and antioxidant, antitumour effect to DLA, EAC cells using *Ecteinascidia venui* has been carried out so far.[14-24]. The objective of this work is to investigate the antioxidant nature in *Phallusia nigra* by cyclic voltammetric studies.

MATERIALS AND METHODS

Collection and identification

Phallusia nigra (Plate:1) was collected from Green Gate area (8˚48'N and 78˚11'E) of Thoothukudi Port, Tamil Nadu by SCUBA diving and identified using Key to identification of Indian ascidians.[25] A voucher specimen (AS 2083) was deposited in the Museum of the Department of Zoology, A.P.C. Mahalaxmi College for Women, Tuticorin 628002 Tamilnadu, India.

Plate 1: *Phallusia nigra* Sav.

Preparation of extract

The whole animal was dried in shade and homogenized to get a coarse powder. The powder was successively extracted with various solvents such as petroleum ether (400-600 °C), benzene, chloroform, ethanol, methanol and water. The ethanolic extract of *Phallusia nigra* was used to prepare nanoparticles like FeO and silver etc.,

a. Synthesis of iron oxide nanoparticles

A. Preparation of Ferric chloride

Iron (III) chloride/ Ferric chloride (FeCl3) analytical grade was purchased from Merck & Co. and used without further purification. Double distilled deionised (DI) water was used throughout the course of this investigation. A solution of FeCl3 (0.01 40uM) was prepared by dissolving the solid $FeCl_3$ in DI water.

B. Preparation of *Phallusia nigra* extract

Phallusia nigra simple ascidian, was collected and washed thoroughly to remove the adhering soil and dust and heated 100 g/L fine piece at 80◦C for 30 min followed by filtering through filter paper to separate out the broth. The pH of the extract was 4.10. The extract was stored at 4◦C for further experiments [25].

C. Iron oxide nanoparticles

In the typical synthesis of Iron oxide, the above prepared *nigra* extract was used in order to reduce and cap the Fe ions. 20 ml of the above prepared extract was dripped slowly into the aqueous solution of $FeCl_3$ with constant stirring at room temperature with normal atmosphere pressure. After adding the extract into $FeCl_3$ solutions within 3 mins a visible color changes were observed, the yellow color aqueous solution of $FeCl_3$ turned to greenish black.

b.Synthesis of silver nanoparticles

A. Preparation of Silver nitrate

Silver nitrate (analytical grade) was purchased from Merck & Co. and used without further purification. Double distilled deionised (DI) water was used throughout the course of this investigation. A solution of $AgNO_3$(0.001 M) was prepared by dissolving the solid $AgNO_3$ in DI water.

B. Preparation of *Phallusia nigra* extract

Phallusia nigra simple ascidian, was collected and washed thoroughly to remove the adhering soil and dust and heated 100 g/L fine piece at 80◦C for 30 min followed by filtering through filter paper to separate out the broth. The pH of the extract was 4.10. The extract was stored at 4◦C for further experiments [26].

C. Silver nano particles

Phallusia nigra extract is used to produce silver nanoparticles in this experiment Ag+ ions were reduced to Ag nanoparticles when *nigra* extract is mixed with AgNO3 solution in 1:8 ratio reduction is followed by on immediate change in yellowish to brown color in the aqueous solution of the plant extract due to excitation of surface Plasmon vibration in silver nanoparticle. Further formation of AgNPs in aqueous extract can be monitored by color change.

The color changes when the aqueous extract of *Phallusia nigra* was mixed with an AgNO3 solution. The mixture was kept at room temperature for 24 hours. The appearance of a yellowish-brown color in the reaction

vessel indicated formation of AgNPs. AgNPs exhibit this yellowish-brown color in aqueous solution due to excitation of surface plasmon resonance in the AgNPs.

Antioxidant Studies

Cyclic voltammograms trace the transfer of electrons during an oxidation-reduction (redox) reaction. The potential of an electrode in solution is linearly cycled from a starting potential to final potential and back to the starting potential. Here, the current is measured as a function of potential. This process, in turn, cycles the redox reaction. Multiple cycles can takes place. The system starts off with an initial potential at which no redox can takes place.

At critical potential during the forward scan, the electroactive species will begin to be reduced. After reversal of potential scan direction and depletion of the oxidised species, the reverse reaction, oxidation takes place. The commonly used working electodes are glassy carbon, planar platinum disks, platinum wires, hanging mercury drops and carbon paste electrode. The shape of the voltammogram depends on the mechanism of the electrode process. The number of electrons transferred in each peak can be determined by cyclic voltammetry.

RESULTS AND DISCUSSION

The results of antioxidant studies in a selected simple ascidian *Phallusia nigra* in fig 1 and 2.

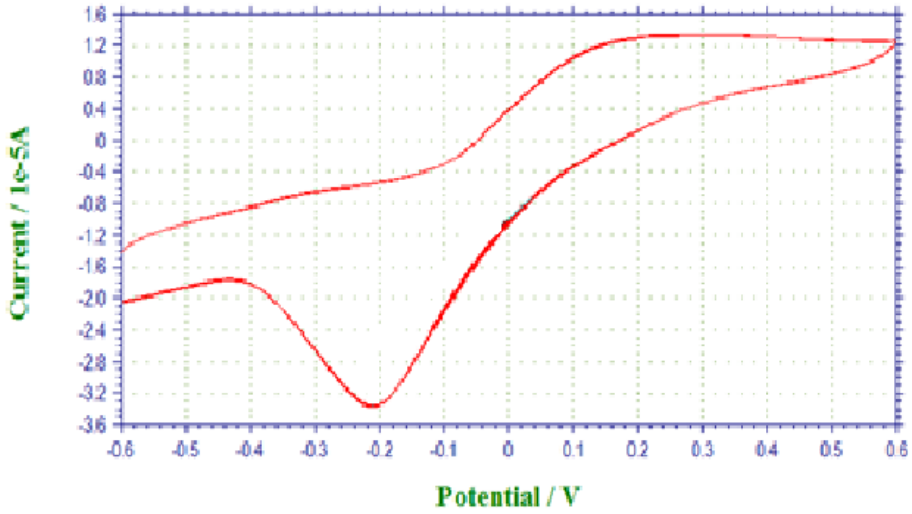
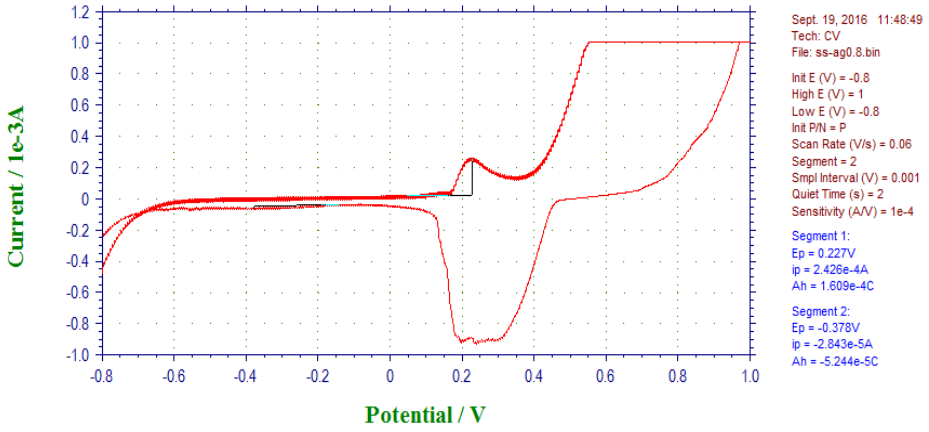


Figure : 1 Cyclic voltammetic studies using FeO Nanoparticle

Cyclic voltammograms were recorded in the scan rate 0.1 for 1.0 ml of Iron oxide nanoparticles synthesised using *Phallusia nigra* extract. The glassy carbon electrode was as working electrode Vs Ag/AgCl Iron oxide nanoparticles. It showed one oxidation peak and one reduction peak. The background current was recorded for all scan rates studied in the potential range from –0.6 to 0.6 V. The voltammogram of nanoparticles exhibited one sharp anodic peak (-0.20) and cathodic peak. This behaviour is associated with the electroactive nature of iron oxide nanoparticles.



Silvernanoparticles.

Figure 2: cyclic voltammetric studies of silver nanoparticles

Cyclic voltammograms were recorded in the scan rate 0.1 for 1.0 ml of silver nanoparticles synthesised using *Phallusia nigra* extract. The glassy carbon electrode was as working electrode Vs Ag/AgCl Iron oxide nanoparticles. It showed one oxidation peak and one reduction peak. The background current was recorded for all scan rates studied in the potential range from –0.8 to 0.8 V. The voltammogram of nanoparticles exhibited one sharp anodic peak and cathodic peak. This behaviour is associated with the electroactive nature of silver nanoparticles.

Conclusion:

The results of the present study suggest that the alcoholic and aqueous extract of *Phallusia nigra* illustrates highly significant antidiabetic activity, which may be due to the presence of flavonoids and phenols.

References:

REFERENCES

1. Harant H, Les Tuniciers comestibies. Atti del 11 congresso Inter. Nazionvale d' Igiene di Medicina Mediterranca Palermo, 1951; 1-3.
2. Tokioka, T., Ascidians of Sagami Bay, "Iwanami Bhoten, Tokyo, 1953.
3. Van Name, W.G., The North and South American ascidians. Bull. Am. Mus. Nat. Hist., 1945; 84: 1-476.
4. Margalino, G.A. and Destefano. M., Contributo alla conoscenza della digeribilita delle Ascidie Eduli. Thalassia jonica, 1960; 3: 69-82.
5. Gopalakrishnan S, Meenakshi VK, Shanmugapriya D. Antipyretic and Analgesic activity of Phallusia nigra Savigny, 1816. Annals of Biological Research, 2011; 20, 2(4): 192-196.
6. Gopalakrishnan S, Meenakshi VK, Shanmugapriya D, Anaesthetic activity of Phallusia nigra Savigny. Annals of Biological Research, 2012; 3(4): 1863-1865.

7. Gopalakrishnan S, Meenakshi VK, Shanmugapriya D, Anti-Inflammatory activity of Simple Ascidian, Phallusia nigra Savigny. International Journal of Pharmaceutical sciences Review and Research, 2013; 22(2): 162-167.
8. Gopalakrishnan S, Meenakshi VK, Shanmugapriya D.Wound healing activity of the methanolic extract of Phallusia nigra Savigny. International Journal of Chemical and Pharmaceutical Sciences, 2013; 45-51.
9. Gopalakrishnan S, Meenakshi VK, Shanmugapriya D, Antimicrobial activity of the methanolic extract of Phallusia nigra Savigny. Journal of Natural Product and Plant Resources, 2012; 2(5): 579-583.
10. Shanmuga priya D, Kohila Subathra Christy H, S. Sankaravadivu. Antimicrobial activity of a simple ascidian, Phallusia nigra. World journal of pharmacy and Pharmaceutical sciences, 2015; 4(7): 822-827.
11. Shanmuga priya D, Kohila Subathra Christy H, S.Sankaravadivu and C.Stella Packiam Antioxidant activity of the simple ascidian, Phallusia nigra of Tuticorin cost. International journal of Pharmaceutical chemistry, 2015; 410-412.
12. Shanmuga priya D, Kohila Subathra Christy H, S.Sankaravadivu and C. Stella Packaim Antidiabetic activity of the ethanolic extracts of a simple ascidian, Phallusia nigra. World journal of pharmacy and Pharmaceutical sciences, 2015; 4(11): 1557-1563.
13. Shanmuga priya D, Kohila Subathra Christy H, S. Sankaravadivu. Hepatprotective activity of the ethanolic extracts a simple ascidian, Phallusia nigra against ccl4 induced hepatotoxicity in rats. World journal of pharmaceutical research, 2015; 5(1): 648-655.
14. Sankaravadivu, S, R. Jothibai Margret and V.K. Meenakshi. 2013. Infrared andgas chromatogram-mass spectral studies of the ethanolic extract of *Ecteinascidia venui* Meenakshi, 2000. International Journal of Chemical and Pharmaceutical Sciences, 4(2):84-89, ISSN: 0976-9390, Impact factor: 0.684
15. Sankaravadivu, S, R. Jothibai Margret and V.K. Meenakshi. 2013. Spectrophotometric studies of a colonial ascidian *Ecteinascidia venui* Meenakshi, 2000. International journal of pharmacy and biological sciences, 3(4): 159-163, ISSN: 2321-3272, Impact factor: 0.885, UGC Journal number 46322.
16. Sankaravadivu, S, R. Jothibai Margret and V.K. Meenakshi. 2015. Preliminary Screening and IR Spectral studies of a colonial ascidian *Ecteinascidia venui* Meenakshi, 2000. Journal of Chemical, biological and physical sciences, 5(4): 4205-4210, Impact factor: 1.310.
17. Sankaravadivu, S, R. Jothibai Margret and V.K. Meenakshi. 2016. AntitumourActivity of *Ecteinascidia venui* Meenakshi, 2000 against Dalton's Lymphoma Ascites. International Journal of Pharma Research and Health sciences, 2016; 4(3): 1214-1222, ISSN: 2348-6465, Impact factor: 0.039.
18. Sankaravadivu, S, R. Jothibai Margret and V.K. Meenakshi. 2016. Assessment of Acute and Subchronic Oral Toxicity of *Ecteinascidia venui* Meenakshi, 2000. World Journal of Pharmacy and Pharmaceutical Sciences, 5(7): 1225-1234, ISSN: 2278-4357, Impact factor: 7.421.
19. Sankaravadivu, S, R. Jothibai Margret and V.K Meenakshi. 2016. *In vitro* antioxidant studies of a colonial ascidian *Ecteinascidia venui* Meenakshi, 2000. International Journal of Pharmaceutical Chemistry, 6(6): 169-177, Impact factor: 0.498.

20. Sankaravadivu, S, R. Jothibai Margret and V.K. Meenakshi. 2016. *Ecteinascidia venui* Meenakshi, 2000 induces immunomodulations against Dalton's lymphoma ascites. International Journal of Medicinal Chemistry and Analysis, 6(2): 79-86, ISSN: 2279-7595, Impact factor: 1.34.
21. Sankaravadivu, S, R. Jothibai Margret and V.K. Meenakshi. 2016. *Ecteinascidia venui* Meenakshi 2000 against Ehrlich Ascites carcinoma - Anticancer Potential. European Journal of Pharmaceutical and Medical Research, 3(9): 329-334, ISSN:2394-3211, Impact factor: 4.8971.
22. Sankaravadivu, S, R. Jothibai Margret and V.K. Meenakshi. 2016. Immunonature of *Ecteinascidia venui* Meenakshi, 2000 against Ehlrich Ascites Carcinoma. International Journal of Current Research, 8(11):41678-41684, ISSN: 0975-833X, Impact factor: 7.749.
23. Sankaravadivu, S, R. Jothibai Margret and V.K. Meenakshi. 2016. Evaluation of anticancer activity of *Ecteinascidia venui* Meenakssi, 2000 against S-180. Scholars Journal of Applied Sciences, 4(12A):4231-4238, ISSN: 2347-954X, Impact factor: 0.671.
24. Sankaravadivu, S, R. Jothibai Margret and V.K. Meenakshi. 2018. Synthesis and characterization of iron oxide nanoparticles using colonial tunicate *Ecteinascidia venui*. International Journal of Emerging Technology and Innovative Research, 5(7):393 -397, ISSN: 2349-5162, Impact factor: 3.24. UGC journal number 63975.
25. Meenakshi, V.K. Biology of a few chosen ascidians. Ph. D Thesis, Manonmaniam Sundaranar University, Tirunelveli, 1997; 157-173.
26. Matheswaran Balamurugan, Shanmugam Saravanan, Tetsuoo soga. E-jourmnal of surface science and Nanotechnology. Synthesis of Ironoxide Nano particles by using *Eucalyptus Globulus* Plant Extract, 12, 201 363-367.
27. Green Synthesis of Silver Nanoparticles Using Extracts of *Ananas comosus* Naheed Ahmad1, Seema Sharma2* 1Department of Botany, Patna University, Patna, India 2Department of Physics, A. N. College, Magadh University, Patna, India