Journal of Coastal Life Medicine

journal homepage: www.jclmm.com

Short communication doi: 10.12980/jclm.4.2016j5-66

Antibacterial activity of *Ulva reticulata* from southwest coast of Kanyakumari, India

Sundaram Ravikumar, Lawrance Anburajan[*#], Balakrishnan Meena[#]

Centre for Marine Science and Technology, Manonmaniam Sundaranar University, Rajakkamangalam 629 502, Tamil Nadu, India

ARTICLE INFO

Article history:
Received 27 May 2015
Received in revised form 1 Jun, 2nd revised form 29 Jun 2015
Accepted 5 Aug 2015
Available online 27 Feb 2016

Keywords:
Ulva reticulata
Antibacterial activity
Kanyakumari

ABSTRACT

Objective: To evaluate the antibacterial activity of *Ulva reticulata* species collected from the Kanyakumari coast of India to determine their potential for bioactivity.
Methods: The algal extract was prepared using *n*-butanol for evaluating the antibacterial activity of *Salmonella typhi, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Vibrio cholerae, Vibrio parahaemolyticus, Bacillus cereus* and *Listeria monocytogenes*.
Results: It was observed that the *n*-butanolic extract of the seaweed powder of *Ulva reticulata* (25–100 mg/mL) exerted notable antibacterial activity against tested bacterial strains. The maximum antibacterial activity was exhibited against *Escherichia coli* and *Bacillus cereus* in all concentrations.
Conclusions: The results obtained in the present investigation supported the traditional use of the seaweeds against various infections. However, further investigation has been carried out to elucidate the exact mechanism and isolation of active principle.

1. Introduction

Marine algae are known to produce a wide variety of bioactive secondary metabolites and several compounds have been derived from them for prospective development of novel drugs by the pharmaceutical industries[1]. Marine macro-algae are considered as the actual producers of some bioactive compounds with high activity[2]. Red algae of family Rhodomelaceae are known as a rich source of bromophenols[3]. Some of these compounds previously isolated from the family exhibited a wide spectrum of pharmacological activities such as cytotoxic, antioxidant, anti-inflammatory and antimicrobial activities[4].

The green algae (*Ulva lactuca*) have long been used as food and as a traditional medical agent to treat various infections and diseases[5]. The antimicrobial activity of *Ulva lactuca* was reported to be caused by the acrylic acid, commonly found in the algae[6]. Antibacterial effects of hexane and methanol extracts of the macro-algae (*Mastocarpus stellatus*) againist pathogenic bacteria were also reported[7]. Antibacterial activity of *Ulva reticulata* (*U. reticulata*)from Kanyakumari coast has not been studied for biotechnological applications and biopharmaceuticals. In this context, a study was undertaken to isolate and evaluate the prospective bioactive substances from *U. reticulata*.

2 Materials and methods

2.1. Collection of seaweed samples

Fresh seaweed samples of *U. reticulata* were collected from the Kanyakumari coast of India. Healthy and well grown plants were collected and cleaned with seawater and then freshwater to remove all epiphytes and dried in room temperature. The dried samples were powdered for the extraction of antimicrobial compounds.

2.2. Extraction of macro-algae

Dried powder of (50 g) seaweed samples was immersed in *n*-butanol, percolated three times and kept for evaporation. The dried extract powder was dissolved in the respective solvent and used for the bioassay.

*Corresponding author: Lawrance Anburajan, Andaman and Nicobar Centre for Ocean Science and Technology, ESSO-NIOT, Dollygunj P.O., Port Blair 744 103, Andaman and Nicobar Islands, India.
Tel: +91-9679550065
Fax: +91-3192-225089
E-mail: anburajanl@yahoo.co.in
#These authors contributed equally to this work.
The journal implements double-blind peer review practiced by specially invited international editorial board members.

2.3. Evaluation of antibacterial activity

Antibacterial activity of the *U. reticulata* was tested using pathogenic bacteria. The pathogens included *Salmonella typhi, Staphylococcus aureus, Escherichia coli* (*E. coli*), *Pseudomonas aeruginosa, Vibrio cholerae, Vibrio parahaemolyticus, Bacillus cereus* (*B. cereus*) and *Listeria monocytogenes*. The bacterial strains were grown in nutrient broth medium at 37 °C. Stock cultures were maintained in nutrient medium at 4 °C and sub-cultured at regular intervals. The nutrient agar medium contained 5 g peptone, 3 g beef extract, 5 g NaCl and 20 g agar in distilled water.

Antimicrobial activity was evaluated using the agar diffusion technique in Petri dishes. Briefly, 20 mg evaporated extract was impregnated into a sterile filter paper disc (5 mm diameter). The impregnated extracts and commercial antibiotic disc were placed on seeded agar plates and kept it for incubation. After 24 h of incubation, the zone of inhibition of the bacterial species was measured by using graduated scale and expressed as millimetre in diameter. Discs containing standard concentrations of chloramphenicol were used as controls.

3. Results

The antibacterial activity of *U. reticulata* was evaluated against the pathogenic bacterial strains. The antibacterial activity against each bacterial strain was presented in Table 1. The *n*-butanolic extract of the seaweed powder of *U. reticulata* (25–100 mg/mL) exerted notable antibacterial activity against tested bacterial strains. The maximum antibacterial activity was exhibited against *E. coli* and *B. cereus* in all concentrations.

Table 1

Antibacterial activity of *n*-butanol extract of *U. reticulata*[a].

Microorganisms		*n*-butanol extracts (mg/mL)				Standards
		25	75	50	100	C
Salmonella typhi	G +	-	-	3	5	22
Staphylococcus aureus	G +	-	-	4	6	22
E. coli	G -	2	5	8	12	27
Pseudomonas aeruginosa	G -	-	5	9	10	23
Vibrio cholerae	G -	-	-	5	7	28
Vibrio parahaemolyticus	G -	-	-	6	7	21
B. cereus	G +	4	7	9	13	26
Listeria monocytogenes	G +	-	3	6	8	21

[a]:Values were the zone of inhibition [mm, including the diameter of disc (5mm)]; G +: Gram-positive; G -: Gram-negative; C: Chloramphenicol (20 μg/mL).

4. Discussion

The results obtained in the present investigation supported the traditional use of the seaweeds against various infections. The present study revealed that *n*-butanol has higher efficiency in extracting antibacterial compounds from macro-algae. Pesando and Caram reported that *E. coli* was more sensitive to *Laurencia obtusa*[8]. Glombitza suggested that dimethyl sulphide and acrylic acid from seaweeds have antimicrobial activity[9]. Pratt *et al*. observed that macro-algae were known to reduce typhoid, cholera, dysentery[10]. Literature survey clarified that marine algae are the richest sources of dietary fibre, minerals, proteins and vitamins, and anti-oxidant activity of these seaweeds would elevate their value in the human diet as food and pharmaceutical supplements[11]. To our knowledge, this is the first report from India of bioactive compounds from *U. reticulata*, which is effective against the multiple drug resistant bacteria.

In conclusion, the results of the present investigation indicated the scope for deriving biologically active compounds from macro-algae which are effective in inhibiting the growth of the pathogenic bacteria Gram-positive and Gram-negative, indicating a great scope for further investigations towards the development of novel drugs.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgments

The authors are grateful to the authorities of M. S. University, Tirunelveli for providing facilities to conduct the research.

References

[1] Abedin RMA, Taha HM. Antibacterial and antifungal activity of cyanobacteria and green microalgae. Evaluation of medium components by Plackett-Burman design for antimicrobial activity of *Spirulina plastensis*. *Glob J Biotechnol Biochem* 2008; **3**: 22-31.

[2] Shimizu Y. Microalgal metabolites: a new perspective. *Annu Rev Microbiol* 1996; **50**: 431-65.

[3] Oh KB, Lee JH, Chung SC, Shin J, Shin HJ, Kim HK, et al. Antimicrobial activities of the bromophenols from the red alga *Odonthalia corymbifera* and some synthetic derivatives. *Bioorg Med Chem Lett* 2008; **18**: 104-8.

[4] Williamson G, Carughi A. Polyphenol content and health benefits of raisins. *Nutr Res* 2010; **30**: 511-9.

[5] Kim IH, Lee DG, Lee SH, Ha JM, Ha BJ, Kim SK, et al. Antibacterial activity of *Ulva lactuca* against methicillin-resistant *Staphylococcus aureus* (MRSH). *Biotechnol Bioprocess Eng* 2007; **12**: 579-82.

[6] El Yamany KNM. Studies on some marine macroalgae isolated from Red Seashores (Quseir, Marsa Alam), Egypt [dissertation]. Beni-Suef: Beni-Suef University; 2008.

[7] Dubber D, Harder T. Extracts of *Ceramium rubrum*, *Mastocarpus stellatus* and *Laminaria digitata* inhibit growth of marine and fish pathogenic bacteria at ecologically realistic concentrations. *Aquaculture* 2007; **274**: 196-200.

[8] Pesando D, Caram B. Screening of marine algae from the French Mediterranean coast for antibacterial and antifungal activity. *Bot Mar* 1984; **27**: 381-6.

[9] Glombitza KW. Antimicrobial constituents in algae quantitative determination of acrylic acid in sea-algae. *Planta Med* 1970; **18**: 210-21.

[10] Pratt R, Mautner H, Gardner GM, Sha V, Dufrenoy J. Report on antibiotic activity of seaweed extracts. *J Am Pharm Assoc Am Pharm Assoc* 1951; **40**: 575-9.

[11] Abdel-Raouf N, Ibraheem IBM, Abdel-Tawab S, Naser YAG. Antimicrobial and antihyperlipidemic activities of isolated quercetin from *Anabaena aequalis*. *J Phycol* 2011; **47**: 955-62.