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Chemical Component Analysis of Marine Sponge Extract of Potentially Medicinal Based on Solvent Differences

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Abstract*—Tracing and characterizing marine natural materials with special medicinal abilities is important to obtain new materials to enrich the diversity of drugs to treat particular diseases. The identification of the chemical components of sponges is interesting, considering the uniqueness and several other abilities possessed by sponges that are thought to have medicinal potential. Searching for chemical components in sponge extracts is suspected to contain secondary metabolic substances with medicinal potential. The study aimed to identify the chemical components of sponge extract with potential medicinal value based on differences in solvents. The first extract on the sponge *Clathria (Thalysias) reinwardti* Sp.1 (CTR) by maceration method using semi-polar solvents (methanol). The second extraction uses a separating funnel with two types of non-polar solvents (diethyl-ether and n-hexane). The chemical components of the three extracts were analyzed using a gas chromatography-mass spectrophotometer instrument. The identified chemical components of sponge extract generally belong to the class of free fatty acids and cholesterol. Investigation of identified compounds with medicinal value chemical components, for example, Cholestan-3.alpha.-ol, Ergosta-5, Hexadecanoic acid, 1-(2,6-Dichlorophenyl)-2-indolinone and Pyridine-3-carboxamide. Searching for chemical components with medicinal potential from sponge extracts is novelty research based on differences in solvents, a new method. Complementing the data from this research, it is necessary to carry out further and specific searches related to chemical components with medicinal properties, which can be carried out by chromatographic fractionation and testing the activity of the extract against bacteria. pathogens and parasitic fungi.

***Keywords*— Chemical component; extract; marine sponge; medicinal potential; solvent.**

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I. INTRODUCTION

The marine environment is a source of various bioactive compounds that greatly benefit human life [1], [2]. The enormous biodiversity of marine ecosystems, diverse environmental conditions, and the potential to produce many types of secondary metabolites by marine plants, invertebrates, and microbial communities [3], [4], [5]. Various marine organisms, such as sponges and corals, are a type of marine animal one of the sources of metabolic compounds [6], [7]. Sponges are marine biota scattered in shallow coastal waters to deep waters [2], [3]. The population of sponges in marine ecosystems is relatively large [8], [9]. Sponges' unique way of life is thought to produce secondary metabolic compounds that may benefit human life, such as raw materials for medicines, cosmetics, specific cooking spices, or food ingredients to meet needs. [10], [11], [12].

Previous research on this topic has reported that several marine animals, such as sea stars and sponges, have medicinal value [13], [14]. This can be seen in the antibacterial activity of the sponge extract against pathogenic bacteria and parasitic fungi, such as the ability to inhibit the growth of *Staphylococcus aureus*, *Bacillus subtilis*, *Salmonella thypi,* and *Escherichia coli*, *Candida albicans* [15], [16], [17]. The results of other studies also report that sponge extract can inhibit the growth of disease-causing enzymes; for example, it has Acetylcholinesterase activity, an

enzyme that can lead to a weakening of the ability to think in humans [18], [17], [18].

The variety, type, and amount of volume contained as a chemical component that is composed of biological material, such as sponge extract is determined by the dynamics of metabolism that runs in the body for its growth and development [7], [19], [20]. The nutrition and lifestyle of these biological natural materials determine the type and diversity of metabolic substances from these materials [21], [22]. Marine sponges are one of the oldest civilized marine animals and unique animals with a way of life or a filter feeder nutritional pattern, forming a mutualism symbiosis with several microorganisms, mainly bacteria [23], [24]. This labels sea sponges as one of the unique biotas. Another uniqueness of sponges is their ability to adapt to extreme habitats contaminated with heavy metal pollutants and carcinogenic hydrocarbon components [11], [25], [26]. This makes sea sponges often used as biomonitoring animals for the presence of pollutants and bioindicators for the pollution level of heavy metals and PAH components in a water area [27], [28].

Based on these conditions, ideally, the use of sponges should not only be for the bioremediation function but broader than that, which can extend to screening chemical components or metabolic substances of sponges for specific purposes such as medicine, cosmetics, and high nutritional supplements [2], [6], [10]. Research that has been carried out currently revolves around screening of sponge symbiont bacteria, especially sponge morphology analysis, isolation and extraction of symbiont bacteria, as well as phenotypic and genotypic analysis of potential bacteria for bioremediation applications or bacteria that are thought to be able to carry out biodegradation functions against several types of PAHs pollutants and biosorption functions against several kinds of heavy metals [12], [15], [21].

Expanding the benefits of sponges and their derived metabolic substances, initial research was carried out by searching for sponge metabolic substances thought to have medicinal potential. The urgency of this research is as a form of enrichment which is expected to be able to discover new things related to potential medicinal sponge metabolic substances specifically intended to treat specific diseases (cancer, tumors, HIV-Aids, arthritis, osteoporosis, Alzheimer's disease and other diseases) [13], [14], [18], including efforts to search for antibiotics in dealing with various diseases in fish and crustacean farming, due to attacks by various types of pathogenic bacteria and viruses which until now have not been identified [7], [8], [18]; drugs were found to be effective in overcoming it [1], [4].

Therefore, this preliminary research aimed to identify the chemical components of sponge extracts as metabolic substances that are thought to have potential and medicinal value based on differences in solvents [21], [22]. Screening for potentially medicinal chemical components from sponge extracts is research based on different solvents, as a novelty method for tracking specific and unique chemical components. The hope is to find new compounds from sponge extracts that can be used as basic ingredients for medicines to treat several current generative diseases [3], [6], [16].

II. Materials and Method

A. Materials and Equipment

The research material consisted of marine sponge samples as the main ingredient, and the details of the sponge samples are shown in Figure 1. Other ingredients, namely: 70% ethanol (pa), 99.6% methanol (*Sigma-Aldrich, 67561*), 98% n-hexane (Sigma -Aldrich, 34859), diethyl ether, 99% (*Sigma-Aldrich, 60297*), Na_2SO_4 (pa), NaOH (pa), physiological 0.9% NaCl, aquabides. Some of the equipment used included the LEICA DM500 neubauer hemocytometer microscope, Portable Water Quality AZ-8361, Gas Chromatography-Mass Spectrometry (GC-MS) Agilent Technologies 7890A, a set of glassware (pyrex), Nikon Coolpix W100 underwater camera, separating funnel, rotary evaporator.

Fig. 1 Sponge sample (Underwater camera photo documentation)

Detailed sponge samples (Fig. 1) were obtained from the waters around Barrang Caddi Island, part of the administrative area of Makassar City, where this island is part of the Spermonde Archipelago. Sampling point at coordinates E -5.049456°; S 119.330629°, depth ± 7 m from marine level, salinity 29.2 ‰, temperature 30.8 ^{0}C, pH 3.7, TDS 8.12 (mg/L), EC 16.19 (ds/m) [29], [30]. The research work procedures, starting from sample preparation and extraction to the process of measuring chemical components, can be briefly seen in Figure 2, [27[, [32].

B. Data Analysis

The data obtained consisted of 3 GC-MS chromatograms based on solvent type. Data on the GC-MS chromatogram includes retention time, percent quantity of each chemical component, peak height (abundance), quality/level of similarity of the compound to the GC-MS library database, and the name of each chemical component. All existing data is analyzed and interpreted based on the chromatogram profile visible on GC. Data on sponge extracts as secondary metabolic substances were interpreted to compare the chemical components of potential drugs and the performance of extracts from each solvent used. It was also used to see the compounds that have potential as medicinal, cosmetic, and beauty ingredients.

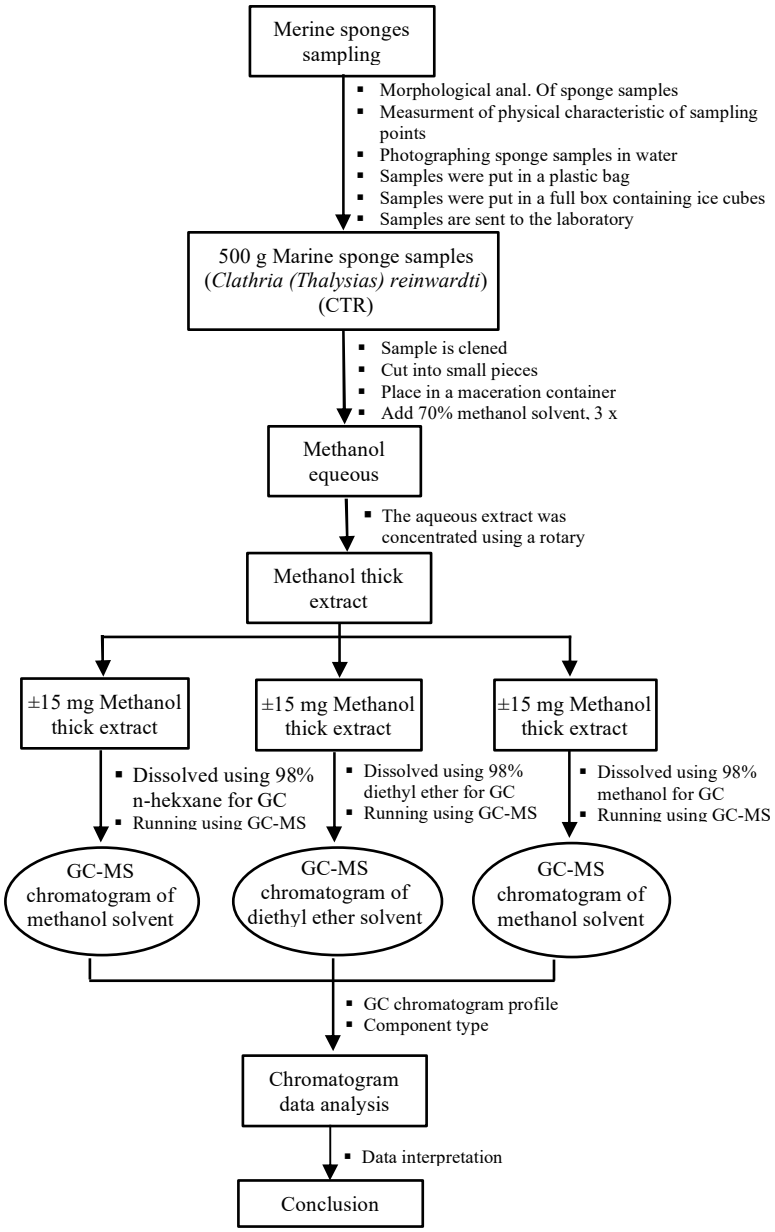

Fig. 2 Working scheme for extracting marine sponge samples and measuring using a GC-MS instrument

III. Results and Discussion

A. Sponge Morphology Analysis

A morphological analysis was carried out to determine the type of sea sponge used as a sample. A clear species of sea sponge will make it easier to search if the results of this study found that in the extract a particular type of sponge has chemical components that have potential or medicinal value, although it does not rule out the possibility that the same sponge species does not rule out the possibility of having a different chemical composition and composition, conversely, there is also the possibility of different sponge species, that have the same chemical components [32], [33]. Based on the macroscopic and microscopic data of the sample (Fig. 3), especially regarding the appearance of acanthostyle (C) and Tylostyles (D) spicules combined with the macroscopic characteristics of the orange-colored sponge (Fig. 3). The sponge sample is light orange in 97% ethanol (Fig. 3. B). Another macroscopic character is that this sponge sample has the properties and character of spongy tissue that is hard and tough, so for this species, it is identified and concluded as a *Clathria (Thalysias) reinwardti* Sp.1 (CTR) [1], [34], [35].

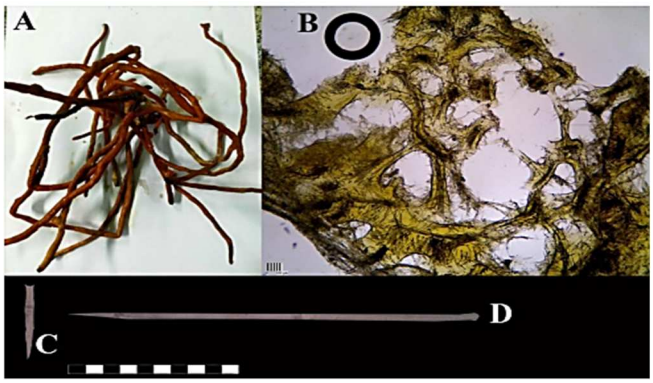

Fig. 3 Structure of macroscopic and microscopic morphology of sea sponge *Clathria (Thalysias) reinwardti* Sp. 1

B. Methanol Extract on Clathria (Thalysias) reinwardti Sp.1

Identification of chemical components of *Clathria (Thalysias) reinwardti* Sp.1 (CTR) sponge extract using methanol aims to attract all the chemical components that are composed, both those with polar and non-polar characters. The type, composition, and abundance of chemical components arranged in the body of the sponge are influenced by many factors, especially nutrition, the dynamics of the living habitat, and the type of metabolism that occurs in the body of the sponge [13], [36], [37]. The visible GC-MS chromatogram peaks were identified as ± 12 (Fig. 4), indicating that at least 12 different chemical components were composed in the methanol extract of the *Clathria (Thalysias) reinwardti* Sp.1 (CTR) sponge [17].

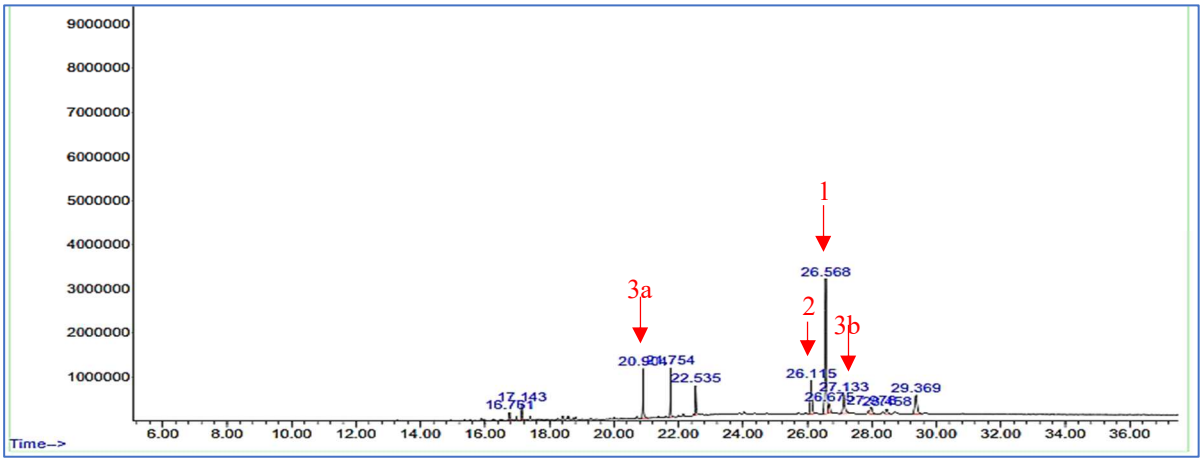

Fig. 4 GC-MS chromatogram of methanol extract of *Clathria (Thalysias) reinwardti* Sp. 1

This is indicated by the appearance of 12 peaks which have different retention times [7], [13], [32]. Based on the abundance of these components, there were four dominant chemical components, namely peak number 1 (Fig. 4, site 1) or peak number 7 (in Table 1) with an abundance of 40.53%, followed by peak number 6 (11.36%) (Fig. 4, site 2) and peak numbers 3 and 9 with an abundance value of 7.91% respectively (Fig. 4, site 3a and 3b) [7], [26], [38]. The GC-MS chromatogram in Figure 3 also shows that of the 12 identical peaks with 12 types of chemical components, two components have a low level of similarity below 90%, namely each component with a peak number of 10, (64% similarity level) and peak number 11 (level of similarities only 46%) (Table 1).

TABLE I
THE CHEMICAL COMPONENT COMPOSITION OF THE METHANOL EXTRACT OF CLATHRIA (THALYSIAS) REINWARDTI SP. 1

Peak number	Retention Time (Second)	Quantity (%)	Quality of similarity (%)	Name of the chemical component
1	16.761	1.14	95	1-Hexadecanol
2	17.143	2.15	98	Pentadecanoic acid
3	20.904	7.91	97	1-(2,6-dihydroxy-4 -methoxyphenyl)
4	21.754	6.82	91	1,2-Benzenedicarboxylic acid
5	22.535	4.58	93	Bicyclo[10.8.0]eicosane
6	26.115	11.36	92	Cholestan-3-ol
7	26.568	40.53	99	Cholest-5-en-3-ol
8	26.675	3.34	91	Cholestan-3.alpha.-ol
9	27.133	7.91	97	Ergosta-5
10	27.978	3.19	64	Silicic acid
11	28.458	1.90	46	Cyclotrisiloxane
12	29.369	9.17	96	beta.-Sitosterol

Based on the data in Table 1, it appears that 12 peaks indicate the presence of 12 types of chemical components in the methanol extract of the *Clathria (Thalysias) reinwardti* Sp.1 (CTR) sponge that can be identified. Based on the level of similarity with the quality standard of 90% and above, two peaks (two components) with low quality were identified, each peak number 10 and 11 [21], [39], [40]. These data indicate that these two chemical components cannot be claimed as chemical components of the methanol extract of the CTR sponge [5], [41], [42]. The chemical components of the methanol extract of CTR which have a quality of ≥ 90% are dominated by the chemical components of the cholesterol group, especially peak numbers 6 – 9 and peak numbers 12, followed by the carboxylic acid group (peak numbers 2, 4 and 10) and chemical components with the tiniest abundance is the alcohol group (peak number 1), phenol group (peak number 3) [32], [43], (Table 1).

C. Analysis of the Chemical Components of Sponge Extracts Using Nonpolar Solvents

Diethyl-ether solvent is a nonpolar solvent group but has different characteristics from other nonpolar solvents. Based on the chemical structure, diethyl-ether (C_2H_5-O-C_2H_5) has a constituent element in the form of the element oxygen which has two pairs of free electrons, causing diethyl-ether to have a relatively high degree of reactivity [7], [15], [44]. Thus,

diethyl-ether solvent can attract certain chemical components that may be different from other nonpolar solvents [8], [14], [41], however, in this study, the extraction performance of diethyl-ether was not better than n-hexane.

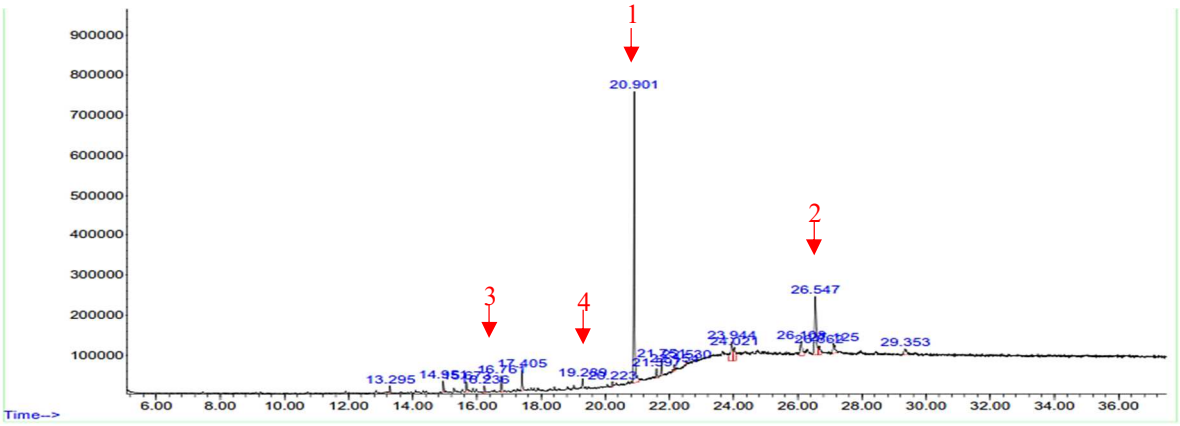

Fig. 5 GC-MS chromatogram of diethyl-ether extract of *Clathria (Thalysias) reinwardti* Sp.1

The GC-MS chromatogram data of the diethyl-ether extract of *Clathria (Thalysias) reinwardti* Sp.1 (CTR) sponge, (Fig. 5) identified ± 20 peaks (Table 2). Each peak with a particular abundance is identical to one type of chemical component. Among the 20 chemical components that appear, there are two chemical components with the highest abundance, namely the chemical component referred to is identical to the phenyl group compound, namely 2-Propen-1-one (1-(2-methoxy phenyl), peak number 9, with abundance reaching 40.50% and 97% similarity level (Fig. 5, site 1) [21], [25], [46]. The second dominant chemical component group is the cholesterol group, namely Cholest-5-en-3-ol, peak number 17, abundance reaching 16.78%, and similarity value up to 92% (Fig. 5, site 2). The chemical components of diethyl ether extract are shown in Table 2.

The combination of data from Table 2 and Figure 5, identified 20 peaks or 20 different types of chemical components but based on the level of similarity data, after analysis, there were only five chemical components that had a similarity level of ≥ 90%. The chemical components referred to respectively have a peak number of 5 (Cyclotetradecane) abundance reaching 2.62% (Fig. 5, site 3); peak number 7 (1-(2,6-Dichlorophenyl)-2-indolinone) abundance 1.50% (Fig. 5, site 4) and peak number 9, (2-Propen-1-one) and peak number 17 (Cholest-5-en-3-ol) (Table 2) [1], [32], [46]. Other components with their respective peak numbers cannot be claimed as chemical components of the diethyl-ether extract of CTR sponge because they have a similarity level of < 90%. In general, it can be said that the chemical components of the diethyl-ether extract of CTR sponge are dominated by phenyl group compounds, namely 2-methoxyphenyl, followed by cholesterol group compounds, namely Cholest-5-en-3-ol [9], [21], [47].

TABLE II
THE CHEMICAL COMPONENT COMPOSITION OF THE DIETHYL-ETHER EXTRACT OF CLATHRIA (THALYSIAS) REINWARDTI SP.1

Peak number	Retention Time (Second)	Quantity (%)	Quality of similarity (%)	Name of the chemical component
1	13.295	0.78	81	Phenol, 2,4-bis(1,1-dimethyl ethyl)
2	14.951	1.88	74	Oxirane
3	15.673	1.93	59	Pyrrolidine
4	16.236	1.06	83	Cysteamine
5	16.761	2.62	97	Cyclotetradecane
6	17.405	3.08	90	Hexadecanoic acid
7	19.289	1.50	99	1-(2,6-Dichlorophenyl)-2-indolinone
8	20.223	0.80	50	p-phenylenebis[trimethyl
9	20.901	40.50	97	2-Propen-1-one
10	21.597	1.34	47	2-Methyl-5H-dibenz[b,f]azepine Cyclotrisiloxane
11	21.751	1.94	46	1,2-Benzenedicarboxylic acid
12	22.154	0.99	50	diethyl bis(trimethylsilyl) ester
13	22.530	0.35	46	Cyclotrisiloxane
14	23.944	6.99	49	2-p-Nitrophenyl-oxadiazol-1,3,4-one-5
15	24.021	3.84	50	Silikonfett
16	26.108	5.27	46	Cyclotrisiloxane
17	26.547	16.78	92	Cholest-5-en-3-ol
18	26.662	3.02	47	Tetrasiloxane
19	27.125	3.30	49	Cyclotrisiloxane
20	29.353	2.04	47	Decamethyltetrasiloxane

D. The Chemical Component of the n-hexane Extract on Clathria (Thalysias) Reinwardti Sp.1 Sponge

The n-hexane solvent [$CH_3(CH_2)_4CH_3$] belongs to a class of solvents with a high nonpolar level. Having a longer carbon chain structure is predicted to be able to attract chemical components that have a saturated carbon chain structure. The character of n-hexane is also considered to attract various chemical components, especially those with nonpolar characteristics that are different from other non-polar solvents [21], [48].

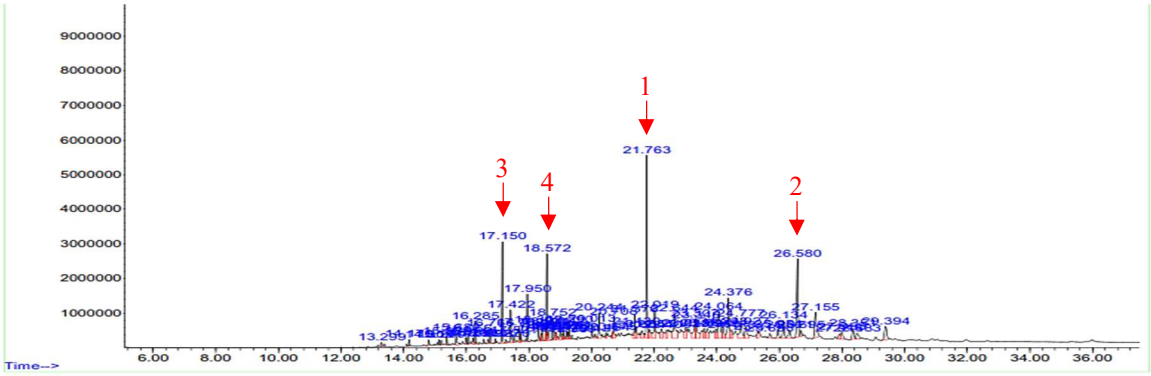

Fig. 6 GC-MS chromatogram of n-hexane extract of *Clathria (Thalysias) reinwardti* Sp.1

The GC-MS chromatogram (Fig.6) has four peaks with the highest abundance. These peaks, based on the order of their abundance, are identical to the chemical components, namely: peak number 48 (1,2-Benzenedicarboxylic acid), abundance 8.71% (Fig.6, site 1), followed by chemical component peak number 71 (Cholest-5-en-3-ol) with an abundance of 7.18% (Fig. 6, site 2) [4], [6], followed by the chemical component peak number 27 (9-Octadecenoic acid), abundance 4.42% (Fig. 6, site 3) and peak number 16 (Hexadecanoic acid), abundance 4.31% (Fig. 6, site 4). What stands out from the four dominant chemical components is that three of them are carboxylic acid group compounds [6], [32], [49]. Details of the chemical components described above, especially peak numbers, retention times, abundance values, quantity and quality, and component names can be seen in Table 3.

TABLE III
THE CHEMICAL COMPONENT COMPOSITION OF THE N-HEXANE EXTRACT OF CLATHRIA (THALYSIAS) REINWARDTI SP.1 SPONGE (QUALITY ⩾ 90%)

Peak number	Retention Time (Second)	Quantity (%)	Quality of similarity (%)	Name of the chemical component
1	13.299	0.27	96	Phenol
2	14.170	0.25	98	Hexadecane
3	14.809	0.34	91	Octane
4	15.141	0.26	98	Heptadecane
5	15.200	0.32	94	Pentadecane
6	15.382	0.42	98	Tetradecanoic acid
7	15.682	0.88	93	Octanal
8	15.999	0.35	98	1-Octadecene
9	16.056	0.46	98	Octadecane
10	16.218	0.37	95	2-Ethylhexyl salicylate
11	16.285	1.00	99	Iso-Propyl tetradecanoate
12	16.567	0.17	95	Pentadecanoic acid
13	16.698	0.26	99	Hexamethyl-pyranoindane
14	16.766	0.72	98	Cyclohexadecane
15	16.922	0.20	98	Nonadecane
16	17.150	4.31	99	Hexadecanoic acid
17	17.270	0.29	90	Trifluoroacetic acid
18	17.422	1.80	99	Hexadecanoic acid
19	17.521	0.47	93	Dibutyl phthalate
20	17.702	0.71	91	Hexadecanoic acid
21	17.748	0.50	98	Eicosane
23	18.307	0.84	94	1,12-Tridecadiene
24	18.392	0.40	95	Sulfur
25	18.424	0.66	98	1-Octadecene
26	18.534	0.62	96	Heneicosane
27	18.572	4.42	99	9-Octadecenoic acid
28	18.615	0.57	99	10-Octadecenoic acid
29	18.752	0.92	99	Stearic acid
30	18.842	0.53	95	Oleic acid
32	19.002	0.78	93	Octadecanoic acid
33	19.079	0.38	99	9-Octadecenoic acid
34	19.118	0.41	98	2-Propenoic acid
35	19.199	0.48	98	Hexadecanoic acid
36	19.251	0.38	99	1-Nonadecene

Peak number	Retention Time (Second)	Quantity (%)	Quality of similarity (%)	Name of the chemical component
37	19.290	0.61	98	Docosane
38	19.369	0.20	91	14-.Beta.-H-Pregna
39	20.013	0.72	98	Tricosane
40	20.121	0.32	94	9-Tricosene
41	20.244	1.65	98	2-Propenoic acid
43	20.675	0.48	93	Dotriacontyl pentafluoropropionate
44	20.708	1.29	98	Docosane
45	21.376	1.54	98	Pentacosane
46	21.430	1.11	90	Erucic acid
47	21.604	0.75	96	Eicosane
48	21.763	8.71	91	1,2-Benzenedicarboxylic acid
49	21.853	0.64	96	Eicosane
50	22.019	2.22	98	Icosane
51	22.231	1.21	96	Eicosane
52	22.408	1.09	95	Eicosane
53	22.644	3.18	98	Heptacosane
55	23.307	2.13	99	Octacosane
62	24.376	3.84	99	Cholesta-3,5-diene
64	24.777	2.78	90	Ergosta-4,6,22-triene
65	24.927	1.60	96	Eicosane
71	26.580	7.18	99	Cholest-5-en-3-ol
72	26.695	0.50	93	Cholestan-3-ol
73	27.155	3.47	92	Ergosta-5,22-dien-3-ol
75	27.993	1.08	91	5-Cholestene-3-ol
76	28.351	1.23	97	Cholest-4-en-3-one

A total of 78 chemical components were identified in the n-hexane extract of the *Clathria (Thalysias) reinwardti* Sp.1 (CTR) sponge type, according to the peaks that appeared. The chemical components were divided into two groups; namely, 59 chemical components had a similarity level of ≥ 90% (Table 3), and 19 chemical components were suspected of having a similarity level of < 90% (Table 4). Tables 3 and 4 are arranged based on the retention time on the GC-MS chromatogram from low to high [9], [13], [36]. The chemical components that appear (Table 3) are dominated by carboxylic acid group compounds, saturated hydrocarbons, cholesterol groups, and a small portion of alcohol and phenols group. An interesting phenomenon in the chemical components identified using n-hexane solvents is the identification of several chemical compounds in the saturated hydrocarbon group [17], [20]. This component is thought to influence the type of n-hexane solvent, which has a saturated and longer carbon chain [34], [50]. These results show the role of solvents with different characteristics between diethyl-ether and n-hexane, which shows that both have different performance in extracting non-polar chemical components contained in CTR sponges, even though both types of solvents are non-polar solvents [14], [42].

TABLE IV
THE CHEMICAL COMPONENT COMPOSITION OF THE N-HEXANE EXTRACT OF CLATHRIA (THALYSIAS) REINWARDTI SP. 1 (QUALITY < 90%)

Peak number	Retention Time (Second)	Quantity (%)	Quality of similarity (%)	Name of the chemical component
22	17.950	2.15	83	iso-Propyl hexadecanoate
31	18.867	0.47	80	1-Nonadecene
42	20.464	0.39	68	Eicosane
54	23.013	1.13	74	Eicosane
56	23.346	2.21	56	Heneicosane
57	23.589	0.86	35	Pyridine-3-carboxamide
58	23.691	1.27	44	Chola-5,22-dien-3-ol
59	23.968	1.10	38	Cyclotrisiloxane
60	24.064	3.53	64	3-Methylheneicosane
61	24.203	1.52	41	N-Methyl-1-adamantaneacetamide
63	24.473	1.13	49	14.alpha.-Cheilanth-12-enic Methyl Ester
5	25.311	0.67	45	1,1,1,3,5,5,5-Heptamethyltrisiloxane
67	25.696	0.69	50	1,1,1,3,5,5,5-Heptamethyltrisiloxane
68	25.954	1.05	53	3,11-Dimethyl-Nonacosane
69	26.134	1.85	53	Cholesta-5,22-dien-3-ol
70	26.321	1.15	41	1H-Indole-2-Carboxylic acid
74	27.915	0.59	55	1,1,1,3,5,5,5-Heptamethyltrisiloxane
77	28.483	0.90	50	2-Methyl-5H-dibenz[b,f]azepine Cyclotrisiloxane
78	29.394	2.04	84	beta.-Sitosterol

Data in Table 4 shows 19 chemical components of the n-hexane extract of CTR sponge, which have a similarity level of < 90%. This shows that these chemical components cannot be claimed as part of the chemical components that make up the CTR sponge extract concerning the standard similarity level of at least 90% [13], [18], [51]. In general, the chemical components of *Clathria (Thalysias) reinwardti* Sp.1 (CTR) sponge which were identified well in the use of methanol, diethyl-ether, and N-hexane solvents are chemical components that have medicinal value, such as Cholestan-3.alpha.-ol, Ergosta-5, Hexadecanoic acid, 1-(2,6-

Dichlorophenyl)-2-indolinone and Pyridine-3-carboxamide [5], [13], [52].

The unique thing that is of concern to the author, especially the results of data analysis in Tables 3 and 4 and Figure 5, is the identification of several saturated hydrocarbon components [23], [27]. Saturated hydrocarbon components contained in the CTR sponge extract are suspected that these marine sponges most likely live or grow and reproduce in marine waters exposed to hydrocarbon pollutants [23], [26]. Sponges nourish these pollutants because sponges can convert carbon into energy for living activities [14], [16], [53]. Nourishing the carbon component causes these pollutants to enter the sponge's living metabolic system, eventually becoming a part or component forming the body structure of the sponge [19], [54]. These saturated hydrocarbon pollutants are predicted to enter marine ecosystems from ship transportation or possibly oil spills from ships, where the waters around Barrang Caddi are included in the transportation zone for tankers and other types of ships [9], [30], [55]. A comparison of GC-MS chromatogram data using 3 types of solvents (methanol, diethyl-ether, n-hexane), shows that the n-hexane solvent performs better in attracting or separating chemical components between polar and non-polar components than the diethyl-ether solvent [5], [56]. The extraction capabilities of the three types of solvents are shown respectively in the GC-MS chromatograms, methanol (Fig. 4 and Table 1), diethyl ether (Fig. 5 and Table 2), and n-hexane (Fig. 6 and Tables 3 to 4) [2], [19].

The polarity of methanol is lower than water, so it is not strong enough to separate the polar and non-polar chemical components that make up the thick CTR ethanol extract. Diethyl ether solvent can also be considered a semi-polar solvent, with a polarity level below that of methanol [32], [48]. Diethyl ether does not have sufficient ability to attract non-polar components in the extract. However, the non-polar properties of diethyl ether are higher than methanol but much lower than n-hexane [12], [20]. The prominent characteristic of n-hexane, apart from its high non-polar properties, is that it is a stable, inert, and volatile organic solvent, so its extraction performance attracts non-polar chemical components in the thick ethanol extract, which is relatively high [32], [47].

Based on the conditions above, it can be said that n-hexane is a better solvent than diethyl-ether in extracting the chemical components of materials [18]. Research findings related to sponge extract metabolic substances can also be said that several chemical components in the steroid group are thought to have antibiotic characteristics, so more comprehensive research is needed to be able to obtain new compounds that can be used as primary ingredients for medicines [1], [7].

IV. Conclusion

Based on the analysis of several existing data, several assumptions can be made as the conclusion of this study, namely: The chemical components of the *Clathria (Thalysias) reinwardti* Sp.1 (CTR) sponge extract are generally compounds of the free fatty acid, carboxylic acid, cholesterol group, a small portion of alcohol and phenol group compounds. The chemical components that make up *Clathria (Thalysias) reinwardti* Sp.1 sponge extract have been identified as being in the category of medicinal value, for example, Cholestan-3.alpha.-ol, Ergosta-5, Hexadecanoic acid, 1-(2,6-Dichlorophenyl)-2-indolinone and pyridine-3-carboxamide. The presence of saturated hydrocarbon components in sponge extracts is thought to originate from nutritious pollutants that enter the sponge's metabolic cycle. The characteristics of each solvent (methanol, diethyl-ether, and n-hexane) affect the ability to extract the chemical components of the sponge extract. A more specific search related to medicinal value chemical components can be carried out by fractionation through chromatography methods and extract activity tests against pathogenic bacteria and parasitic fungi.

Nomenclature

%	percent.
‰	unit of measurement of seawater salinity at the CTR sponge sampling location.
ds/m	desi siemens per meter.
E and S	Marine sponge sampling point (CTR) coordinate measurement direction symbol; "E" = north direction, and "S" = south direction
EC	Electrical Conductivity
g	grams.
GC	gas Chromatography
GC-MS	is an acronym for the Gas Chromatography–Mass Spectrometry instrument, which is a combination/combination of 2 types of instruments, namely Gas Chromatography (GC) and Mass Spectrometry (MS).
HDL	is an acronym for electrical conductivity, namely the ability to conduct electricity to the ions contained in marine water.
pH	potential Hydrogen
Sp 1	shows the type and characteristics of the sea sponge sample Clathria (Thalysias) reinwardti used in this study
TCR	the acronym of the sea sponge Clathria (Thalysias) reinwardti samples used in this study
TDS	is an acronym for total dissolved solids, namely the amount of dissolved solids in seawater at the sampling point.

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