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**EVALUATION OF PROXIMATE ANALYSIS AND ANTIMICROBIAL
ACTIVITY OF *SUAEDA MARITIMA* COLLECTED FROM MANORA
BEACH LOCATED IN THANJAVUR**

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ABSTRACT

Background: *Suaeda maritima* is a perennial flora which thrives in salt marshes and can withstand not just salt but also flooding. Plants are shorter at lower elevations in salt marshes than at higher elevations. In this study we evaluated the antimicrobial activity of the halophyte *Suaeda maritima* against diverse ocular pathogens, including several drug resistant bacteria, was investigated using whole plant extracts.

Methods: The disc diffusion method was used to determine the extracts' antimicrobial activity and also the total carbohydrates, proteins, lipids, fibre, and ash content are assessed for proximate analysis.

Result: According to the findings, the hexane, chloroform, and ethanol extracts of *Suaeda maritima* shows stronger antibacterial power against microorganisms and can be used to treat ocular infections caused by resistant pathogenic microbes.

Conclusion: Furthermore, *Suaeda* plants were found to have high carbohydrate and ash content, as well as significant amounts of protein and crude fibre, and low total lipid.

Keywords: *Suaeda maritima*, Salt marsh, Halophytes, Disc Diffusion, Ocular pathogens

1. INTRODUCTION

Antibacterial resistance to commonly used antibiotics has prompted researchers to look for newer and alternative molecules to treat drug-resistant illnesses. As the globe's population grows, so does the demand for medications around the world. Despite the fact that pharmaceutical companies have developed a number of novel antibiotics in the previous three decades, bacteria have developed resistance to these medications [1]. This resistance has also been observed specifically among pathogens that cause ocular infections, with factors such as empirical antibiotic prescribing, short-term antibiotic exposure, and repeated exposure to the same antibiotic being identified as contributing to ocular pathogen resistance, as well as leading to changes in resident ocular flora. Antimicrobial prophylaxis, which is intended to prevent endophthalmitis and intraoperative infection in patients having eye surgery, may also contribute to higher ocular pathogen resistance rates [2, 3]. Due to this rise in multidrug-resistant bacteria, the urgent demand for new therapeutic medications derived from natural sources has grown in the recent decade. Today, one of the most important aspects of bioactive substance research is the identification of new bioactive chemicals with potent effects

against resistant pathogenic and dangerous microbes. Natural products' diversity makes them one of the most important sources of novel structures that have been discovered to have biologically beneficial properties [4].

Extractions for medicines come from a variety of sources, including plants, animals, and microbes [5]. Plants, in comparison to animals and other organisms, have the property of easy renewability. These medicinal herbs can also be used as a flavonoid, food, fragrances, and for other spiritual purposes. Inadequate drug supplies, exorbitant treatment costs, side effects of many synthetic drugs, and increased resistance to many recently used drugs for infectious diseases have led to a greater reliance on plant-based materials as a source of medicines for the benefit of a healthier human existence [6]. For at least 2000 years, antimicrobials derived from plant extracts have been utilised to treat infectious infections. Penicillin, a natural antibacterial discovered in 1928, has been successfully utilised to treat a variety of microbiological illnesses. An antimicrobial agent's principal job is to stop germs from growing or killing those [7].

Suaeda maritima is a salt marsh perennial plant that can tolerate not only

salt but also flooding. The salinity of coastal salt marshes varies, as does their height, and thus the frequency of tidal inundation. Plants may be covered with seawater twice daily at lower elevations, while this may be monthly or even less frequently at higher elevations. Tolerance to flooding is predicted to be a key element in the zonation of plants in salt marshes when sea levels rise as a result of climate change [8]. *Suaeda* plants might biosynthesize natural compounds with strong antioxidant activity, making them a sustainable resource, sustenance, and edible oil for a bigger population living in tough environments with high salt and drought. These plants also satisfy the needs of folk and alternative medicine. Hence, the overall goal of this study was to determine the antimicrobial activity of *Suaeda maritima* against selected ocular pathogens that cause disease in humans and animals, as well as to identify the likely phytochemical compounds present in the extract that are responsible for these activities.

2. MATERIALS AND METHODS

2.1 Collection of plant materials

Plants of *Suaeda maritima* were obtained from Manora Beach in Pattukkottai Taluk, Thanjavur District (24.8031° N latitude and 66.9596° E). Dr. S. Soosairaj, Assistant Professor,

Department of Botany, St. Joseph's College, Trichy, confirmed the plant's identity as *Suaeda maritima*. To eliminate salt, related organisms, and other foreign debris, the samples were washed in both sea and fresh water. The seaweeds were then spread out on blotting paper to absorb excess moisture before being air dried and pulverised. The powdered samples were then kept in the refrigerator and used to calculate nutritional factors such as carbs, protein, lipid, fibre, and ash content, as well as minerals.

2.2 Proximate Analysis

Total carbohydrates, proteins, lipids, fibre, and ash content are among the parameters assessed for proximate analysis.

2.2.1 Carbohydrates

The total carbohydrate was calculated using phenol's sulphuric acid technique [9].

2.2.2 Protein

The protein content was estimated using Lowry's method [10].

2.2.3 Lipids

According to Folch *et al* [11], lipids were estimated.

2.2.4 Fiber content

The AOAC enzymatic gravimetric method was used to assess the dietary fibre content of seaweeds [12].

2.2.5 Ash content

The *Suaeda* plants have a high ash

concentration. 1g of the material was incinerated to ascertain taken in a crucible of silica and stored in a muffle Preheat the oven to 600 degrees Fahrenheit. The net remains after incineration. The contents were chilled and weighed, represented as a proportion of the total.

2.3 Screening of phytochemicals

Hexane, chloroform, water and ethanol were all used to extract the dried powdered plant material in order to check their antimicrobial potential. After filtration with Whatman filter paper, the extracts were concentrated in a rotary evaporator. For further investigation, the crude extracts were preserved in airtight containers. Standard techniques were used to analyse saponins, alkaloids, tannins, flavonoids, phenols, steroids, glycosides, and diterpenes in both polar and non-polar solvent extracts of *Suaeda maritima*.

2.4 Antimicrobial Activity

2.4.1 Disc Diffusion Method

The ocular pathogens used in this study were already isolated and preserved in our laboratory. All of the selected ocular pathogens were examined using the KBDD method according to the Clinical Laboratory Standards Institute (CLSI) recommendations for their susceptibility to the various solvent extracts of *Suaeda maritima* plant. The test organism was picked up with a sterile loop and suspended

in peptone water before being cultured for two hours at 37°C. The suspension's turbidity was set to 0.5 McFarland's standard (1.5×10^8 CFU/mL). It was then smeared using a sterile cotton swab over the surface of a cation-adjusted Mueller-Hinton agar (MHA) plate. The sterile disc was placed on the agar with varied concentrations of plant extracts (100, 200, 300, and 400). Gentamycin used as positive control. Overnight at 37°C, the plates were incubated. The inhibitory zone was calculated and interpreted [13].

3. RESULTS AND DISCUSSION

3.1 Proximate Composition

The proximate composition was determined, which included carbohydrate, protein, fat, fibre, and ash levels (**Table 1 and Figure 1**). Carbohydrate is an essential component of metabolism because it provides the energy required for respiration and other vital functions [14]. In our study, 19.63% of Total Ash, 9.21% of Moisture, 6.57% of Fat, 2.43 % of Protein, 28.26% of crude fibre and 32.81% of Carbohydrate were observed. The concentration of carbohydrate was higher than other compounds (32.81%). Similar to our study Omer *et al* [15] reported that carbohydrates were shown to be the most prevalent component in macroalgae by proximate composition analysis, accounting for up to 90.83 percent of the dry matter of

the seaweeds.

Proteins play an essential role in every biological process. Enzymatic catalysis, transportation and storage, and mechanical aliment control can all be used to characterise their functions. In the present investigation the crude protein content was recorded as 2.42% of total dry weight. The variations in protein levels may be due to the geographic locations. Lipids, in general, give a higher degree of energy in the oxidation process than in other biological molecules. They serve as a form of storage for live organisms [16]. The lipid content measured in this study was to be 6.57%. Dietary fibres have a number of physiological benefits, including laxation and blood cholesterol control. Dietary fibres can bind harmful substances and so prevent them from moving about in the consumer's body. In this current investigation we recorded higher amount of dietary fibre (28.26%). These findings are in accordance with the findings of Sakthivel and Pandima Devi [17] and Radha [18]. The ash content was noted as 19.63%. Generally ash contents in Coastal plants were high.

3.2 Phytochemical Compounds

Phytochemical constituents obtained in this study using different polar and non-polar solvents were tabulated (Table 2) shows the presence of Alkaloids

and Flavonoids in Hexane extracts, saponins, steroids and phenols in chloroform extracts, saponins, steroids and phenols in aqueous extracts and in case of ethanolic extracts contains only flavonoids, steroids and phenols.

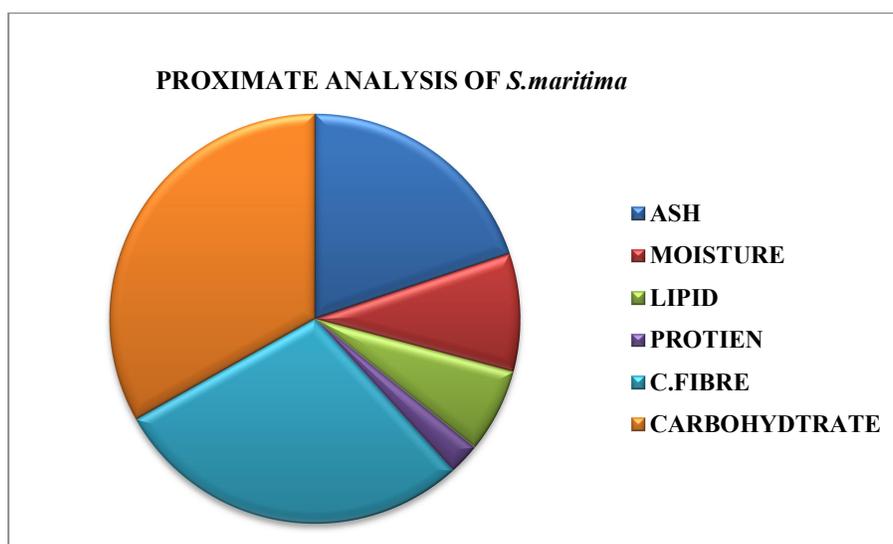
3.3 Antimicrobial activity

Antimicrobial activities of both polar and non-polar extracts of *Suaeda maritima* were evaluated against selected ocular pathogens such as *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Haemophilus influenzae*. The results were tabulated (Table 3 and 4; Figures 2, 3, 4 and 5). Of these ethanolic extracts showed inhibitory effect against all the pathogens in all concentration used whereas aqueous extracts showed any inhibition on pathogens. In case of chloroform extracts showed inhibition on *Staphylococcus aureus*, *Escherichia coli* and hexane inhibits the growth of *Staphylococcus aureus* only. When compared to the standard gentamycin all the solvent extracts showed less inhibitory effect. A study conducted by Beulah *et al* [19] reported that the ethanol and water extracts of *Suaeda maritima* leaves showed inhibitory effect against the pathogens such as *Staphylococcus aureus* (4.9 ± 1.3), *Escherichia coli* (1.6 ± 0.3), *Klebsiella*

pneumonia (4.2 ± 1.8) and *Pseudomonas aeruginosa* (4.1 ± 1.2) and the values that were very similar to the activity of the synthetic antibiotic amikacin.

Table 1: Proximate analysis of seagrass

Name of the seagrass	Ash (%)	Moisture (%)	Lipid (%)	Protein (%)	Crude Fibre (%)	Carbohydrate (%)
<i>Suaedamaritima</i>	19.63	9.21	6.57	2.43	28.26	32.81

Fig. 1 Proximate analysis of seagrass (*S.maritima*)Table 2: Phytochemical composition of *S.maritima*

Compounds	Solvents			
	Hexane	Chloroform	Aqueous	Ethanol
Saponins	-	+	+	-
Alkaloids	+	-	-	-
Flavonoids	+	-	-	+
Steroids	-	+	+	+
Phenols	-	+	+	+

(-)Indicates Absence; (+) indicates Presence

Table 3: Anti-bacterial activity of non-polar extracts of *Suaeda maritima* against ocular pathogens

S. No.	Bacterial pathogens	Zone of inhibition (mm in diameter)									
		Chloroform(μ g)					Hexane(μ g)				
		Gentamycin	100	200	300	400	Gentamycin	100	200	300	400
1	<i>Klebsiella pneumoniae</i>	18.0 \pm 0.0	-	-	-	-	16.0 \pm 0.0	-	-	-	-
2	<i>Staphylococcus aureus</i>	18.0 \pm 0.0	8.0 \pm 0.0	10.0 \pm 0.0	11.0 \pm 0.0	15.0 \pm 0.0	19.0 \pm 0.0	6.0 \pm 0.0	6.0 \pm 0.0	8.0 \pm 0.0	9.0 \pm 0.0
3	<i>Streptococcus pneumoniae</i>	17.0 \pm 0.0	-	-	-	-	12.0 \pm 0.0	-	-	-	-
4	<i>Escherichia coli</i>	12.0 \pm 0.0	8.0 \pm 0.0	9.0 \pm 0.0	10.0 \pm 0.0	10.0 \pm 0.0	12.0 \pm 0.0	-	-	-	-
5	<i>Pseudomonas aeruginosa</i>	15.0 \pm 0.0	-	-	-	-	17.0 \pm 0.0	-	-	-	-
6	<i>Haemophilus influenzae</i>	17.0 \pm 0.0	-	-	-	-	19.0 \pm 0.0	-	-	-	-

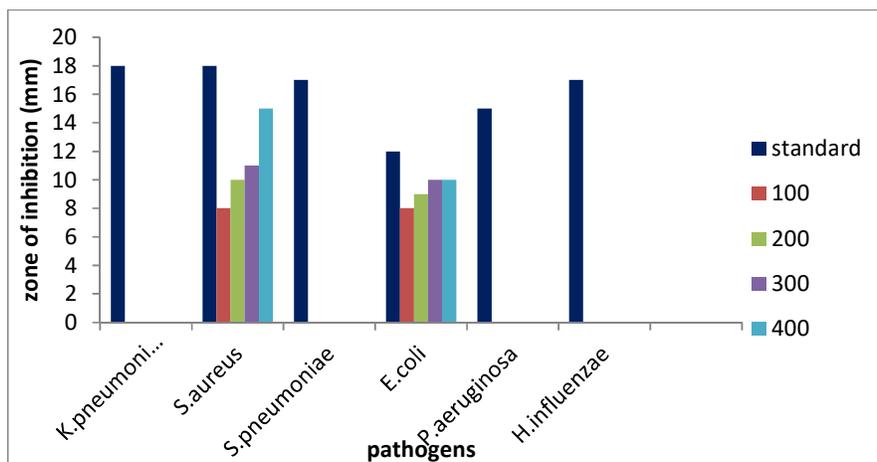


Figure 2: Antimicrobial Activity of chloroform extract of *Suaeda maritima*

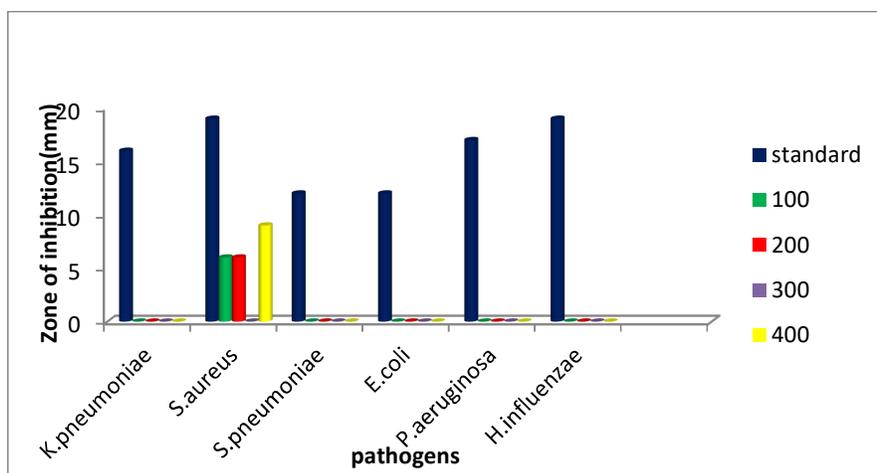


Figure 3: Antimicrobial Activity of hexane extract of *Suaeda maritima*

Table 4: Anti-bacterial activity of polar extracts of *Suaeda maritima* against ocular pathogens

		Zone of inhibition (mm in diameter)									
S. No.	Bacterial pathogens	Water (µg)					Ethanol (µg)				
		Gentamycin	100	200	300	400	Gentamycin	100	200	300	400
1	<i>Klebsiella pneumoniae</i>	18.0±0.0	-	-	-	7.0±0.0	16.0±0.0	8.0±0.0	9.0±0.0	10.0±0.0	11.0±0.0
2	<i>Staphylococcus aureus</i>	18.0±0.0	-	-	-	-	19.0±0.0	6.0±0.0	8.0±0.0	12.0±0.0	14.0±0.0
3	<i>Streptococcus pneumoniae</i>	12.0±0.0	-	-	-	-	19.0±0.0	5.0±0.0	5.0±0.0	8.0±0.0	9.0±0.0
4	<i>Escherichia coli</i>	16.0±0.0	-	-	-	-	13.0±0.0	8.0±0.0	9.0±0.0	9.0±0.0	11.0±0.0
5	<i>Pseudomonas aeruginosa</i>	15.0±0.0	-	-	-	-	16.0±0.0	7.0±0.0	7.0±0.0	8.0±0.0	9.0±0.0
6	<i>Haemophilus influenzae</i>	17.0±0.0	-	-	-	-	18.0±0.0	6.0±0.0	5.0±0.0	7.0±0.0	8.0±0.0

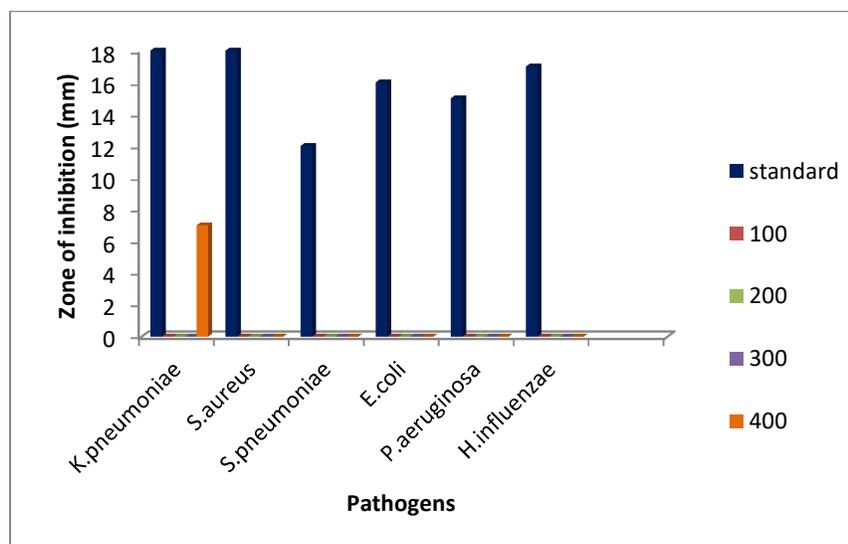


Figure 4: Antimicrobial Activity of Aqueous extract of *Suaeda maritima*

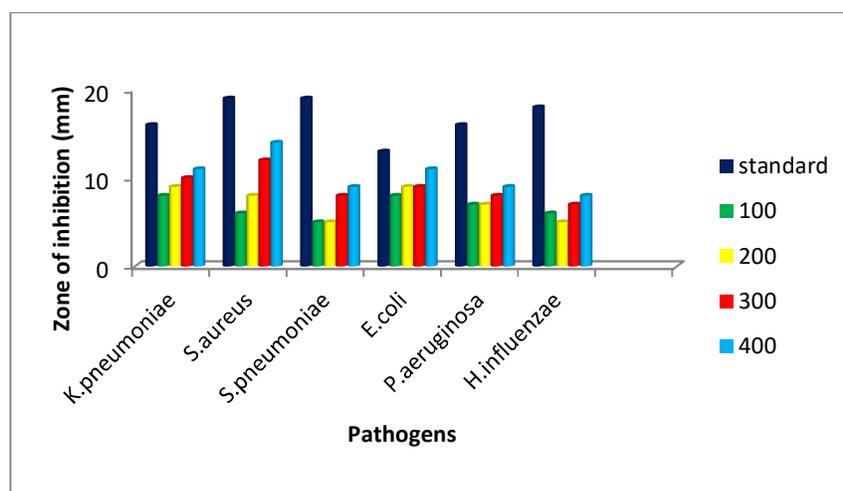


Figure 5: Antimicrobial Activity of Ethanol extract of *Suaeda maritima*

4. CONCLUSION

All the solvent extracts of *Suaeda maritima* are rich sources of natural antibacterial activity, according to the findings of this study. The presence of phenolic compounds and flavonoids is particularly crucial for expressing varied bioactivities, even though the plant includes most phytochemicals in various amounts. Hence, it can be employed in

pharmaceutical applications to create new and more potent natural antibacterial medicines with high bioefficacy. Based on proximate analysis reports this herb is incredibly good for both humans and animals because it is used as food and feed. To satisfy the need for health care, this plant also be used to make herbal medications that match modern standards of safety and efficacy.

Conflict of interest

We declare that we do not have any competing interests.

Funding Agencies

Not Applicable

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