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Anti-inflammatory Activity of Sulphated Polysaccharide Isolated from *Ulva fasciata*

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Abstract: ***There are various components to an inflammatory reaction that can contribute to the associated symptoms and tissue injury and these include Oedema formation, leukocyte infiltration and granuloma formation. Anti-inflammatory activity of the polysaccharide isolated from Ulva fasciata was analysed by carrageenan induced acute paw Oedema and formalin induced chronic paw Oedema. The isolated polysaccharide showed anti-inflammatory activity.***
Keywords: Ulva fasciata, Sulphated Polysaccharide, Paw Oedema, Anti-inflammatory Activity

I. INTRODUCTION

Polysaccharides widely exist in the plants, microorganism (Fungi and Bacteria), algae, and animals and they represent a structurally diverse class of macromolecules of relatively widespread occurrence in nature. polysaccharides offer the highest capacity for carrying biological information because they have the greatest potential for structural variability (Sharon, N., 1993). Inflammation is considered as a fundamental protective response that helps body to stay against infections. Although it is a defence mechanism, the complex events and mediators involved in the inflammatory reaction can induce, maintain or aggravate many diseases (Sosa *et al*., 2002). There are various components to an inflammatory reaction that can contribute to the associated symptoms and tissue injury. Oedema formation, leukocyte infiltration and granuloma formation represent such components of inflammation (Mitchell and Cootran, 2000).Though different types of anti-inflammatory agents are available, there is an increasing demand for natural source derived products for the treatment of inflammation. This is due to the fact that prolonged use of synthetic drugs causes many side effects and undesirable hazards.

II. MATERIALS AND METHODS

A. Anti-inflammatory Activity of Polysaccharide on Carrageenan Induced Acute Paw Edema

The polysaccharide from *Ulva fasciata* was extracted according to the method of (Athukorala *et al.*, 2007) with minor modification of the extraction temperature. Male Swiss albino mice were divided into five groups comprising of six animals in each group. Animals were given intraperitoneally with different concentration of polysaccharide (20, 50 and 100 mg/kg bodyweight) in normal saline one hour before the carrageenan induction. One hour after the administration of the polysaccharide preparations, acute inflammation was induced in the hind paw of mice by sub planar injection of 0.02 mL freshly prepared 0.1 % suspension of carrageenan in normal saline.

The paw thickness was measured using vernier callipers and recorded every hour up to 6^{th} h. The degree of paw Oedema formation was assayed as increase in paw thickness; the increase in paw thickness was calculated using the formula P_i-P_o, where P_i is the paw thickness at time t and P_o is the initial paw thickness. The percent inhibition was calculated using the formula $(1\text{-}P_T/P_C) \times 100$. Where P_C is the increase in paw thickness of the control groups and P_T is that of the polysaccharide treated groups. Control group was administered with Carrageenan and reference group with Diclofenac.

B. Anti-inflammatory Activity of Polysaccharide on Formalin Induced Chronic Paw Edema

Male Swiss albino mice were divided into five groups comprising of six animals in each group. Animals were given with different concentrations of polysaccharide in normal saline (20, 50 and 100 mg/kg b.wt.) intraperitoneally. 0.2 mL of freshly prepared 2% formalin was used for the induction of chronic inflammation.

The administration of the polysaccharide at different concentrations and the standard drug Diclofenac were continued regularly for six days. The paw thickness was measured before, and six days regularly after the formalin injection. The percent inhibition was calculated using the formula $(1\text{-}P_T/P_C) \times 100$.

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III.RESULTS AND DISCUSSION

A. Carrageenan Induced Paw Oedema

The paw Oedema was induced by carrageenan in mice and the effect of polysaccharides in reducing paw Oedema was studied and the results are given in Figure1. The sub planar injection of carrageenan into the mice hind paw elicited an inflammation that was maximal at 3rd hour. The inflammatory response was reduced by the polysaccharide at doses of 20, 50 and 100mg/Kg.body weight of the animal. Effect of polysaccharide on percent inhibition in the paw thickness was calculated and the results are given in Table 1.

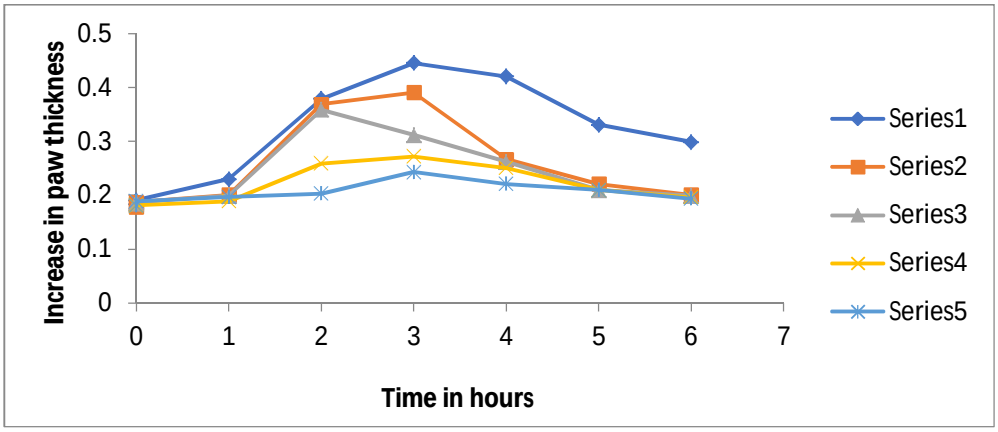

Fig. 1 Effect of Polysaccharide on Carrageenan Induced Paw Edema.

Values are Mean±SD of 5 Animals in Each Group. Statistical Significance Compared to Control Values is Denoted by *p<0.05 Versus Controls. ANOVA Followed by Dunnet t-Test

TABLE 1: Percent Inhibition of Polysaccharide on Carrageenan Induced Paw Edema

Groups	Dose mg/kg	Percent inhibition
Vehicle control	-	-
Polysaccharide treated groups	20	19.39
	50	51.33
	100	65.01
Diclofenac	20	76.43

B. Formalin Induced Chronic Paw Oedema

The effect of polysaccharide in reducing paw Oedema induced by formalin was calculated and the results are given in Figure 2. The sub planar injection of formalin into the mice hind paw elicited an inflammation and was analysed for a period of six consecutive days. The inflammatory response was reduced by the polysaccharide at doses of 20, 50 and 100mg/Kg.body weight of the animal. Effect of polysaccharide on percent inhibition in the paw thickness was calculated and the results are given in Table II.

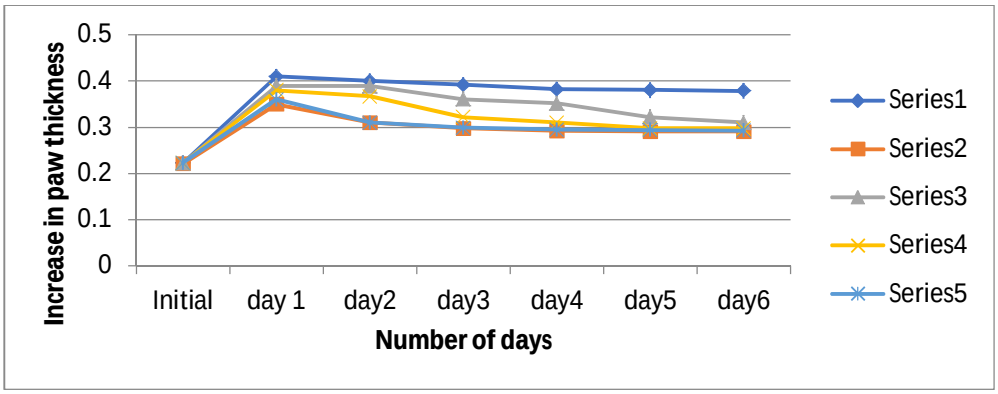

Fig. 2 Effect of Polysaccharide on Formalin Induced Paw Edema.

Values are Mean±SD of 5 Animals in Each Group. Statistical Significance Compared to Control Values is Denoted by *p<0.05 Versus Controls. ANOVA Followed by Dunnet t-Test

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TABLE II Percent Inhibition of Polysaccharide on Formalin Induced Paw Edema

Groups	Dose mg/kg	Percent Inhibition
Vehicle Control	-	-
Polysaccharide Treated Groups	20	24.39
	50	56.33
	100	70.01
Diclofenac	20	76.43

In the carrageenan induced Oedema, the results suggest that the polysaccharide from *Ulva fasciata* significantly inhibit the inflammation as evidenced by decrease in paw Oedema. The present study shows that carrageenan induced mouse paw Oedema constitutes an interesting model for the screening of new anti-inflammatory drug and the polysaccharide isolated from *Ulva fasciata* showed a marked decrease in paw Oedema induced by carrageenan in a dose dependent manner. One of the most suitable methods to screen chronic anti-inflammatory agents is formalin induced paw Oedema, as it closely resembles arthritis in humans. Inflammation induced by formalin is biphasic and the Oedema is mediated by substance P and bradykinin in the early phase, followed by tissue mediated response induced by histamine, prostaglandin and bradykinins (Wheeler & Cowan, 1991).The polysaccharide from *Ulva fasciata* effectively inhibits the inflammation induced by formalin.

IV. CONCLUSIONS

The anti-inflammatory study of the polysaccharide was carried out in carrageenan induced acute paw edema and formalin induced chronic paw edema. The results revealed the anti-inflammatory potential of the polysaccharide. As the bioactivity of seaweed polysaccharides differs according to the variations in molecular weights, structural parameters and physiological characteristics (Ponce *et al.*, 2003) the polysaccharides isolated from *Ulva fasciata* is found to be a promising natural drug for inflammation.

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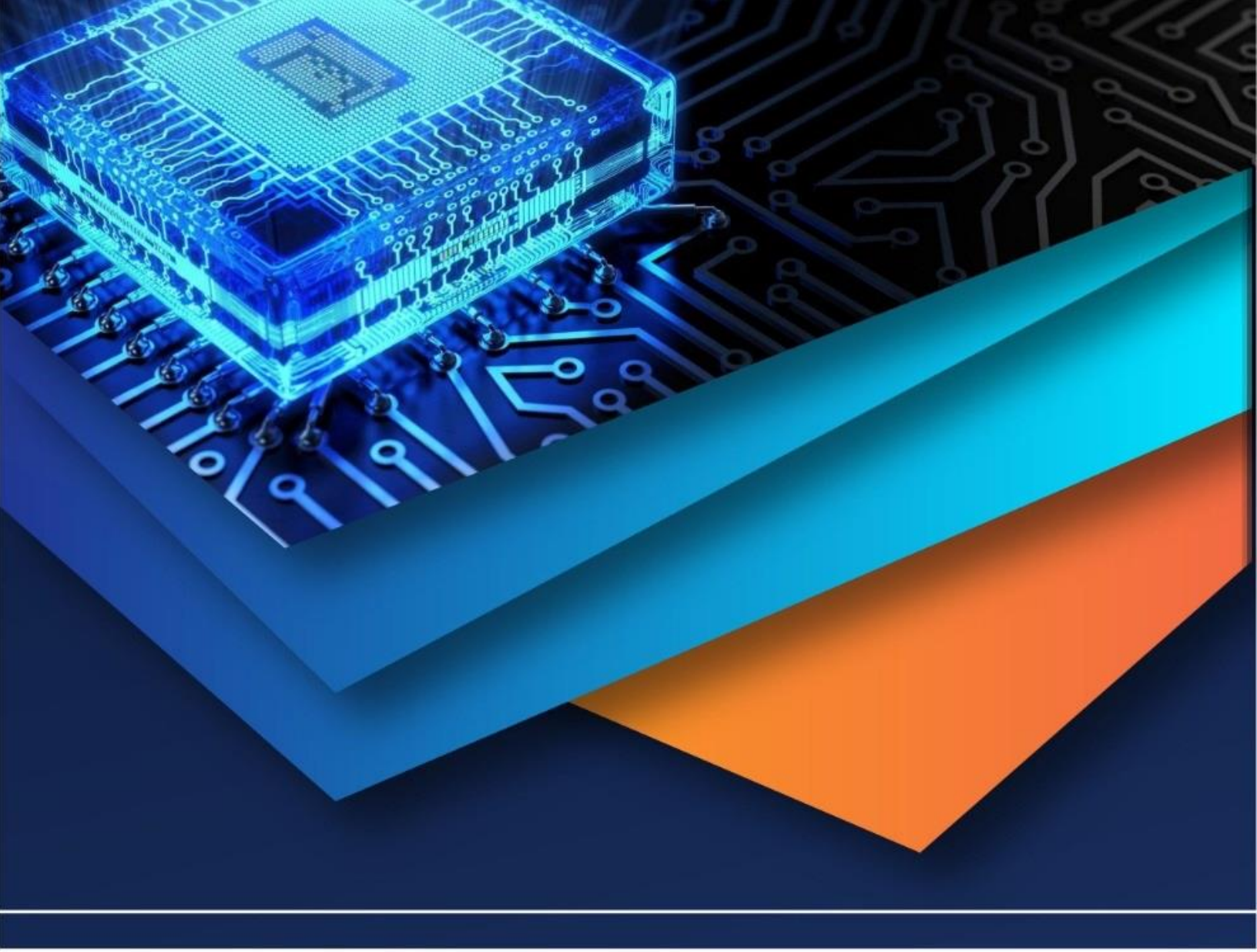

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