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# SEBDENIA POLYDACTYLA—A NOVEL SOURCE OF CARRAGEENAN

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**Key Word Index**—*Sebdenia polydactyla*; Gigartinales; polysaccharide; carrageenan; phycocolloid.

**Abstract**—The polysaccharide extracted from *S. Polydactyla* with sodium hydrogen carbonate at 90° accounted for 32% of the dry weight of the alga. It was characterized as λ-carrageenan by IR and physico-chemical analysis.

## INTRODUCTION

Some of the red seaweeds of the order Gigartinales contain considerable amounts of polysaccharides [1]. However, *Sebdenia polydactyla* (Boergs) Balak, [2] a red alga from India, has not been chemically investigated. In this paper we show that it contains the phycocolloid, λ-carrageenan.

## RESULTS AND DISCUSSION

A water-soluble polysaccharide, which constituted *ca* 32% of the dry weight of the alga, was isolated as a white powder which on hydrolysis gave the monosaccharides, D-galactose and 3,6-anhydrogalactose. All its properties (Table 1) support the identity of the polysaccharide from *Sebdenia* as a λ-carrageenan.

Table 1. Content and properties of polysaccharide from *S. polydactyla*

| | |
|---|---|
| Appearance | White powder |
| Yield (%) | 32 ± 0.5 |
| Total ash | 25.97 |
| Total sulphate (%) | 17.2 |
| Galactose (%) | 32.8 |
| 3,6-Anhydrogalactose (%) | 2.4 |
| Aqueous gel strength (1 g in 1% KCl soln.) | No gel formation |
| Optical rotation (0.25% in $H_2O$) | Positive, $[\alpha]_D^{25}$ 55° |
| Solubility in KCl soln. (3 M KCl) | Completely soluble, polysaccharide precipitated with *iso*-PrOH from the filtrate |
| Methylene Blue test | Positive, the phycocolloid precipitates Methylene Blue. |
| Solubility in $H_2O$ | Dissolves in cold $H_2O$, but completely above 70°. |
| Solubility in milk | Insoluble in cold but soluble in hot milk |
| Milk reactivity at 25° (O.154% polysaccharide in homogenized milk) | $<50\,g\,cm^{-2}$ |

| IR spectra [3–6] | Intensity of absorption bands ($cm^{-1}$)* 1240 | 930 | 840–850 | 805 |
|---|---|---|---|---|
| Difco-Bacto agar (0140–01) | w | s | — | — |
| κ-Carrageenan (C-1263) | vs | s | s | — |
| λ-Carrageenan (C-3889) | vs | w | w | — |
| i-Carrageenan (C-4014) | vs | s | s | vs |
| *Sebdenia* polysaccharide | vs | w | w | — |
| *Sebdenia* polysaccharide (alkali modified) | vs | m | w | — |

*w, weak; m, medium; s, strong; vs, very strong.

## EXPERIMENTAL

*Sebdenia polydactyla* (Sebdeniaceae) was collected during Feb. from the low-tide water mark at Okha (22° 18'N, 69° 06'E) on the west coast of India. A voucher specimen identified by one of the authors (VDC) an algologist is deposited in CSMCRI Herbarium, Bhavnagar, India. The plants after collection were washed thoroughly in seawater, rinsed with $H_2O$ and dried in a hot air circulating oven at 60° followed by grinding. Carrageenan was extracted by the method of ref. [7].

Dry depigmented algal powder was initially extracted with 0.5 M $NaHCO_3$ soln at 90° for 3 hr. The hot viscous soln was pressure filtered and the residues re-extracted as above for another 30 min. Both filtrates were combined and filtered through glass fibre filter paper (Whatman GF/C). The phycocolloid was pptd with CTAB. The pptd material was washed sequentially with $H_2O$, a saturated soln of NaOAc in EtOH, EtOH and $Et_2O$ and then dried *in vacuo* over $P_2O_5$.

Fractionation of the polysaccharide was carried out with KCl as described in ref. [5]. The samples were alkali modified following the procedure of ref. [8] with $NaBH_4$. Aqueous gel strength was determined with 1% polysaccharide in 1% KCl soln. Sulphate was estimated gravimetrically after hydrolysis of the polysaccharide with MHCl for 2 hr at 105° in sealed tubes. The 3,6-AG content was obtained as per the modified resorcinol method of ref. [9] and galactose by PC [10]. Films for IR studies were prepared by evaporating a 0.2% soln over Hg [11]. Difco-Bacto agar (0140–01, Difco Labs USA), κ-carrageenan (C-1263), λ-carrageenan (C-3889) and ι-carrageenan (C-4014) were procured from Sigma. The milk reactivity was determined by the standard procedure [12] and the Methylene Blue test was performed using a 1% soln of polysaccharide in $H_2O$. KCl solubility was ascertained as follows:

The powdered polysaccharide was dissolved at 0.1% concn by warming to 70° in 3 M KCl, cooled to 25° and filtered. Observations for the dissolution of polysaccharide in KCl soln were made. To the filtrate, 2.5 vol. *iso*-PrOH was added to detect the reprecipitation of the algal polysaccharide.

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