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Improvement of *Gracilaria* Agar Solubility by Acid Treatments

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ABSTRACT

In order to increase the solubility of alkali-treated agar biopolymers extracted from *Gracilariopsis lemaneiformis*, sixteen hydrolysis methods with four kinds of acids (sulfuric acid, acetic acid, oxalic acid, and citric acid) were evaluated to determine a suitable procedure. The agar solubility against DMSO and water at 25°C and 95°C were tested. Among the procedures tested, partial hydrolysis with 0.001N acetic acid for 1 hour was more effective for increasing agar solubility while maintaining its gelling ability. The results indicated that partial hydrolysis of agar under effective conditions improves agar solubility and produces high grade agar from the Japanese agarophyte, especially *Gracilaria* (*Gracilariopsis*). The resulting high solubility agar may facilitate the spread of industrial applications of *Gracilaria agars*.

Keywords: Marine macroalgae, *Gracilaria*, *agar*, solubility; hydrolysis.

INTRODUCTION

Agar is the first phycocolloid to be used in the human food industry (Armisen and Galatas, 1987). Nowadays, the commercially valuable agarocolloids are principally extracted from red algae genera *Gelidium* and *Gracilaria*. To overcome the shortage of *Gelidium*, the utilization of *Gracilaria* as an agar resource began just before the beginning of this century (Armisen, 1995). There are basically three grades of agar; (1) food grade, (2) bacteriological (microbiological)

RESULTS

Partial Hydrolysis with Various Acids

The solubility of alkali-treated agar biopolymers with partial hydrolysis with various acids and at two different temperatures is summarized in Table 1. Partial acid hydrolysis of alkali-treated agar biopolymers had a drastic effect on solubility. Sulfuric acid hydrolysis was the strongest, increasing agar solubility rapidly (only 1 h), but concentrated acids (more than 0.01 N) caused treated agar to become insoluble. Among hydrolysis with a dilute acid solution (0.001 N), only sulfuric acid treatment was able to produce hot water-soluble agar biopolymers. The order of acid effects on agar solubility was as follows; sulfuric acid > oxalic acid > citric acid > acetic acid.

Table 1 Effects of partial hydrolysis on agar solubility

Acid	Conc. (N)	Time (hour)	Solubility			
			Water		DMSO	
			25°C	95°C	25°C	95°C
Alkali-treated agar	---	---	I	I	I	S
Sulfuric acid	0.001	1	I	S	I	S
		2	I	S	S	S
		3	I	S	S	S
	0.01	1	I	I	S	S
		2	I	I	I	I
		3	I	I	I	I
	0.1	1	I	I	I	I
		2	I	I	I	I
		3	I	I	I	I
Acetic acid	0.001	1	I	I	I	S
		2	I	I	S	S
		3	I	I	S	S
	0.01	1	I	S	I	S
		2	I	S	S	S
		3	I	S	S	S
	0.1	1	I	S	S	S
		2	I	S	S	S
		3	I	S	S	S
Oxalic acid	0.001	1	I	I	I	S
		2	I	I	S	S
		3	I	I	S	S
	0.01	1	I	I	I	I
		2	I	I	I	I
		3	I	I	I	I
	0.1	1	I	I	I	I
		2	I	I	I	I
		3	I	I	I	I

Contd.

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