CHAPTER IV

EXPERIMENTAL RESULTS

4.1 Determination of Moisture Content in Seaweeds from Various Sources in Southern Thailand

The moisture content in seaweeds from Ranong, Songkla and Suratthanee are shown is Table 4-1, 4-2 and 4-3 respectively.

Table 4-1 Moisture Content in Seaweeds from Ranong

No sample	% moisture content	% on dry basis
1	14.8	85.2
2	15.2	84.8
3	17.4	82.6
4	14.9	85.1
5	15.7	84.3
6	18.2	81.8
7	18.9	81.1
8	17.1	82.9
9	18.2	81.8
10	15.7	84.3

Average ($\bar{x}$) = 16.61 : S.D. = 1.4494

n = 10

Table 4-2 Moisture Content in Seaweeds Obtained from Songkla

No sample	% moisture content	% on dry basis
1	13.4	86.6
2	15.8	84.2
3	13.1	86.9
4	16.4	83.6
5	15.7	84.3
6	17.0	83.0
7	12.9	87.1
8	14.6	84.4
9	15.6	84.4
10	16.1	83.9

Average (x) = 15.06 : S.D. = 1.3913

n = 10

Table 4-3 Moisture Content in Seaweeds Obtained from Suratthanee

No sample	% moisture content	% on dry basis
1	13.1	86.9
2	15.3	84.7
3	11.9	88.1
4	16.7	83.3
5	15.8	84.2
6	17.0	83.0
7	12.6	87.4
8	13.9	86.1
9	14.9	85.1
10	14.6	85.4

Average ($\bar{x}$) = 14.58 : S.D. = 1.6191

n = 10

4.2 Determination of the Composition of Seaweed from Various Sources in Southern Thailand

Table 4-4 Composition of Seaweed* Obtained from Various Sources in Southern Thailand

	Sources of seaweed		
	Ranong	Songkla	Suratthanee
% moisture content	15 - 19	13 - 17	12 - 17
% ash	18.7	17.1	20.1
% fiber	3.7	5.2	3.1
% protein	4.375	7.5	6.875

Note* Red Seaweed, Class Rhodophyceae, genus Gracilaria spp.

4.3 Determination of the Optimum Condition for Extracting Agar from Seaweeds

Table 4-5 Effect of pH on % Yield of Agar Extracted from Seaweeds from Ranong, Heated at 90-100°C with Stirring for 2 hr.

Sample No.	Solvent	** pH	Sample wt. (gm)	**** % mc	mc.free sample wt.	yield (gm)	% yield
1	Distilled water, pH = 6.9	7.3	10	15.8	8.42	-	-*
2	H_2O + 1% H_2SO_4, pH = 5.5	6.3	10	15.8	8.42	-	-*
3	H_2O + 1% H_2SO_4, pH = 5.5***	6.35	10	17.5	8.25	1.5943	19.3
4	Acid sodium phosphate buffer, pH = 5.5	5.55	10	16.8	8.32	1.8336	22

Note

* Less yield due to difficulty in filtering because of in complete breakage of the seaweed cell wall.

** pH after the seaweeds were added in the solvent

*** Control the pH of the solution between 5.5-6.5 with 1% H_2SO_4.

**** Moisture content.

Table 4-6 Effect of Time on % Yield of Agar Extracted from Seaweeds from Ranong, with Acid Sodium Phosphate buffer, pH = 5.5, and heated at 90-100°C with Stirring.

sample No.	sample wt (gm)	% mc.	mc.free sample wt (gm)	Time (hr.)	yield (gm)	% yield
1	10	16.8	8.32	0.5	-	-*
2	10	16.8	8.32	1.0	0.9677	11.6
3	10	16.8	8.32	1.5	1.6569	19.9
4	10	15.9	8.41	2.0	2.1205	25.2
5	10	17.3	8.27	2.5	2.1105	25.5
6	10	17.3	8.27	3.0	1.2157	14.7**

Note * The filtered liquor was too weak to gel.

** The solution was very viscous due to loss of water during boiling which caused difficulties in filtration.

Table 4-7 Effect of Amount of Solvent* used on % Yield of Agar Wxtracted from Seaweeds from Ranong, Heated at 90-100°C with Stirring for 2 hr.

Sample No.	Sample wt. (gm)	% mc	mc-free sample (gm)	Vol. of solvent (ml)	Ratio (approx) weeds: solvent	yield (gm)	% yield	Note
1	10	16.8	8.32	100	1:12	-	-	Too viscous to filter
2	10	16.8	8.32	150	1:18	-	-	Too viscous to filter
3	10	16.8	8.32	200	1:24	1.7256	20.7	-
4	10	15.7	8.43	250	1:29	2.0982	24.9	-
5	10	15.7	8.43	300	1:35	2.0347	24.1	Gel was slightly weak yield loss due to weak gel
6	10	17.1	8.29	400	1:48	1.1302	13.6	
7	10	17.6	8.24	500	1:60	-	-	Too weak, did not form gel

Note * Solvent used is Acid sodium phosphate buffer, pH = 5.5

4.4 Determination of the % Yield of Agar in Seaweeds from Various Sources in Southern Thailand

Table 4-8 % Yield of Agar Extracted from Seaweeds from Ranong, with Water at 90-100°C, pH = 5.5-6.5, with Stirring for 2 hr.

No sample	wt.sample (gm)	mc.of sample (%)	moisture free sample (gm)	wt.agar extracted (gm)	% yield
1	10	17.5	8.25	1.5219	18.4
2	10	17.47	8.253	1.5606	18.9
3	10	16.8	8.32	1.6723	20.1
4	10	17.68	8.232	1.8374	22.3
5	20	18	16.4	3.1359	19.1
6	20	17.9	16.42	3.3874	20.6

Range of % yield = 18-22%

Table 4-9 % Yield of Agar Extracted from Seaweeds from Ranong, with Alkali Pretreatment and Extracted with Acid Sodium Phosphate Buffer pH = 5.5, at 90-100°C with Stirring for 2 hr.

No. sample	wt.sample (gm)	mc.in sample (%)	mc.free sample (gm)	agar extract (gm)	% yield
1	10	17.8	8.22	1.7401	21.2
2	10	18.0	8.2	2.1347	26.0
3	10	18.0	8.2	1.9026	23.2
4	10	17.4	8.26	1.8833	22.8
5	10	18.2	8.18	1.7996	24.1
6	20	18.2	16.36	4.0407	24.7

Range of % yield = 21-26%

Table 4-10 % Yield of Agar Extracted from Seaweeds from Songkla, with Alkali Pretreatment and Extracted with Acid Sodium Phosphate Byffer pH = 5.5, at 90-100°C with Stirring for 2 hr.

No. sample	wt.sample (gm)	mc.in sample (%)	mc.free sample (gm)	agar extracted (gm)	% yield
1	10	17.1	8.29	1.6527	19.9
2	10	14.1	8.59	1.9498	22.7
3	10	14.8	8.52	1.7304	20.3
4	10	16.3	8.37	1.7326	20.7
5	20	17.4	16.52	3.5022	21.2
6	20	17.9	16.42	3.5247	21.3

Range of % yield = 20-23%

Table 4-11 % Yield of Agar Extracted from Seaweeds from Suratthanee, with Alkali Pretreatment and Extracted with Acid Sodium Phosphate Buffer pH = 5.5, at 90-100°C with Stirring for 2 hr.

No. sample	wt.sample (gm)	mc.in sample (%)	mc.free sample (gm)	agar extracted (gm)	% yield
1	10	12.7	8.73	1.6238	18.6
2	10	17.0	8.3	1.6028	19.3
3	10	16.9	8.31	1.4876	17.9
4	10	14.8	8.52	1.5506	18.2
5	20	17.0	16.6	3.3614	20.3
6	20	16.9	16.62	3.5071	21.1

Range of % yield = 18-21%

4.5 Effect of Alkali Pretreatment on Seaweed before Extraction

Table 4-12 Effect of Alkali Pretreatment of Seaweeds before Extraction* on some Properties of Agar.

	processed with	
	no alkali pretreatment	alkali pretreatment
% yield	18-22	21-26
% moisture content	18.4	17.3
% Transmittance**, 1.5%	74-82 %	88
Gelation temperature, 1.5%	37-42 ^{o}C	43 ^{o}C
Gel melting temperature, 1, 5%	72-74 ^{o}C	76 ^{o}C
Rate of dissolution, 1.5%	4-8 min	3.5 min
Rate of gel forming, 1.5%	12-15 min	11 min
Gel strength, after 2 hr settling	84.8 gm/cm^2	113.4 gm/cm^2

Note * Extraction with acid sodium phosphate buffer pH = 5.5, at 90-100^{o}C with stirring for 2 hr.

** The transmittance was measured against the solution blank at 520 mμ using spectrophotometer (Bausch & Lomb, Inc. Spectronic 20)

4.6 Determination of Some Properties of Agar Extracted from Seaweed from Various Sources in Southern Thailand.

Table 4-13 Some Properties of Agar Extracted* from Seaweeds from Various Sources in Southern Thailand.

	Reference**	Agar extracted from seaweeds from		
		Ranong	Suratthanee	Songkla
% moisture content	17.2 %	17.3 %	18.1 %	15.9 %
% Transmittance***, 1.5%	92 %	88 %	86 %	89 %
Gelation temperature, 1.5%	38°C	43°C	40°C	37°C
Gel melting Temperature, 1.5%	83°C	76°C	74°C	79°C
Rate of dissolution, 1.5%	2 min	3.5 min	5 min	4.5 min
Rate of gel forming, 1.5%	12 min	11 min	14 min	17 min
Gel strength, after 2 hr settling, 1.5%	188.5 gm/cm^2	113.4 gm/cm^2	122.1 gm/cm^2	92.6 gm/cm^2

Note

* Processed with alkali pretreatment, extracted with acid sodium phosphate buffer pH 5.5, at 90-100°C stirring for 2 hr.

** Powder agar sold in the market

*** The transmittance was measured against the solution blank at 520 mμ using Spectrophotometer (Bausch & Lomb, Inc. Spectronic 20)