

Production of Carboxymethyl Cellulose(CMC) from Durians hulks

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Introduction: *Durian (Durio zibethinus Murr.)* a tropical fruit, is one of the most highly valued and desired fruits among Southeast Asians due to its distinct flavor and unique taste. Thailand is one of the primary producers and a world exporter of fresh and frozen durian. Beginning in May through August, the durian seasonally announces its presence and massive amounts of the rind is disposed as waste which could lead to environmental problems.

The purpose of this study is to make value of this agricultural waste as a source of valuable materials of commercial importance; for example, alpha cellulose and CMC as major derivative from esterification reaction.

Cellulose (-1,4-linked glucan chains) is the most abundant biopolymer in nature. A billion metric tons of cellulose are produced every year, synthesized by a wide variety of organisms including plants, algae, bacteria, and animals. **Carboxymethyl cellulose (CMC)** are important industrial polymers with a wide range of applications in detergents, ceramics, textiles, paper, food, drugs, and oil well drilling operations. Most properties of CMCs in actual applications depend to a large extent on three key parameters, molecular weight of the polymer, average number of carboxymethyl substituents per anhydroglucose unit (degree of substitution, DS), and the distribution of the carboxymethyl substituents along the polymer chain.

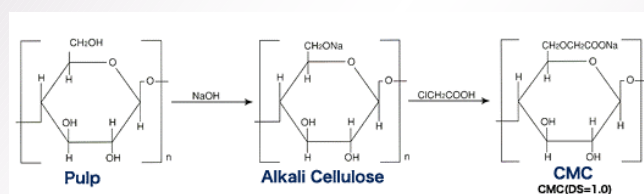


Figure 1 Illustrates the reaction for the manufacture of CMC.

Methodology and Results: CMC from durian rinds was prepared by etherification of cellulose and monochloroacetic acid. Cellulose was first recovered by chemical pulping process with yield approx. 38-44 % w/w of dried durian rinds prior to CMC preparation. CMC prepared with different pulps/acid ratio (1:0.75, 1:1.0, 1:1.25, and 1:1.5) in alkaline condition, yielding 45-52% of pure CMC (Table 2). The CMC samples were further analyzed for DS and rheological property in term of apparent viscosity. Illustrates the reaction for the manufacture of CMC (Figure 1) and the physical properties are also given.

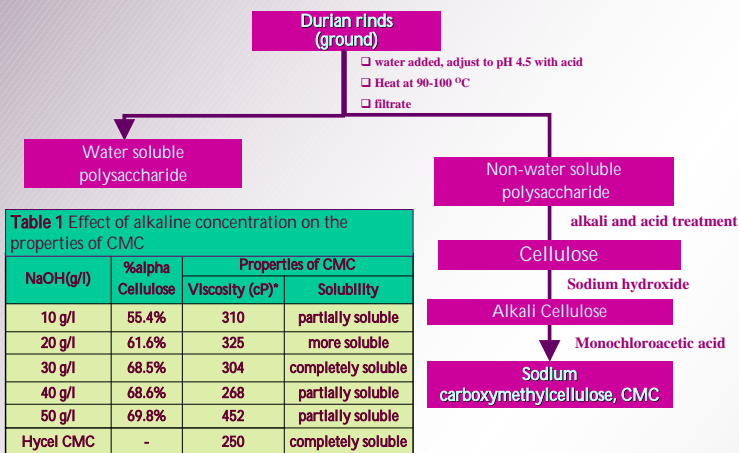


Table 1 Effect of alkaline concentration on the properties of CMC

NaOH(g/l)	%alpha Cellulose	Properties of CMC	
		Viscosity (cP)*	Solubility
10 g/l	55.4%	310	partially soluble
20 g/l	61.6%	325	more soluble
30 g/l	68.5%	304	completely soluble
40 g/l	68.6%	268	partially soluble
50 g/l	69.8%	452	partially soluble
Hycel CMC	-	250	completely soluble

Table 2 Effect of different reaction condition on the degree of substitution, DS of CMC

Cellulose: Acid Ratio	Degree of Substitution (DS)*	Apparent viscosity (cP)	Purity	% Yield
1:0.5	0.36	99.9	68.47	45.4
1:0.75	0.59	139.4	82.89	49.5
1:1	0.61	175.0	89.47	50.6
1:1.25	0.67	229.2	79.99	51.8
1:1.5	0.66	222.9	86.22	50.7
Hycel CMC	0.57	150.0	80.43	-

* Spindle number 1, 100 rpm, 26°C

Conclusion: The pulps obtained from durian hulks in this study proved to be reactive toward the esterification reaction and regarding product characteristics the following was observed:

- a) the values of degree of substitution the DS values slightly increase by increasing the etherifying agents concentration within the range studied and it is found in the range used for commercial grade,
- b) the apparent viscosity increase with increasing degree of substitution.

From this results, it is concluded that cellulosic pulps from durian hulks in the process of aqueous solvent system can be used for the preparation of carboxymethyl cellulose of medium to low viscosities.

References:

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