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Effects of crude, semipurified and purified starch of sago *(Metroxylon sagu* Rottb.) on the water stability of pelleted shrimp diets

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The quality of a shrimp diet is determined not only by its chemical composition but also by its physical properties, especially water stability. The pellet should be of suitable texture and should remain stable in water for a reasonable length of time so it can be found and consumed by the animals. Various natural and synthetic substances have been used as binding agents for shrimp diets. The binding agents prevent disintegration of the pellet upon exposure to water and the leaching out of water-solution nutrients, which can result in deterioration of water quality and poor diet utilization.

Several locally available sources of carbohydrates such as corn starch, cassava starch, gulaman and sago starch have been tested at the SEAFDEC feed laboratory (F. P. Pascual, personal communication). Among various binders tested, sago starch showed to be a promising binder for shrimp feeds. This material is available in several Philippines islands, notably Cebu, Bohol and Mindanao, but the cost varies considerably depending upon its quality.

This study has been made to determine the comparative effectiveness of purified, semipurified and crude starch of sago as binders for pelleted shrimp diets.

Three isonitrogenous, isocaloric and practical diets with purified, semipurified and crude sago starch as binders were pelleted through a 2-mm diameter die in a Hobart meat grinder, steamed for 5 minutes at 85 to 90°C and oven dried to a moisture content of approximately 10%. The pellets were evaluated for water stability after 3, 6 and 12 hours in sewater with 32 ppt salinity and 28°C temperature. Approximately equal amounts of the 3 diets remained intact after 3 and 6 hours (Table 2 and Fig 1). After 12 hours of immersion, the pelleted diets decreased significantly in water stability. However, the diet containing semipurified sago starch had the highest water stability (79.1%). The values were nearly the same for the pellets bound with purified and crude sago strarch. Reasons for the low binding capacity of purified and crude sago could be that the gel of the purified sago is weakened due to purification and that of the crude sago is due to the spongy material present in the product. Thus, semipurified sago starch is a better source of binder than purified or crude sago.

The cost of various binders per kg of diet are presented in Table 2. The lowest additional cost per kg of feed was for the crude sago starch (₱0.135), which produced unsatisfactory pellet water stability. The second lowest cost (₱0.17) was for the semipurified sago starch which provided the highest water stability. The purified sago, whose binding capacity is comparable to that of the crude sago, provided the highest additional cost (₱4.15) to the feed. From the standpoint of economy, the cost of purified sago is prohibitive for use as binder. Both semipurified and crude sago palm starch are acceptable.

Table 1. Composition of shrimp diets containing various sources of sago palm starch.

INGREDIENT	Percent in Diets		
	I	II	III
Fish meal	29.3	29.3	29.3
Shrimp head meal	17.4	17.4	17.4
Copra meal	10.0	10.0	10.0
Rice bran	10.0	10.0	10.0
Wheat flour	15.0	15.0	15.0
Purified sago palm starch	5.0		
Bohol sago palm starch		5.0	
Cebu sago palm starch			5.0
Corn oil	2.6	2.6	2.6
Vitamin mix[1]	1.0	1.0	1.0
Mineral mix[2]	1.0	1.0	1.0
Dicalcium phosphate	2.8	2.8	2.8
Filler (finely ground rice hull)	5.9	5.9	5.9

[1]Vitamin mix (mg/kg of diet): thiamine, 30; Riboflavin, 80; Pyrodoxin, 40; Vitamin B_{12}, 0.1; Niacin, 400; Panthothenic acid, 200; Biotin, 2; Inosital, 600; Folic acid, 10; Choline Chloride, 5000; Paraaminobenzaie acid, 150; Ascorbic acid, 500; Vitamin A (20,000 I.U), 40; Vitamin D_3, 10; Vitamin E, 150 Vitamin K, 30; BHT, 10; finely ground corn meal, 2747.9.

[2]Mineral mix (g/kg of diet): K_2HPO_4, 1.00; NaH_2PO_4, 2.15; $Ca(H_2PO_4)_4 \cdot H_2O$, 2.65; $CaCO_3$, 1.05; Ca-lactate, 1.65; KCl, 0.28; $MgSO_4 \cdot 7H_2O$, 1.00; Fe-citrate, 0.12; $AlCl_3 \cdot 6H_2O$, 0.0024; $ZnSO_4 \cdot 7H_2O$, 0.0476; $MnSO_4 \cdot 6H_2O$, 0.0107; CuCl, 0.0015; KI, 0.0023; $CaCl_3 \cdot 6H_2O$, 0.0140; finely ground corn meal, 0.0215.

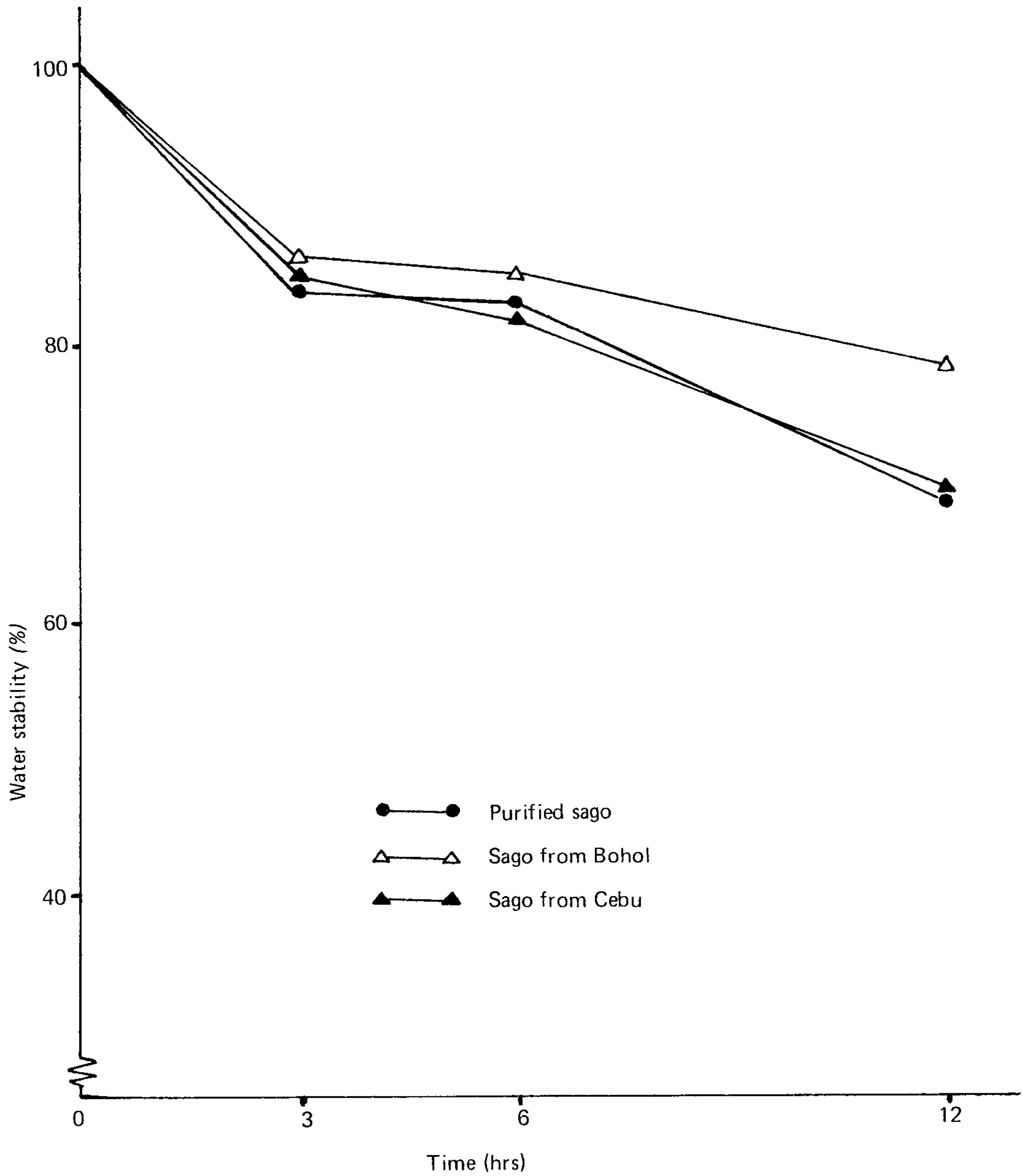

Figure 1. Water stability of shrimp pellets containing various sources of sago palm starch tested at 3, 6 and 12 hours.

Table 2. Binder cost and water stability of shrimp diets containing various sources of sago palm starch tested at 3, 6 and 12 hours.

DIET	Nature of sago	Period tested (hrs.)	Water stability[1] *(%)*	Binder cost/kg diet[2] (₱)
I	Purified		84.0[a]	4.15
II	Semi-purified	3	86.4[a]	0.17
III	Crude		85.2[a]	0.135
I	Purified		83.4[a]	4.15
II	Semi-purified	6	85.1[a]	0.17
III	Crude		82.6[a]	0.135
I	Purified		68.9[a]	4.15
II	Semi-purified	12	79.1[b]	0.17
III	Crude		69.5[a]	0.135

[1]Treatment means with the same superscript are not statistically different at $P < 0.05$.

[2]Binder cost were calculated based on November 1977 market prices in the Philippines.

Purified	: ₱83.00/kg
Semi-purified	: ₱ 3.40/kg
Crude	: ₱ 2.70/kg

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