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Pascual, F. P.

Aquaculture Department, Southeast Asian Fisheries Development Center

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Fishwater and agar as binders in a prawn diet

F. P. Pascual and N. Tabbu

One important aspect of a good pellet for the prawn is that it should be stable in water. A non stable pellet can cause rapid water pollution particularly when the prawns are confined and reared in tanks. A stable pellet can withstand the weight of the prawn on the pellets and one that will not easily disintegrate in seawater is necessary. When the pellet is unstable, the shrimp is not fully able to utilize the food ingredients and the water becomes polluted particularly when the prawns are reared in a concrete tank or aquaria. Several binders have been tried in the laboratory, among them, glutinous rice, sweet potato, cassava starch, cornstarch, sago palm starch, chitosan, alginate and agar bars (Pascual et al., 1978, unpublished). Some of these are too expensive and are not practical for commercial feeds while others like sweet potato and cassava starch have relatively poor binding capacities. Cornstarch and sago palm starch have been found to give water stability of 60 to 70 percent after 18 hours with 4 mm diameter pellets and 70-80 percent with 2 mm diameter pellets.

The objectives of the study were to find out the proportion of water to fish fins, skin and bones that would give a good gel and to determine the effect of a combination of fish water and commercial crude agar on the water stability of the prawn diet.

Fins, skin and bones of whole guitar fish, *Rhynochobatus djiddensis* (Forskal) and sharp nosed shark *Scoliodon palasorrah* (Cuvier), in various amounts of water-weight: volume – 1:5, 1:2.5, 1:2, 1:1.5 were boiled for an hour until a very soft mass was obtained. The resulting mixture referred to as fishwater was strained through a fine nylon mesh and the water squeezed out. This fishwater was used in gelatinizing sago palm starch and commercial agar and gulaman dagat, or crude agar. Crude agar was prepared by sun drying the fresh seaweed and grinding the dried product into a fine powder. The gel was added to the dry ingredients of a formulated diet for the broodstock.

Table 1. Composition of the feed

Ingredients	% Composition
Fish meal	20
Squid meal	25
Shrimp head meal	20
Rice bran	10
Wheat flour	10
Corn oil	5
Vitamin-mineral mix	3
Sago palm starch	5
Agar bar or crude agar	2.5
Fishwater or plain water	44 ml

Sago palm starch was soaked in 7 mL and agar in 12 mL fishwater or plain water. The remainder of the water was boiled and the moistened agar was added and cooked until a gel was formed. The soaked sago palm starch was then added to the agar gel and gelatinized.

Pellets were tested for their stability by placing 10 g each in wire baskets, in triplicates, immersing these in seven liters of seawater and determining the stability every 6, 12 and 24 hours.

The formula for water stability was:

$$\text{Water stability} = \frac{\text{Original weight x percent dry weight}}{\text{Final weight x percent dry weight}} \times 100$$

Turbidity of water was also determined by means of a spectrophometer and was compared with results of water stability percentages of the pellets by regression analysis.

A proportion of 1:2.5 guitar fish, fins and bones to water and 1:1.5 shark fins and bones gave a good gel.

Results of the water stability test for Study 1 after 6, 12 and 24 hours are shown in Figure 1 and Table 2. There were significant differences in water stability among treatment means after 6 and 12 hours. However, after 24 hours of immersion, the pellets prepared with fishwater from guitar fish and commercial agar (D) was most stable (70.2 percent), and was significantly different from the others ($P < 0.05$). The water stability of pellets prepared with fishwater, one part shark fins, skin and bones and 1.5 parts of water (C) was 67.5 percent and was not significantly different from Treatment D. All other pellets (A, B, and E) were less stable than the D pellets.

Study II was carried out to compare the effectiveness of crude and commercial agar prepared with plain or fish water. Acceptability of pellets made with the crude agar seemed to be better than those prepared from commercial agar. Probably some of the constituents present must have been destroyed or removed in the process of purification. In the process of bleaching there might have been some chemical constituents removed that made seaweed attractive to the prawn.

The most stable pellets after 6 hours were those prepared with fish water or plain water and crude agar (82.7 and 83.8 percent) respectively, while the least stable pellets were those prepared with fish water and agar (Fig. 2 and Table 2).

The use of plain water with crude agar increased the water stability of the pellet significantly. On the contrary, water stability decreased when plain water was used to dissolve the agar bar. Perhaps there was not enough water in the fishwater to dissolve the crude agar which contained, aside from galactans, other substances such as salt, fat and fiber. Furthermore, the salts and other substances present in the crude agar could have changed the binding capacity of the whole mixture. On the other hand, the protein or collagen in fish water increased the stability of the pellet when used with agar bars which has been devoid of protein during purification and processing from seaweed to agar bars. The collagen in fish water also acts as a binder.

Turbidimetric measurements of the water in which the pellets were immersed showed a significant linear correlation between turbidity and water stability (coefficient of correlation = 0.73).

Various proportions of fish fins and bones of guitar and shark fish to water were tried and the proportion of 1:2.5 for guitar fish and 1:1.5 for shark were found to be the best proportions. The fish water was used to dissolve the agar and gelatinize the sago palm starch. These pellets prepared with fish water and crude agar were least stable. When both kinds of agar were dissolved in plain water instead of fish water, a more stable pellet than those made with fish water and crude agar was obtained. Cost of commercial agar is P1.50/5 g while that of crude agar is P0.10/5 g. Crude agar in the pellets made the pellets readily acceptable to the prawn.

Under the conditions of the experiment the following conclusions were arrived at:

1. Fish water and commercial agar or agar bar gave the most stable pellet, 65 percent water stability.

2. Fish water and crude agar gave the least stable pellet, 43.7 percent after 24 hours.

3. A strong gel is obtained when one part shark fin is boiled in 1.5 parts water.

4. More fish water of about the same gel strength can be obtained from guitar fish than from shark fins. A 1:2.5 proportion produces about the same binding capacity as a 1:1.5 proportion shark to water.

5. Plain water and crude agar would be the choice when the cost, stability and acceptability are taken into consideration.

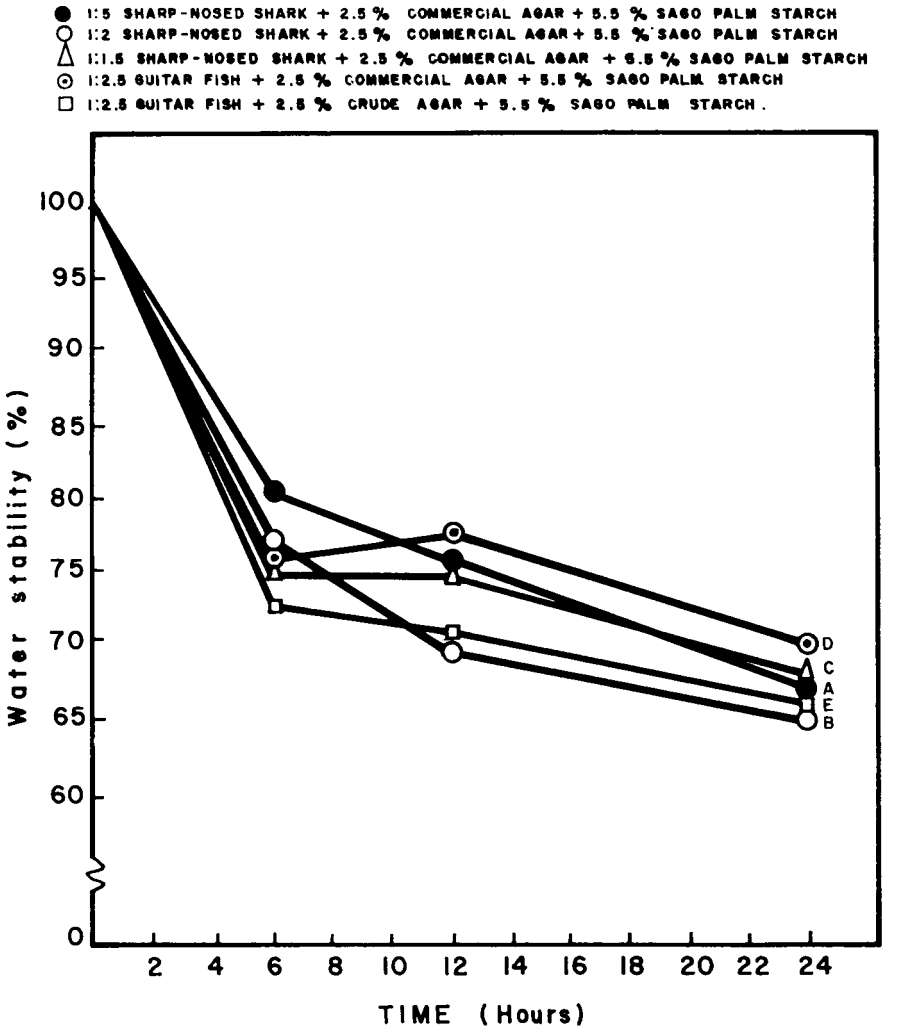

Fig.1. WATER STABILITY (%) OF PELLETS PREPARED WITH FISH WATER FROM GUITAR FISH AND SHARK FISH.

Table 2. Mean percentage water stability after 6, 12 and 24 hours.

Study 1 Treatments	6 hrs	12 hrs	24 hrs
A	80.2[a]	75.6[a]	67.0[b]
B	77.1[a]	69.5[a]	65.2[b]
C	75.0[a]	74.8[a]	67.6[a,b]
D	76.7[a]	77.5[a]	70.2[a]
E	73.9[a]	70.7[a]	65.9[b]

Study 2 Treatments	6 hrs	12 hrs	24 hrs
A	87.2[a]	71.1[a]	59.8[a]
B	83.2[b]	75.8[a]	56.6[a]
C	83.8[a, b]	67.6[a]	43.7[b]
D	70.5[c]	68.4[a]	65.1[c]

Figures with the same superscripts are not significantly different from each other ($P<0.05$)

Study 1 Broodstock diet with the binders as follows:

A – 1:5 sharp-nosed shark, commercial agar
B – 1:2 sharp-nosed shark, commercial agar
C – 1:1.5 sharp-nosed sahrk, commercial agar
D – 1:2.5 guitar fish, commercial agar
E – 1:2.5 guitar fish water, crude agar

Study 2

A – plain water, crude agar
B – plain water, commercial agar
C – fish water, crude agar
D – fish water, commercial agar

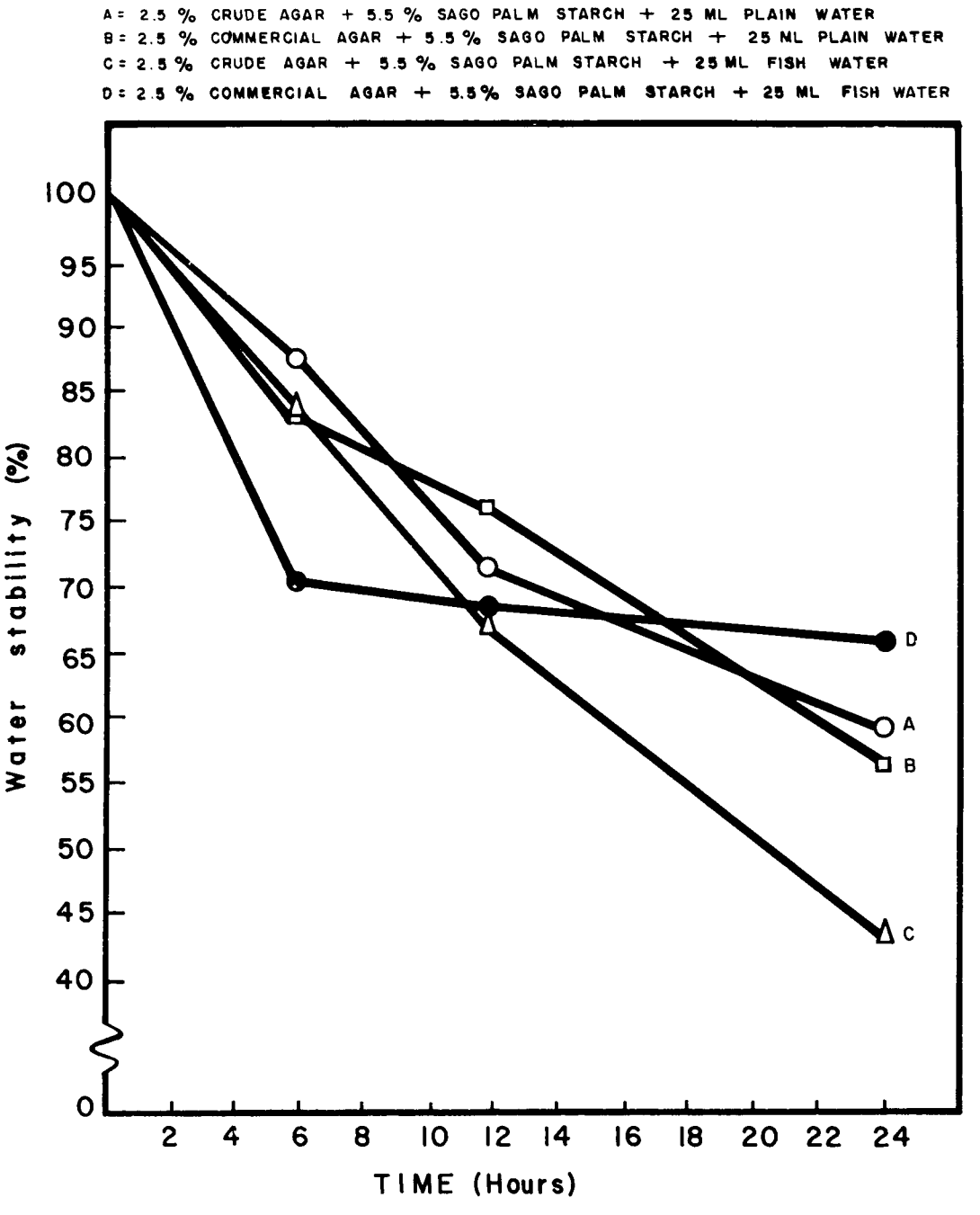

Fig. 2. WATER STABILITY (%) OF PELLETS PREPARED WITH PLAIN WATER OR FISH WATER.

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