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DEVELOPMENT OF FARM MADE FLOATING FEED FOR AQUACULTURE SPECIES

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ABSTRACT
Six feeds were formulated to evaluate the effect of catalyst on the buoyancy of the feed (pellets and flakes). The feed were formulated using yeast and baking powder as the catalyst at 5% and 10%, respectively. The research result shows that feed formulated at 5% and 10% fishmeal based feed of 5% and 10% catalyst gave the highest floatation while the soyabean based feed with both percentage of catalyst did not float at all. . The objective of this study is to explore the buoyancy potential of locally available floating catalysts to develop floating fish feed on-farm.

KEY WORDS: floating catalysts, feeds, pellet, and flake.

INTRODUCTION

Fish feed cost is a major factor militating against fish culture in Nigeria in that it accounts for about 60-80% of management costs (Olomola, 1990). Pelleted fish feed are prone to leaching of nutrient in pond waters due poor water stability, poor nutrient retention and immediate sinking and disintegration to the bottom of ponds at feeding. This is a big loss in aquaculture input management (Holm and Walther, 1988; Lopez-Alverado *et al.,* 1994; Falayi *et al.,* 2003). Extruded floating feed cost is a significant disadvantage over locally produced dried and moist pellets (Lovell, 1988). The actual extruding machine for floating feed such as Insta PRO 2000 is very expensive and all efforts to procure the machine by the National Agricultural research Project (NARP) during the World Bank Project in 1900's proved abortive in that less effective (Insta PRO 600) extruder, made solely to process soybean for African countries were brought to Nigeria (Falayi, 2009). This has made Nigeria permanent buyer of expanded floating feeds at high cost from United State of America and other western countries. The Nigeria economy policy should not support such outrageous wastage of our foreign exchange. Therefore, it is imperative that emphasis should be geared towards the technology of developing buoyant (floating) fish feeds without adverse effect on the quality of compounded nutrients. Such feed must be very stable and afloat in water for a period of time before it sinks Kearns, 1989; Hilton *et al.,* 1981). The objective of this study is to explore the buoyancy potential of locally available floating catalysts to develop floating fish feed on-farm.

MATERIALS AND METHODS

The research was carried out in Water, Aquaculture and Fisheries Technology Department Laboratory of the Federal University of Technology Minna, Niger state.

Source of feedstuffs

The feedstuffs used in this study included research are: fish meal, wheat meal, soyabeans meal, yeast, and baking powder.

Feeds formulation

Equational method or Algebra method ($x_1+y_1= z$ (eqn 1); $x_2+y_2=p$ (eqn 2); where x_1 and y_1 denote unknown values for wheat meal and catalysts while x_2 and y_2 represent nutritional values for wheatmeal and catalysts respectively and while z and p denote ration target and nutrient level of feed formulation (Falayi, 2009) was adopted for feed 1 and 2 since there was no target crude protein level. Feed 1 and 2 served as control to establish the bouyancy potential of the catalysts. Pearson square method was used for formulating feeds 3, 4, 5 and 6. The other feeds were formulated at 20% crude protein fixing yeast and baking powder at 5% and 10% using the following feedstuffs (Table 1).

Buoyancy Test

The floating ability of pellets and flakes wheat-flour based feed with floating catalyst at 5% and 10% were evaluated for 1hour. 10 pellets /flakes samples were randomly selected. They were put in a 250 ml beaker with 150 ml of freshwater. With the aid of a stop watch degree of floatation was recorded wwithin the time frame of 1 hour. The trial was replicated with their means statistically analyzed. The Density of feed s were calculated [(Mass/Volume (g/cm^3)] as well as the Relative density (Mass of feed/Mass of equal volume of water) were also evaluated to establish the floating level of the feeds as against the mass of water.

Statistical Analysis

Data were subjected to one way analysis of variance to test their significant levels at 5% probability. The means were separated using Turkey's method using Minitab Release 14 while the graphs were drawn using the Microsoft excel window 2007.

TABLE 1: Formulated feeds

Ingredients (g)	Feed 1 (Control)	Inclusion Feed 2 (Control)	LEVELS Feed 3	Feed 4	Feed 5	Feed 6
Fishmeal	-	-	12.23	9.18	-	-
Soya bean meal	-	-	-	-	23.02	17.78
Wheat meal	9.98	9.45	82.76	80.82	71.95	72.72
Yeast & Baking Powder	1.64 (5%)	3.28 (10%)	1.64 (5%)	3.28 (10%)	1.64 (5%)	3.28 (10%)
Mineral Premix	3.37	6.72	3.37	6.72	3.39	6.22
TOTAL	14.99	19.45	100.00	100.00	100.00	100.00

Feeds compounding (pellets and flakes)

The correct measurement of every ingredient was administered according to the values in the formulation (Table 1) using a sensitive weighing balance (CITIZEN 300), the measured feedstuffs were ground into powder and thoroughly mixed together after which the feedstuffs were compounded using warm water at 150ml for every 500g of feedstuff measured to make the mixture semi-solid. The dough was kept under the sun to activate the yeast in the feed for the period of 30-40 minutes. This will allow for yeast fermentation and production of carbondioxide for expansion of dough. The fermented dough was then pelleted using manual pelleting machine with 2mm die, the strands were then oven dried at 60 ^{o}C. The Flakes were also made from the compounded feedstuffs. Flakes were made by pressing flat little ball of the dough. Flakes were then covered in a bucket to allow for expansion following pressing which was to enhance buoyancy of feeds. This process allowed the feeds to pulp-up and was later transferred to the air condition exhaust (an improvised hot air device which was adopted due to high humid environment and absence of functioning oven) for proper drying for a period of 6 hours, the dried feeds were then packaged in a polythene and store in refrigerator at 4°c.

RESULTS

Table 2 showed the density and relative density of six experimented pelleted feeds. There were significant differences (P<0.05) in the density of tested pellets. Feed 3, 5 and 6 exhibited significantly low (P<0.05) density (1.12) than feed 1, 2 and 4 with (1.17). However feed 6 had the lowest relative density (1.12), while feed 5 had the highest relative density of (1.26) with no significant difference (P>0.05) to feed 2.

TABLE 2: Density and relative density of farm made aqua feed as pellets

Bouyancy Parameters	Feed 1	Feed 2	Feed 3	Feed 4	Feed 5	Feed 6	SD ±
Volume of Pellet (cm^3)	1.88 ±0.01^{a}	1.80±0.01^{a}	1.80±0.01a	1.75±0.01^{a}	1.45±0.01b	1.69±0.00a	0.01
Mass of pellet(g)	0.22±0.00^{a}	0.21±0.01^{b}	0.20±0.00^{b}	0.21±0.01^{b}	1.71±0.00^{c}	0.19±0.01^{b}	0.01
Density	1.17±0.01^{a}	1.17±0.00^{a}	1.12±0.01^{b}	1.17±0.01^{a}	1.12±0.00^{b}	1.12±0.01^{b}	0.01
Density Mass of Water (g)	0.19±01^{a}	0.17±0.00^{b}	0.18±0.01^{b}	0.17±0.00^{b}	0.15±0.01^{c}	0.16±0.00^{bc}	0.01
Relative Density	1.20±0.00^{b}	1.24±0.01^{a}	1.17±0.01^{c}	1.24±0.01^{a}	1.26±0.01^{a}	1.12±0.00^{d}	0.01

Mean data on the same column carrying same superscripts are not significantly different (P>0.05) from each other

Table 3 shows the density and relative density of six flake feeds which were significantly different (P<0.05) from each other. The density of the six feeds ranged from 1.109 – 1.323 with feed 1 having significantly low (P<0.05) density (1.109), while feed 2 had a significantly higher (P<0.05) density (1.32). The relative density of six feed followed the same pattern with no significant difference (P>0.05) among feeds 4, 5 and 6. While feed 2 exhibited significantly high (P<0.05) density and relative density (1.38 and 1.323 respectively)

TABLE 3: Density and relative density of farm made aqua feed as flakes

Bouyancy Parameters	Feed 1	Feed 2	Feed 3	Feed 4	Feed 5	Feed 6	SD ±
Volume of Pellet (cm^3)	0.173^{a} ± 0.001	0.130^{c} ±0.000	0.150^{b} ± 0.00	0.147^{b} ± 0.001	0.133^{c} ± 0.000	0.133^{c} ± 0.000	0.01
Mass of pellet(g)	0.192^{a} ± 0.000	0.172^{c} ±0.001	0.170^{c} ± 0.001	0.178^{b} ± 0.001	0.166^{c} ± 0.001	0.163^{d} ± 0.001	0.01
Density	1.109c ± 0.001	1.323^{a} ±0.001	1.130^{c} ± 0.000	1.211b ± 0.000	1.248^{b} ± 0.001	1.225^{b} ± 0.001	0.01
Density Mass of Water (g)	0.166a ± 001	0.125^{c} ±0.001	0.144^{b} ± 0.001	0.141^{b} ± 0.001	0.128^{c} ± 0.000	0.127^{c} ± 0.001	0.01
Relative Density	1.16^{c} ± 0.001	1.38^{a} ±0.001	1.18^{c} ± 0.001	1.26^{b} ± 0.000	1.30^{b} ± 0.001	1.28^{b}±0.001	0.01

Mean data on the same column carrying same superscripts are not significantly different (P>0.05) from each other

The buoyancy of the six pelleted aqua feeds was evaluated for 60 mins. Figure 1 indicated that at 0 min feed 5 and 6 did not float at all while feed 1 and 3 had 50 % and 100 % floatation respectively. At the end of 60 min feeds 2, 5 and 6 had 0 % floatation while feed 3 had the highest floatation of 70%.

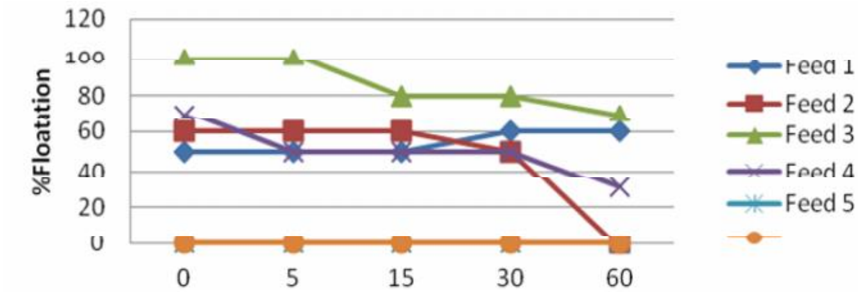

Fig. 1: Floating time of pellets six feeds

The buoyancy of six flakes farm made fish feed were evaluated for the period of 60 min. All the flaked feeds floated. However, the floatation varies among the feeds. At 0 min feeds 2, 5 and 6 had the lowest floatation value of 40 % while feed 3 had the highest floatation value of 90 %. After 30 mins the floatation value changes among the feeds, feed 6 had the lowest value of 20 % while Feed 1 had the highest floatation value at 100 %. At the end of 60 minutes feed 6 still had the lowest floatation of 20 % while feed 3 had 70 % floatation (Fig 2). At 0 min pelleted feed had the highest floatation of 80 % while flakes had the lowest at 50 %. After 5 mins, the floatation of the pellets feed increased to 90 % and 100 % at 30 minutes while the flakes remained at 50 % after 15 minutes and increased to 60 % at 30 minutes. However, the floatation of both the pellets and flakes at 60 minutes were 60% respectively (Fig.3)

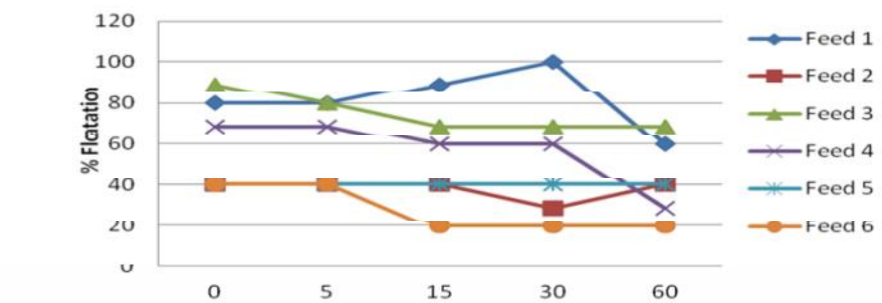

Fig. 2: Floating time of thick layer flakes from six feeds

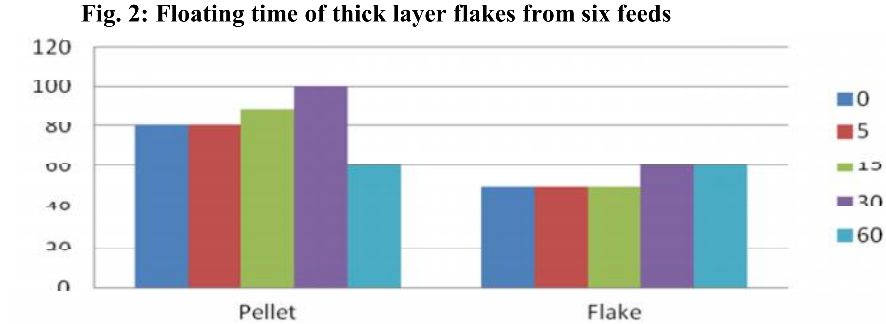

Fig. 3: Floating ability of wheat flour based diet with floating catalyst at 5%

At 0 minute the pellet feed had 60 % floatation and flakes 40 %, however, at 30 minutes floatation value dropped to 30 %. At 60 minutes pellets had 50 % floatation while flakes had 40 % (Figure 4).

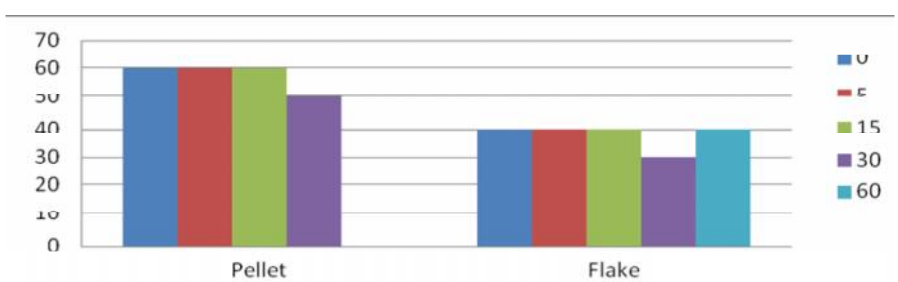

Fig. 4: Floating ability of wheat flour based diet with floating catalyst at 10%

At 0-5 minutes pellets has 100% floatation while flakes had 90% floatation at 0 min and reduced to 80 % at 5minutes. 15-30 minutes pellets had 80 % floatation while flakes had 70 %, at 60 minutes both pellet and flakes had the same floatation at 70 % (Figure 5).

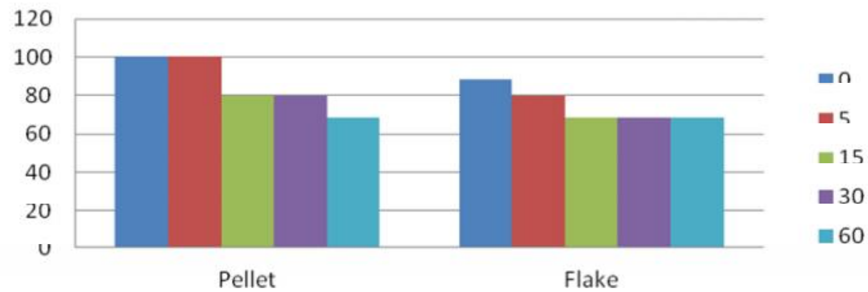

Fig. 5: Floating ability of fish meal based diet with floating catalyst at 5%

At 0 min both pellet and flakes had the same floatation of 70 %, at 5 minuutes the pellet floatation reduced to 50 % while flakes still at 70 %, 15-30 minutes pellets still had 50 % while flakes had 60 %, at 60 min they both have the same floatation of 30 % (Figure 6).

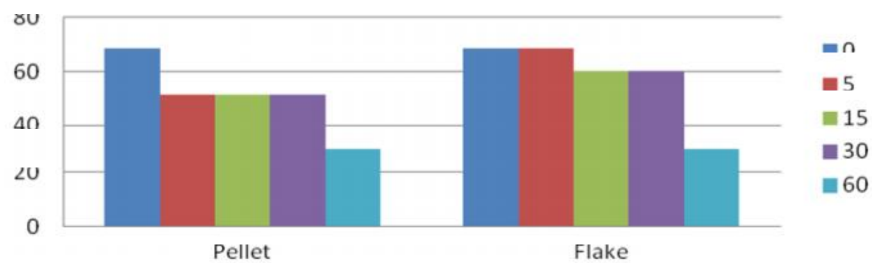

Fig. 6: Floating ability of fish meal based diet with floating catalyst at 10%

Figure 7 showed the floating ability of pelleted and flaked soybean based feed with floating catalyst at 5 %. The pellets did not float while flaked feed attained 40 % floatation in 60 minutes.

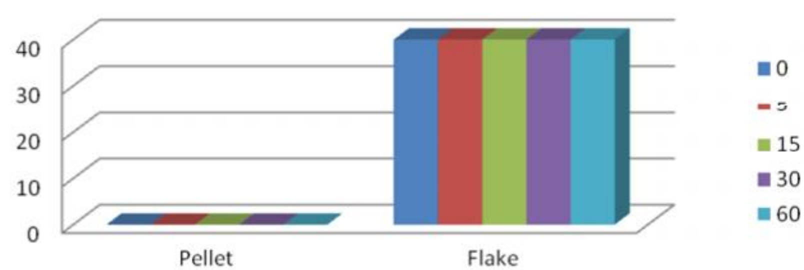

Fig. 7: Floating ability of soybean based diet with floating catalyst at

Figure 8 exhibited the floating ability of pelleted and flakes of soybean based feed containing 10% floating catalyst. The pellets did not float at all while flaked feed also exhibited 40 % floatation during the first 5 minutes of testing while there was 20 % floatation throughout the 60 minutes.

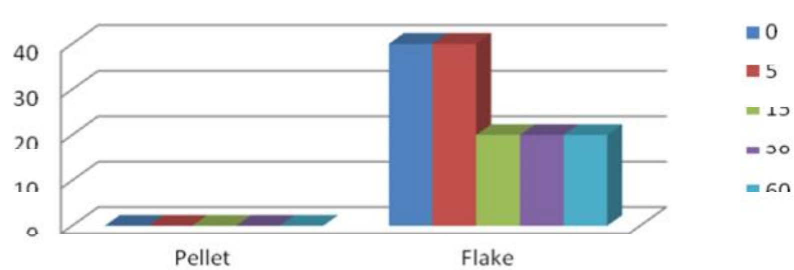

Fig. 8: Floating ability of soybean based diet with floating catalyst at 10%

DISCUSSION

The floating catalysts aided buoyancy as indicated in the rsults. Fishmeal based feed floated better while soybean based feed did not float. This could be due to better gramme-upthrust of fish oil and molecular weight . The buoyancy disparity could be attributed to molecular weight of feed ingredients. Fish meal-Wheatmeal based feed could float because of expansion of the pellets as impacted by floating catalyst (yeast and baking powder) (Mbogwu and Adeniji, 1988). When feed sinks, there is a serious nutrients loss due to leaching of essential vitamins like A, D, E, K of fat soluble status and about one-third of the free plus protein bound amino acids (Lopez-Alverado *et al*., 1984). Extruded floating feed cost is quite a disadvantage over dried and moist pellets (Lovell, 1988). And as such, floating feed is a management tool as it enables farmers assesses and observes feeding activity of their fishes (Falayi, 2000). However, soybean meal based diet demonstrated poor floatation due to its high molecular weight as seen its high relative density rate (Table 2). The feed though, exhibited low buoyancy could still be of advantage to benthic feeders like catfish (Falayi, *et al.* 2005).

CONCLUSSION

Floating catalyst is necessary to enhance buoyancy of feed, careful selection of feedstuffs is a necessity, feedstuffs with positive buoyancy are better than those with neutral and negative buoyancies, hence fishmeal and wheat meal based feed had better buoyancy. Relatively cheap, toxic free and attainable in the country and also can be easily process, the methodology of floating fish feed formulation and production are very simple and cheap in term of cost than importation of extruded floating feed from the western nation.

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