Pellet Binders

- mastercube
- aquacube
- aquacube concentrate

Low volume inclusion – high quality binding...

kiotechagil

Performance in aquaculture&agriculture

Mixing: The objective when mixing formula feeds is to ensure that small quantities contain the same proportion of ingredients as the formula of the bulk mix. The smaller and more uniformly sized the ingredient particles are ground the faster an even distribution will be achieved. Regular testing of mixing times needs to be conducted for individual ration formulations to ensure correct mixing. Under mixing or over-mixing can result in loss of homogeneity.

Fat and Oil addition: As a general rule more than 1% added at the mixer stage will result in meal particles coated with fat, which interferes with steam absorption and reduces pelletability. Generally higher levels of oil or fat are achieved by post pellet spraying on exiting the die, or immediately after the cooler.

Conditioning (or expanding): This has a major effect on capacity, press output, pellet quality and the life of replaceable parts. The aim of any conditioning process is to:

- allow time to utilise the heat and moisture content of the steam.
- ensure a thorough mixing and homogeneity of any added liquids to the meal.

The activity in the conditioner helps with pregelatinisation of starches and initiates added enzyme activity to improve digestibility. Conditioning also reduces bacterial counts to improve biosecurity. Using acids further enhances the biocidal activity of conditioners.

On leaving the conditioner the meal should be friable and free flowing. Extremes of moisture should be avoided and allowances made for sources such as:

- moisture content of raw materials.
- liquid additions such as molasses.
- the quality of the steam.
  The steam needs to be as dry as possible without being superheated to ensure that the required increase in temperature of the meal to achieve the plasticity vital for pelleting. Attention to location of steam traps is essential to ensure good steam quality.

Pelleting: By ensuring that a meal is in the best possible state to go to the pellet press it is hoped that good quality pellets will result. However, it is still necessary to check the physical set up is correct.

- Select a suitable die for the appropriate pellet size and type.
- Check die condition
- Adjust roller and plough settings correctly. Die wear or damage will result from too tight a setting. Roller slip and die blockage can result from too loose settings.
- Set knives to produce pellets of the correct length and ensure knives are sharp.

Cooling: The cooler immediately after pelleting is important to reduce pellet temperature rapidly to preserve the more heat labile ingredients. Cooling also removes surplus moisture to prevent storage moulding.

Pellet quality is important and is governed by a number of factors, as mentioned above. Many may not be optimal from a pelleting viewpoint on grounds of cost and nutritional requirements. A pellet binder may help to overcome some of the issues but will not be a substitute for the art of pellet production.

introduction

Pelleting has a number of advantages over mash feed:

- Feed hygiene improvement. The addition of heat due to steam and pressure reduces the microbiological load, particularly for the non-spore forming bacteria such as E. coli, Salmonella and Campylobacter.
- Increases bulk density – less space is occupied in storage and transport.
- Avoids suspension of ingredients – the mix remains homogeneous and avoids selective feeding behaviour.
- Less waste – dust losses during transportation and feeding are considerably less than with meal.
- Administration of medication is easier and more accurate with pelleted feed.
- Nutritional improvement – the conditioning of the formulation mix can improve the palatability and digestibility of the feed, resulting in improved performance.

Some of the main factors affecting pellet quality are:

Raw Materials: Raw material choice will be governed by nutritional requirements and availability, but it is helpful to understand potential issues as a result of choosing particular raw materials. Some examples are illustrated of raw materials difficult to pellet, together with the effect on pellet press capacity.

Raw material	Typical fines %	Press throughput kg/KWh		Raw material	Typical fines %	Press throughput kg/KWh
Barley meal	3 – 6	50 - 75		Palm kernel	>50	75 - 125
Blood meal	<1	20 - 30		Poultry meal	4 - 5	40 - 60
Brewers grains	6 - 20	25 - 50		Rice bran	10 - 20	20 - 40
Coconut cake	>6	75 - 125		Straw	10 - 15	12.5 - 25
Canola meal	10 - 20	>125		Sorghum	6	50 - 75
Feather meal	>6	50 - 75		Soya cake	2	60 - 85
Maize	4 - 5	75 - 125		Tapioca	3	15 - 30
Oat meal	>20	25 - 50		Wheat bran	3 - 6	25 - 50

Grinding: is an important process in the manufacture of pelleted feeds. The reduction in particle size

- reduces clumps and large fragments.
- reduces moisture due to aeration.
- helps blend additives such as anti-oxidants.
- increases surface area for better distribution and penetration of steam, molasses, fat and other liquid ingredients to improve adhesive properties, and hence pellet quality.

Insufficient grinding in relation to the pellet diameter will lead to breakage and higher level of fines.
Care to maintain sieve integrity is essential to produce homogeneous grist that will produce good pellets.

kiotechagil pellet binders

The purpose of a pellet binder is to ensure that the pellet quality is maintained, not just at the production stage, but also during transport and storage.

In the case of aquafeed there is an additional requirement to maintain the integrity of the pellet when immersed in water.

Kiotechagil's pellet binders are low inclusion products. These offer the nutritionist the opportunity to optimise the feed formulation by releasing space for lower cost raw materials of nutritional value.

mastercube:

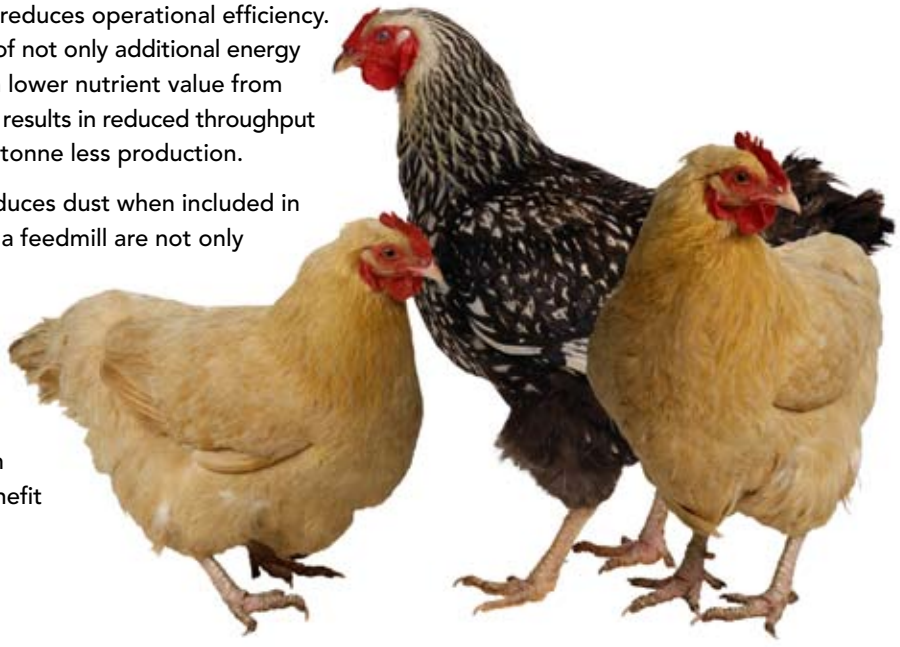
MASTERCUBE is a combination of calcium sulphate and guar gum.

Guar gum is a natural plant gum that rapidly binds the grist into a flexible matrix to give good flowability, lubricating the die and improving durability. This allows pellets to withstand the abrasions of sieving, cooling, handling and transportation.

The moisture added during conditioning hydrolyses the calcium sulphate to produce a hardness capable of withstanding the weight of feed in bags, the feed bin or silo.

The economic climate puts pressure on ration formulation to utilise lower cost materials. This results in raw materials with lower pelletability factors being used. **Mastercube** maintains the pellet quality in such circumstances.

Reduction in fines during a pelleting operation is an economic necessity. Fines are collected and recycled which reduces operational efficiency. This reduction in efficiency is the result of not only additional energy for reconditioning but also can result in lower nutrient value from 're-cooking' the fines. The recycling also results in reduced throughput in the mill, as every tonne recycled is a tonne less production.



Mastercube is not dusty in use and reduces dust when included in ration formulations. High dust levels in a feedmill are not only a health hazard but affects the quality image of the finished feed as the mill and packaging become dusty.

The high cost of energy makes single pelleting combined with a low inclusion binder more efficient than double pelleting irrespective of the benefit in the reduction in fines.

aquacube:

AQUACUBE binders are formulated to provide a high degree of stability in water. Two types of pellet used in aquaculture are:

Low density pellets: These must float and remain stable until consumed.

High density pellets: These sink and need to remain intact for considerably longer time before they are found and eaten by crustacean such as prawns, lobsters and crab.

Kiotechagil binders are formulated for both low and high-density pellets. Their use is dependent on the stability time required and will not influence the ability of the pellet to float or sink. This will depend on the feed formulation.

Feed Stability Characteristics	Sea Water at 20°C (3& salinity)	Fresh Water at 20°C	Kiotechagil Binder Required	
Floating	<480g/l	<440g/l	AQUACUBE	1 - 2 hours
Neutral Buoyancy	520 - 540g/l	480 -500g/l	AQUACUBE	
Slow sinking	580 - 600g/l	540 - 560g/l	AQUACUBE CONCENTRATE	2 - 4 hours
Fast sinking	>640g/l	>600g/l	AQUACUBE CONCENTRATE	

Pellet degradation will allow nutrients to diffuse into the water. This raises the biological oxygen demand (BOD). The loss of pellet integrity results in the direct loss of nutrients to the sediment and elevation of ammonia levels, giving rise to toxicity.

Kiotechagil AQUACUBE binders are formulated to minimise pellet degradation in water.

kiotechagil pellet binder application:

It is suggested the starting application for **Mastercube** is 3 kg/t and AQUACUBE (Concentrate) at 5 kg/t.

If this gives satisfactory results keep reducing the rate in increments of 0.5 kg/t until the point where pellet quality is no longer satisfactory and then revert to the prior level.

trials

1 Broiler Rations:

Rations contained 4% soya oil with a total fat content of 10%. Mesh size (mm) : 3.2 x 5.5.

Parameter	Double Pelleting	Single Pelleting
Binder	None	**MASTERCUBE @ 1.5 kg/t**
Fines	4.8%	3.6%

The additional energy to double pellet is estimated to cost an additional 10 KWh/t. The following assumptions are based on typical costs in currency units (CU). Feed cost CU 500/t; MASTERCUBE 3x feed cost per kg; energy CU 0.170/KWh.

Economic savings:

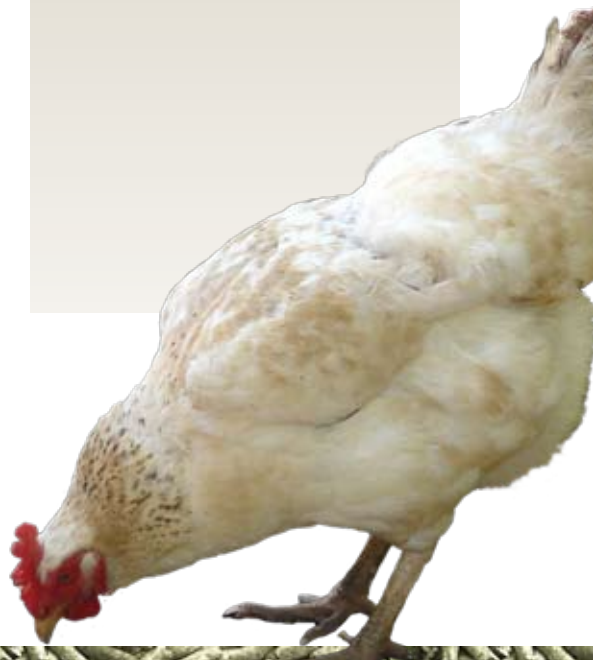
Saving in fines 1.2% i.e. 12 kg/t @ CU500/t	= CU 6.0 /t
Saving energy by single pelleting @ CU 0.17 x10	= CU 1.7/t
TOTAL SAVINGS	= CU 7.7/t
Cost of MASTERCUBE @ CU 0.5/kg x 3	= CU 1.5/t
Net saving from use of MASTERCUBE	= CU 6.2/t

2 Fat Rich Dairy Compound

The test used Dairy Compound with 5.2% fat coated to give a total fat of 10%. Press temperature: 65°C. Die size: 5 x 90 mm

Parameter	Lignosulphonate	MASTERCUBE
Binder Inclusion	20 kg/t	1.3 kg/t
Fines	2.4%	2.3%
Relative Cost of finished feed with binder	100	69

MASTERCUBE at an inclusion of 1.3kg/t gave the same pellet quality as 20kg/t lignosulphonate at a cost saving of 31%. The MASTERCUBE ration included an additional 18.7 kg of nutritional space.



3 Fat Rich Dairy Compound

Test was on Dairy Compound with 10.1% added fat, giving total fat 14.8%.
Pellet diameter: 7mm. Pellet temperature: 95°C.

Parameter	No Binder	MASTERCUBE
Binder Inclusion		1.5 kg/t
Double Pellet matrix	60 + 130mm	60 + 130mm
Fines	11%	7%

MASTERCUBE at 1.5kg/t reduced the fines by 36%.

4 Comparison with Other Binders

Ration was corn based pig feed with 3.75% added fat coated to give total fat 4.6%
Die size: 3x 65 mm. Press Temperature: 68°C.

Parameter	Control	Lignosulphonate A	Diatomaceous E	MASTERCUBE
Binder kg/t	-	12.5	15	1.5
Fines %	6.5	5.0	5.5	4.8

MASTERCUBE at 1.5 kg/t gave about 10% less fines than the other binders and 26% less than the control.
Nutritional space was optimised by at least 11kg/t.

5 Comparison with lignosulphonate

Broiler feed:

Parameter	Lignosulphonate	MASTERCUBE
Application rate	20 kg/t	1 kg/t
Production t/hour	18.0	18.5
Hardeness	71%	92%
Relative cost	100	70

MASTERCUBE not only improved pellet hardness at lower cost but released 19kg/t of nutritional space for raw materials of nutritional value.

mastercube

Low inclusion binder
Helps achieve good pellet quality
Reduces fines
Increases mill throughput by lubricating the die
Saves energy in the press and reduced need to process returns
Enables higher inclusion of fats without compromising pellet quality

aquacube and aquacube concentrate

Low inclusion binder
Helps achieve good pellet quality
Reduces fines
Increases mill throughput by lubricating the die
Saves energy in the press and reduced need to process returns
Enables higher inclusion of fats without compromising pellet quality
Maximises stability in water for floating and sinking pellets

For further information

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