

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GA	Gabon	MR	Mauritania
AU	Australia	GB	United Kingdom	MW	Malawi
BB	Barbados	HU	Hungary	NL	Netherlands
BE	Belgium	IT	Italy	NO	Norway
BG	Bulgaria	JP	Japan	RO	Romania
BR	Brazil	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	LI	Liechtenstein	SN	Senegal
CH	Switzerland	LK	Sri Lanka	SU	Soviet Union
CM	Cameroon	LU	Luxembourg	TD	Chad
DE	Germany, Federal Republic of	MC	Monaco	TG	Togo
DK	Denmark	MG	Madagascar	US	United States of America
FI	Finland	ML	Mali		
FR	France				

1

ANIMAL FEED BLOCK MADE OF MOLASSES
AND CALCIUM OXIDE

BACKGROUND OF THE INVENTION

1. Field Of The Invention

5 This invention relates to an animal feed block
made of molasses and calcium oxide, and its method of
preparation. The molasses-calcium oxide animal feed
block can be used as an animal feed supplement and can
also include minerals, non-protein nitrogen, salt,
10 vitamins, and medicines. The animal feed block can
also be utilized in the form of smaller discrete
particles, such as pellets.



2. Description Of The Prior Art

Several approaches have been used by the prior art in the manufacture of solid animal feed blocks. U.S. Patent No. 4,027,043 to Schroeder et al discloses
5 an animal feed supplement in solid block form whose components include a major proportion of molasses and solidifying components of a phosphate or phosphoric acid and a metal oxide or salt in sufficient quantities and proportions to solidify the product. The phosphate
10 solidifying component can be any suitable feed grade water soluble phosphate or phosphoric acid. These include ammonium or alkali metal phosphates and various phosphoric acids. Orthophosphates or ortho-
15 phosphoric acid are the preferred phosphate source and exist in the feed supplement at a concentration of about 0.5 to about 5% by wt., expressed as P_2O_5 .

The other solidifying component of Schroeder et al's animal feed block composition is an oxide, salt or mixture of a metal such as aluminum, calcium
20 or magnesium. These include calcium oxide, magnesium oxide, aluminum oxide, calcium sulphate, and the like. Of these, calcium oxide or calcium sulphate in the form of gypsum is most preferred and is present in amounts varying from about 0.5 to about 5 wt.%,
25 expressed as the oxide.

Schroeder et al's proportions of the metal salt or oxide to the phosphate component are such that the animal feed product preferably has an acidic pH value, typically from 3 to about 6.5. The
30 importance of the phosphate component as a solidifying agent is underscored by Schroeder et al's statement



-3-

at column 3, lines 24-28 that

5 "The solid blocks which are formed from the composition have a tendency to become soft as the equivalent weights ratio of the phosphate to the metal is reduced substantially below about 1.0." (Emphasis added).

10 Schroeder et al explain that the soluble phosphate and an added metal source, such as calcium oxide, function by at least partial reaction to form a metal phosphate.

15 Other components in Schroeder et al's animal feed block include edible fats and oils which can occupy 2 to about 30 wt.%. An emulsifying agent is also employed for stabilizing the composition and preventing the separation of the fat ingredient during manufacture and occupies from about 0.05 to about 1 wt.% of the feed block. When starch is used as an emulsifying agent, it can occupy 0.5 to about 6 wt.% of the solid
20 feed block. Schroeder et al's animal feed block can also contain a non-protein nitrogen source, such as urea, biuret or mono- or di- ammonium phosphate, various trace nutrients, antibiotics and vitamins, and bloat inhibitors.

25 U.S. Patent No. 4,062,988 to DeSantis relates to an animal feed block comprising molasses, hard soap and a natural protein source. The concentration of the molasses varies from about 25 to 75% by wt. The hard soap is formed in situ during preparation of
30 the hard block by the reaction of a hard metallic soap former with a fatty acid soap former. The concentration of the hard soap in the feed block is generally from about 0.5 to about 10% by wt.



- 4 -

Hard metallic soap formers are disclosed in DeSantis as including calcium oxide, sodium hydroxide and mixtures thereof. The fatty acid soap formers include yellow grease, brown grease, acidulated soap stock, acidulated oils and acidulated fats. Yellow grease and brown grease are trade terms for reclaimed fats and grease which are acid or have been chemically treated to provide an acid constituency. The metallic soap former is generally employed in amounts varying from about 0.5 to about 5% by wt. The fatty acid soap former is generally used in amounts from 2 to about 20% by wt. The natural protein source can be derived from either plant sources or animal sources or mixtures. Examples of plant sources are cottonseed meal, soybean meal, peanut meal, and cell cream. Examples of animal sources are dried blood, meat and bone meal, and feather meal. The natural protein source has a minimum concentration of about 20% by wt. in order to obtain effective setting of the nutrient composition in block form.

U. S. Patent No. 4,016,296 to DeSantis discloses an animal feed block comprising molasses, water absorbent clay, a water binding agent, hard soap, and one or more of the following: natural protein source, non-protein nitrogen source, phosphorus source, fatty acid, and fat. The molasses concentration varies from 25 to 75% by wt. Water absorbent clays include attapulgite clay, bentonite, kaolin, and mixtures thereof, and are present in the animal feed block in amounts varying from 0.5 to about 5% by wt. The water binding agents include calcium sulfate,



hemihydrate, calcium chloride and mixtures thereof
in amounts varying from 0.2 to about 3% by wt. The
hard soap is formed in situ by reaction of a hard
metallic soap former with a fatty acid soap former
5 in a manner similar to that of U.S. Patent No.
4,062,988 to DeSantis. Phosphorus sources include
monosodium phosphate, calcium superphosphate,
ammonium phosphate and phosphoric acid, and are
present in amounts providing 0.5 to about 7% by wt.
10 of phosphorus. Various special purpose additives
such as vitamins, minerals, magnesium compounds,
alkaline compounds, preservatives and antioxidants
can also be included.

U.S. Patent No. 4,061,728 to Graham et al
15 discloses a therapeutic composition primarily used
to control or prevent bloat in ruminant animals which
is in the form of a substantially rigid block comprising
a reaction product of molasses, magnesium oxide, and
an nonionic polyoxyalkylene surface active compound.
20 The amount of nonionic polyoxyalkylene surface active
compound varies from about 5 to 25% by wt. of the
starting material. The amount of magnesium oxide
varies from about 5% w/w to 50% w/w based on the total
weight of starting material. The amount of molasses
25 varies from about 25 to 90% by wt. of the starting
material.

U.S. Patent No. 4,089,701 to Shimizu et al
relates to a process for solidifying molasses by
providing a mixture of molasses and a composition
30 selected from oils, fats, and esters of higher fatty



acids, and concentrating the mixture at a temperature between 100° and 175°C in the presence of sufficient alkali to regulate the pH of the mixture to a value in the range of 8-12.

5 U.S. Patent No. 3,420,672 to Appleman relates to an emulsified animal feed containing molasses, animal and vegetable fats, and starch.

Although several of the prior art approaches utilize molasses and calcium oxide as components, none
10 of them recognize the fact that an excellent feed block can be made with only these two components. As a result, the prior art suffers from numerous disadvantages, the most obvious being the necessity for additional components to form the block.

15 The patents to DeSantis et al and Schroeder et al require expensive fat material which becomes biologically unavailable to the animal due to its reaction with the calcium source. These fats also reduce calcium intake by the formation of insoluble
20 calcium soaps.

Feed blocks which require a soluble phosphate as a component take a longer period of time to produce and require external heating and mixing. This is also true for feed blocks which utilize magnesium
25 oxide and a polyoxyalkylene surface active compound.

All of the above mentioned prior art processes require greater capital costs in terms of equipment and energy.



-7-

SUMMARY OF THE INVENTION

In accordance with the present invention, it has been found that a homogeneous dispersion of calcium oxide and molasses will result in the formation of a substantially rigid composition in a period of about 5 10 to 14 hours. This rigid composition is most conveniently employed in the form of an animal feed block which is resistant to weathering and suitable for free choice feeding of livestock. Moreover, the 10 ratio of calcium oxide to molasses can be controlled to give the animal feed block a degree of hardness and alkalinity which will prevent overconsumption, thereby making the animal feed block eminently suitable as a vehicle for providing medication, mineral 15 supplements, non-protein nitrogen, salt, vitamins, and the like, to animals. The term "animals" in the context of this invention is intended to include animals raised commercially, or for use, especially domesticated quadrupeds, such as hogs, pigs, goats, 20 sheep, horses, cattle, rabbits, etc. and poultry, such as ducks, geese, turkeys, chickens, etc.

Alternatively, the calcium oxide and molasses dispersion, while still in a fluid state can be mixed with a granular animal feed which can then be compacted. 25 Generally, the calcium oxide-molasses dispersion will vary from about 1 to 30% by weight of the total composition including granular solid animal feed particles which are then compacted into a predetermined size and shape, such as pellets.



DETAILED DESCRIPTION OF THE INVENTION

The animal feed composition of the present invention is composed of a homogeneous dispersion of calcium oxide and molasses, which can be allowed to
5 harden to form a basic animal feed block. A wide variety of additional animal feed nutrients, additives, medicines, vitamins, minerals, and the like, can also be included as supplemental components in the molasses-calcium oxide dispersion. The supplemental components
10 generally do not adversely affect the hardness of the feed block.

The present invention is an improvement over the prior art in that the hardening of the feed block depends primarily upon the calcium oxide-molasses reaction.
15 No other components are necessary to form a hard, rigid block. This provides wide flexibility and economy to an animal feed manufacturer, who can supplement the basic calcium oxide-molasses composition with other components depending upon customer needs and require-
20 ments for the end use of the feed block.

Molasses and calcium oxide are mixed together at ambient conditions and subjected to moderate shearing action to obtain a homogeneous dispersion. A rapid exothermic reaction then occurs which will result in
25 the formation of a substantially solid and rigid molasses-calcium oxide composition in about 10 to 14 hours.

The intensity and extent of the exothermic reaction can be controlled by the application of
30 external cooling, if necessary. In general the temperature of the molasses and calcium oxide dispersion should not rise above 175°F.



-9-

Molasses is derived as a by-product from the crystallization of cane or beet sugar, and is comprised mainly of invert sugar, sucrose, water, salts and other carbohydrates. Molasses contains various amounts of solids which affect its viscosity, and the amount of such solids is designated in terms of "degrees brix," which is a measure of the percent sugar.

The molasses used in the present invention can be any sugar-containing molasses such as cane or blackstrap molasses, beet molasses, converted molasses, wood sugar molasses, hydrosyrup, citrus molasses, and the like. Commercial molasses can vary within the range of 60-90° brix, although feed molasses, should be at least 79.5° brix for cane and beet molasses, and 71° brix for citrus molasses. Since cane or blackstrap molasses is most palatable for livestock, it is preferred.

The concentration of molasses in the feed block composition of the present invention can generally vary from about 20-90%, preferably from about 25 to 75% by weight of the final feed block.

The calcium oxide employed in the feed block is known also as lime, burnt lime, calx, quick lime, unslaked lime, finish lime, fat lime, masons lime, and the like. The preferred form of calcium oxide conforms to ASTM Specification C5 and Federal Specification SS-Q-351. The calcium oxide should preferably be in the form of a finely divided powder, and in a pure state so that it will readily combine with water to form a composition with a pasty consistency. A lean lime, i.e., one with a high percentage of impurities will not slake freely with water or molasses and will not function as effectively as pure calcium oxide. The concentration



of calcium oxide in the feed block generally ranges from about 1 to about 20%, preferably 2-16%, and most preferably, 2.5-8% by weight of the final product.

The weight ratio of calcium oxide to molasses
5 in the final feed block product can generally vary from 1:2 to 1:12, preferably from about 1:4 to about 1:10, respectively.

In certain circumstances an excessive heat
buildup from the exothermic reaction between calcium
10 oxide and molasses can be moderated by the substitution of calcium hydroxide, $\text{Ca}(\text{OH})_2$, for at least a portion of the calcium oxide, but there is some loss in the hardness of the solidified composition. It has also
15 been found that the complete substitution of $\text{Ca}(\text{OH})_2$ for CaO , when mixed with molasses results in a dispersion that is substantially more viscous and does not flow as freely as the CaO -molasses dispersion.

A feed block containing a blend of calcium oxide and calcium hydroxide can be made. It has been found
20 that substituting 2-4 parts by weight of calcium hydroxide for each part of calcium oxide removed, generally gives satisfactory results.

Surprisingly, it has been found that magnesium
oxide cannot be substituted for calcium oxide to make
25 the basic animal feed block. It has been found that a molasses-magnesium oxide dispersion is not sufficiently reactive, and will not solidify at the conditions the calcium oxide-molasses dispersion solidifies. However, the animal feed block can contain magnesium oxide as
30 a supplemental nutritional additive, as is the case with a number of other optional ingredients.



-11-

In general, optional feed ingredients should not contribute more than 5 weight % total water to the final product. Some of these optional ingredients can include a suspension aid to prevent settling of insoluble additives until the feed composition solidifies. Examples of suspending aids are water soluble natural or synthetic polymers such as guar, locust bean gum, or xanthan gum, and the like. The amount of suspending aid can vary from 0-2.5%, preferably 0.2 to 1.5% by wt. of the total feed block product.

An insoluble phosphorus source can also be included, such as calcium phosphates since they are most economical. From a nutritional standpoint, a preferred phosphorus additive includes a mixture of approximately 2/3 monocalcium phosphate and 1/3 dicalcium phosphate. A suitable additive of this type is BIOFOSTM available from International Minerals and Chemical Corporation, Libertyville, Indiana, or DIKAL 21TM available from Borden Chemical Co. The feed block composition can contain 0-40%, and preferably 5-35% by weight of these phosphorus sources.

Another recommended feed block component is potassium-magnesium sulfate, which occurs naturally as langbelinite, ($K_2SO_4 \cdot 2MgSO_4$). It is available commercially under the trademark DYNAMATE from International Minerals and Chemical Corporation. The concentration of potassium-magnesium sulfate can vary from 0 to 20, preferably 0 to 10 weight % of the final feed block product. Potassium-magnesium sulfate is also referred to by those in the art as "KMS" and is



-12-

used as a source of sulfur in ruminant blocks containing non-protein nitrogen, usually in the form of urea. The recommended ratio is one part KMS for each 5 parts urea, to yield a sulfur-to-nitrogen ratio of 1-to-10.

5 Magnesium oxide, as noted earlier, can also be a component of the feed block and is available commercially, for example, as MAGOXTM (Basic Chemicals, division of Basic, Inc., Cleveland, Ohio). It can exist in the feed block from 0-60%, preferably 2-25% by weight of the
10 total product.

A sodium source can also be included as a component of the feed block most economically in the form of sodium chloride, or common salt. Iodized salt can also be used, but non-iodized salt is more economical. Iodine, if
15 desired, can be included as part of a trace element premix. The salt can exist in the feed block in amounts varying from 0-50%, preferably 3-20% by weight of the total product.

Sources of natural protein, such as soybean meal, cotton seed meal, blood meal, hydrolyzed feather meal,
20 dried poultry waste, and the like can also be included. Urea is not a natural protein source, but rather a nitrogen source which ruminants metabolize into protein, is preferred for economical reasons, although biuret and ammonium salts can also be used. The natural or metabo-
25 lizable protein sources can vary from 0-50%, preferably from 10-30% by weight of the final feed block product.

Certain elements in trace quantities can also be desirable as components in the feed block, and include
30 cobalt, copper, iodine, iron, manganese, selenium, zinc, silicon, vanadium, tin, nickel, molybdenum, and chromium.



-13-

The trace element package can vary from 0.2%, preferably 0.5-1% by weight of the total feed block product.

An appropriate vitamin package can also be
5 incorporated including such vitamins as A, B-complex, C, D, E, and K. The vitamin package can vary from 0.02%, preferably 0.025-0.05% by weight of the final feed block product.



-14-

Medicinal additives can also be included in the feed block, for example, antibloat compounds; antiparasitic drugs; anticoccidials; antihelminthic drugs, known also as wormers or vermifuges; fly control agents; monensin sodium, which is a fermentation product produced by a strain of streptomyces cinnamomensis, which controls the environment of the rumen to favor certain types of microorganisms which produce essential metabolites to yield higher feed efficiency; antibiotics, and the like. The specific amount of these medicinal additives is subject to regulation by the Food and Drug Administration and is well known to those in the art.

The feed block of the present invention allows for free choice feeding by the animal. In free choice feeding the palatability of the feed block will influence the amount of average daily consumption by the animal.

It has been found that the amount of calcium oxide in the feed block can influence its palatability. Thus, greater amounts of calcium oxide increase the alkalinity of the feed block, and thereby tend to reduce consumption. Other ingredients in the feed block also can influence palatability. Therefore, the formulation of a feed block composition must also take into consideration the rate at which the feed block will be consumed. This must be determined empirically. For example, with cattle or horses, a satisfactory consumption rate is about 1/4 to 3/4 pounds per day per head.

In the event higher consumption rates are desired, the palatability of the feed block can be improved by the introduction of natural and artificial flavoring



-15-

agents therein. These food grade flavoring agents are well-known in the art and include methyl salicylate, sodium saccharin, anethole, coriander oil, fenugreek, and the like. The flavoring agents can vary from 0-5%,
5 preferably from 0.025 to 0.05% by weight of the total feed block.

The feed block composition of the present invention, from the standpoint of mixing the components, can be prepared either in a batch method or a continuous flow
10 method. In the batch method, calcium oxide and the other optional components in a finely divided, particulate form are added individually or as a blended premix to the molasses, and the mixture is then stirred sufficiently to uniformly disperse the particulate components
15 throughout the molasses.

It has been found that with a more intense shearing action, the more rapid the reaction will be between the molasses and the calcium oxide, and the final product will be more homogeneous. The calcium
20 oxide-molasses dispersion together with the other optional components will start to thicken and solidify after about thirty to sixty minutes as the temperature of the feed composition dispersion rises. After about one to two hours, the temperature can reach about 180°F
25 or more and then begins to drop. The viscous feed composition dispersion is then transferred into receptacles or molds, which can be of various shapes and volumetric capacity, in accordance with the dimensional and product requirements. The feed composition will



-16-

then harden or solidify at ambient conditions in about ten to fourteen hours. After hardening, the solidified feed block composition can be conveniently stacked and stored, or transported as the need arises.

5 The mixing of the feed block components in a batch system is more convenient for production on a small scale basis, but not practical for large volume production, because of the greater amounts of time expended in mixing components, and the impracticality
10 of utilizing a batch operation for large volume production.

A continuous system can also be utilized for mixing the feed block components and can be performed in much shorter times, to prepare the feed compositions of the present invention.

15 In general, two approaches can be utilized in the continuous mixing system. The first approach utilizes a two-stage mixing procedure, whereas the second approach utilizes a single-stage mixing procedure.

Both approaches provide for molasses to be metered
20 from a holding vessel into a mixing unit. The molasses can be preheated in the holding vessel to a temperature of about 75°F to about 120°F, to facilitate its movement and mixing. The molasses holding vessel can conveniently be a tank equipped with means for heating, such as coils.

25 In the two-stage continuous mixing approach, calcium oxide is provided from a separate holding vessel, and one or more separate holding vessels provide for the supply of optional supplemental components.

The molasses and calcium oxide are metered into a
30 first-stage mixing unit, such as a tank equipped with a high-speed stirrer, and sheared until the calcium oxide becomes



-17-

uniformly dispersed in the molasses. The uniform dispersion of calcium oxide and molasses is then transferred to the second-stage mixing unit where it is contacted with the optional supplemental components.

5 The second-stage mixing unit is preferably one capable of exerting a high degree of mixing, such as a mixing auger, well known to those skilled in the art. After all the components are thoroughly mixed in the second-stage mixing unit, they are transferred into
10 appropriate receptacles or molds to solidify into blocks of predetermined dimensions.

The two-stage mixing approach is especially amenable in situations where during mixing, the components have a tendency to form lumps, as is the case with a
15 feed block dispersion comprising more than 40 weight % molasses, more than 20 weight % urea, and more than 9% calcium oxide.

In other situations where the formation of lumps during mixing of the calcium oxide-molasses dispersion
20 is not a problem, a single-stage mixing approach can be utilized. In the single-stage mixing approach, all of the particulate components, that is the calcium oxide and the optional supplemental components, are premixed and metered into the mixing unit with the molasses.
25 There they are thoroughly mixed until a homogeneous dispersion is formed, which is then transferred into appropriate receptacles or molds for solidification.

In the continuous mixing approach, the preferred ratio of calcium oxide to molasses will generally vary
30 from about 1:2-12, respectively, by weight.

The following examples represent various embodiments of the invention. All parts and percentages are by weight, unless otherwise noted.



EXAMPLE 1a

85 grams of cane molasses at room temperature (approximately 68°F) were placed in a beaker. 15 grams of finely divided calcium oxide were slowly added as the mixture was stirred continuously and vigorously with a stirring rod. The temperature of the mixture in the beaker increased to about 122°F as it thickened. The thoroughly dispersed mixture was poured into an aluminum pie pan, about 9 inches in diameter and 1 1/2 inches deep, and allowed to harden overnight. The next day the solidified block was placed on a flat surface. It was observed to have a consistency similar to asphalt and when a 170 pound weight was placed on a 4 square inch area of the block, there were no observable signs of deformation.

EXAMPLE 1b

Example 1a was repeated except that calcium oxide was replaced by magnesium oxide. No increase in temperature was observed and the mixture remained in a liquid state after 1 week, with no signs of hardening.

EXAMPLE 1c

Example 1b was repeated except that mixing was effected with a high speed household blender (Hamilton Beach Scovill, Model 620). Again there was no temperature increase and no hardening of the mixture.

EXAMPLE 1d

Example 1c was repeated except that magnesium oxide was replaced by calcium oxide. After 1 minute of mixing the mixture reached a temperature of 250°F. It was then



poured into an aluminum pie and allowed to cool and harden overnight. Its properties were the same as the block in Example 1a.

EXAMPLES 2 - 5

5 Four different solidified calcium oxide-molasses feed compositions were produced using the continuous mixing method. The molasses at a temperature of 90°F, was metered from a heated holding tank into a mixing chamber equipped with an agitator. Finely divided
10 calcium oxide was also metered into the mixing chamber. Both components were thoroughly mixed until the dispersion thereby formed reached a temperature of about 140-180°F. The calcium oxide-molasses dispersion then entered a mixing auger wherein additional feed
15 ingredients in the form of a pre-mix were added to the dispersion, and intermixed as the dispersion traveled along the auger. The auger was fitted with a cooling jacket to control the temperature of the dispersion within a range of 110-125°F. In Example 2, the pro-
20 duction rate was approximately 2 tons per hour, whereas in Examples 3,4 and 5 the production rate was approximately 1 ton per hour. Each of the dispersed feed compositions was then collected in receptacles 14 inches x 14 inches x 8 inches and allowed to harden overnight. Each receptacle
25 formed a solid 55 pound feed block suitable for feeding cattle in feedlot or on pasture. Under various field tests conducted with local farmers, the average consumption was found to vary from 0.25 to 0.5 pounds per head of cattle, per day. The components in the feed
30 blocks of Examples 2 to 5 are tabulated in Table 1.



-20-

Example 2 is a high protein content feed block suitable for cattle and sheep. Example 3 is a high magnesium content feed block suitable for the prevention of grass tetany which normally occurs in the spring of the year
5 when livestock graze lush, green grass pasture which is characteristically high in potassium and low in magnesium. Example 4 is a high mineral content feed block suitable for year-round supplementary feeding for livestock. Example 5 is a high energy salt feed
10 block also suitable for year-round feeding.



-21-

TABLE I

<u>Ingredient</u>	<u>WEIGHT %</u>			
	<u>Example 2</u>	<u>Example 3</u>	<u>Example 4</u>	<u>Example 5</u>
Cane Molasses	44.44	41.51	41.51	70.27
5 Calcium Oxide	9.34	5.69	5.70	9.16
Urea	22.21	---	---	---
BIOFOS ^{TM*}	12.14	23.28	30.37	---
Salt	5.81	12.43	16.20	20.57
DYNAMATE ^{TM**}	5.81	---	---	---
10 Magnesium Oxide	---	16.83	5.97	---
Guar	0.25	0.24	0.23	---
Saccharin	---	0.02	0.02	---

* Monocalcium/Dicalcium Phosphate mixture

** Potassium-magnesium sulfate



EXAMPLE 6

Using the continuous mixing approach, molasses was pumped at a rate of 260 pounds per hour into a horizontal mixing tube fitted with a shaft upon which were mounted several shearing blades. When the shaft operated at about 400-500 rpms or higher, the ingredients were whipped into a homogeneous dispersion. Calcium oxide was metered into the mixing tube at a rate of about 33.75 pounds per hour. The homogeneous dispersion was then collected in a rectangular receptacle (14 inches x 14 inches x 6 inches) and allowed to harden overnight. The solidified block was similar in hardness to the block formed in Example 1, however, it had a smoother and less grainy texture and appearance.



EXAMPLE 7

480 pounds of cane molasses at a temperature of approximately 68°F were added to a 130 gallon tank fitted with a central agitator, mixer, and recirculation pump. 220 pounds of urea, 45 pounds of DYNAMATETM, and 27.5 pounds of salt were added to the molasses. The mixture was agitated and recirculated for about 15 minutes. 100 pounds of calcium oxide, 120 pounds of BIOFOSTM, 2.5 pounds of guar, and 5 pounds of a ruminant trace mineral pre-mix were added. Mixing continued for about 2 hours and the temperature of the mixture reached about 149°F and began to drop. The feed composition was then pumped into rectangular receptacles (10 inches x 14 inches x 8 inches) and allowed to harden overnight into individual 45 pound blocks. The solidified feed blocks were offered to cattle on grass pasture. The average consumption was about 1/3 pound per head of cattle, per day.



EXAMPLES 8-17

These examples utilized a 30 gallon metal drum fitted with a central agitator as a mixing device. In Examples 8-15 and 17, a measured amount of molasses
5 was placed in the drum and agitated at about 100 rpm for 10-15 minutes, during which time urea was slowly added, followed by the addition of the remaining ingredients with calcium oxide being the last component added. In Example 16, however, all the particulate
10 components were pre-mixed and added to the molasses. In each of the examples, after addition of the particulate components had been completed, each mixture was stirred for one to two hours until the temperature reached a maximum of about 158°F and began to fall.
15 At this point, each mixture was poured into a rectangular receptacle (10 inches x 14 inches x 8 inches), and left to harden overnight. Each mixture formed a rigid block weighing 40-50 pounds. The average consumption ranged from about 0.25 to 0.5 pounds
20 per head of cattle, per day in both feedlot and on grass pasture. The formulations are tabulated in Table 2.



TABLE 2
EXAMPLE NO.

INGREDIENT (Wt.%)	8	9	10	11	12	13	14	15	16	17
CANE MOLASSES	39.50	39.50	56.00	56.00	48.00	52.50	---	---	49.00	48.00
5 BEET MOLASSES	---	---	---	---	---	---	52.50	52.75	---	---
UREA	32.00	32.00	9.50	11.00	22.00	22.00	22.00	22.00	22.00	22.00
MONOAMMONIUM PHOSPHATE	13.00	---	4.70	---	---	---	---	---	---	---
MONOCALCIUM PHOSPHATE	---	13.00	---	6.75	6.00	---	---	---	---	---
DIKAL 21 TM	---	---	---	---	---	6.00	6.00	---	---	---
10 BIOFOS TM	---	---	---	---	---	---	---	12.00	12.00	12.00
CALCIUM OXIDE	13.00	13.00	11.00	10.00	11.00	11.00	11.00	8.50	9.00	10.00
DYNAMATE TM	2.25	2.25	8.00	8.00	8.00	4.50	4.50	4.50	4.50	4.50
SALT	---	---	10.50	8.00	4.70	3.75	3.75	---	2.75	2.75
GUAR	0.25	0.25	0.30	0.25	0.30	0.25	0.25	0.25	0.25	0.25
15 TRACE MINERALS	---	---	---	---	---	---	---	---	0.50	0.50



CLAIMS

1. A substantially solid animal feed composition consisting essentially of a homogeneous dispersion of finely divided calcium oxide and molasses.

2. The composition of claim 1, also including additives selected from the group consisting of nutrients, medicines, growth promoters, vitamins, minerals, and mixtures thereof.

3. The composition of claim 1, wherein the concentration of molasses varies from about 20-90%, and the concentration of calcium oxide varies from about 1-20%, by weight of the total feed composition.

4. The composition of claim 3, wherein the concentration of calcium oxide varies from about 2-16%, by weight of the total feed composition

5. The composition of claim 4, wherein the concentration of calcium oxide varies from about 2.5-8%, by weight of the total feed composition.

6. The composition of any of claims 3, 4, or 5, wherein the concentration of molasses varies from about 25-75%, by weight of the total feed composition.



-27-

7. The composition of claim 1, wherein the weight ratio of calcium oxide to molasses in the total feed composition is about 1:2-20, respectively.

8. The composition of claim 7, wherein the weight ratio of calcium oxide to molasses in the total feed composition is about 1:2-12, respectively.

9. The composition of claim 8, wherein the weight ratio of calcium oxide to molasses is about 1:4-7.

10. The composition of claim 8, wherein the weight ratio of calcium oxide to molasses in the total feed composition is about 1:10, respectively.

11. The composition of claim 2, wherein the total additive concentration varies from about 30-70% by weight of the total feed composition.

12. The composition of claim 1, also including an insoluble phosphorus source.

13. The composition of claim 12, wherein said insoluble phosphorus source comprises at least one variety of calcium phosphate.

14. The composition of claim 1, also including 0-20%, by weight of potassium-magnesium sulfate.



-28-

15. The composition of claim 1, having a minimum of 40 weight % molasses, 20 weight % urea, and 9 weight % calcium oxide.

16. The composition of claim 1, also including 0-50% by weight of sodium chloride in the total feed composition.

17. The composition of claim 16, wherein the sodium chloride varies from 3-20% by weight.

18. The composition of claim 1, wherein calcium hydroxide is substituted in whole or in part for the calcium oxide.

19. The composition of claim 18, wherein 2-4 parts by weight of calcium hydroxide are substituted for each part by weight of calcium oxide removed.

20. The composition of claim 1, also including animal tallow as an energy supplement.

21. The composition of claim 20, wherein the source of animal tallow is selected from the group consisting of beef fat, swine fat, mutton fat, and mixtures thereof.

22. The composition of claim 21, wherein the animal tallow varies from 0-10% by weight of the total feed composition.



23. The composition of claim 22, wherein the animal tallow varies from 0-5% by weight.

24. A method for preparing a substantially solid animal feed composition comprising preparing a homogeneous dispersion of finely divided calcium oxide in molasses, in a weight ratio of about 1:2-20, respectively, and allowing said dispersion to solidify.

25. The method of claim 24, wherein the weight ratio of calcium oxide to molasses is 1:2-12.

26. The method of claim 25, wherein the weight ratio of calcium oxide to molasses is 1:4-7.

27. The method of claim 24, wherein the weight ratio of calcium oxide to molasses is 1:10.

28. The method of claim 24, wherein said homogeneous dispersion is prepared in a continuous mixing system.

29. The method of claim 28, wherein said continuous mixing system is single-stage.

30. The method of claim 28, wherein said continuous mixing system is two-stage.

31. The method of claim 24, wherein said homogeneous dispersion is prepared in a batch mixing system.



-30-

32. The method of claim 24, wherein additives selected from the group consisting of nutrients, medicines, growth promoters, vitamins, minerals and mixtures thereof are mixed into said homogeneous dispersion prior to hardening.

33. The method of claim 32, wherein the total concentration of additives varies from about 30-70%, by weight of the total feed composition.

34. The method of claim 24, wherein said homogeneous dispersion is mixed with granular solid animal feed materials in an amount ranging from about 0.5 to 30.0% by weight of the total composition and is then pressure formed and compacted into coherent, discrete particles having a predetermined shape, to produce an internally cohesive product.



AMENDED CLAIMS

(received by the International Bureau on 3 March 1982 (03.03.82))

1. A substantially solid animal feed composition consisting essentially of a homogeneous dispersion of finely divided calcium oxide and molasses.
2. The composition of claim 1, also including additives selected from the group consisting of nutrients, medicines, growth promoters, vitamins, minerals, and mixtures thereof.
3. The composition of claim 1, wherein the concentration of molasses varies from about 20-90%, and the concentration of calcium oxide varies from about 1-20%, by weight of the total feed composition.
4. The composition of claim 3, wherein the concentration of calcium oxide varies from about 2-16%, by weight of the total feed composition.
5. The composition of claim 4, wherein the concentration of calcium oxide varies from about 2.5-8%, by weight of the total feed composition.
6. The composition of any of claims 3, 4, or 5, wherein the concentration of molasses varies from about 25-75%, by weight of the total feed composition.



7. The composition of claim 1, wherein the weight ratio of calcium oxide to molasses in the total feed composition is about 1:2-20, respectively.

8. The composition of claim 7, wherein the weight ratio of calcium oxide to molasses in the total feed composition is about 1:2-12, respectively.

9. The composition of claim 8, wherein the weight ratio of calcium oxide to molasses is about 1:4-7.

10. The composition of claim 8, wherein the weight ratio of calcium oxide to molasses in the total feed composition is about 1:10, respectively.

11. The composition of claim 2, wherein the total additive concentration varies from about 30-70% by weight of the total feed composition.

12. The composition of claim 1, also including an insoluble phosphorus source.

13. The composition of claim 12, wherein said insoluble phosphorus source comprises at least one variety of calcium phosphate.

14. The composition of claim 1, also including 0-20%, by weight of potassium-magnesium sulfate.



15. The composition of claim 1, having a minimum of 40 weight % molasses, 20 weight % urea, and 9 weight % calcium oxide.

16. The composition of claim 1, also including 0-50% by weight of sodium chloride in the total feed composition.

17. The composition of claim 16, wherein the sodium chloride varies from 3-20% by weight.

18. The composition of claim 1, wherein calcium hydroxide is substituted in whole or in part for the calcium oxide.

19. The composition of claim 18, wherein 2-4 parts by weight of calcium hydroxide are substituted for each part by weight of calcium oxide removed.

20. The composition of claim 1, also including animal tallow as an energy supplement.

21. The composition of claim 20, wherein the source of animal tallow is selected from the group consisting of beef fat, swine fat, mutton fat, and mixtures thereof.

22. The composition of claim 21, wherein the animal tallow varies from 0-10% by weight of the total feed composition.



23. The composition of claim 22, wherein the animal tallow varies from 0-5% by weight.

(amended) 24. In a method for preparing a substantially solid animal feed composition containing molasses, the improvement which comprises preparing a homogeneous dispersion consisting essentially of finely divided calcium oxide in molasses, in a weight ratio of about 1:2-20, respectively, and allowing said dispersion to solidify.

25. A method of claim 24, wherein the weight ratio of calcium oxide to molasses is 1:2-12.

26. The method of claim 25, wherein the weight ratio of calcium oxide to molasses is 1:4-7.

27. The method of claim 24, wherein the weight ratio of calcium oxide to molasses is 1:10.

28. The method of claim 24, wherein said homogeneous dispersion is prepared in a continuous mixing system.

29. The method of claim 28, wherein said continuous mixing system is single-stage.

30. The method of claim 28, wherein said continuous mixing system is two-stage.

31. The method of claim 24, wherein said homogeneous dispersion is prepared in a batch mixing system.



32. The method of claim 24, wherein additives selected from the group consisting of nutrients, medicines, growth promoters, vitamins, minerals and mixtures thereof are mixed into said homogeneous dispersion prior to hardening.

33. The method of claim 32, wherein the total concentration of additives varies from about 30-70%, by weight of the total feed composition.

34. The method of claim 24, wherein said homogeneous dispersion is mixed with granular solid animal feed materials in an amount ranging from about 0.5 to 30.0% by weight of the total composition and is then pressure formed and compacted into coherent, discrete particles having a predetermined shape, to produce an internally cohesive product.

(new) 35. The method of claim 24, wherein said molasses and said calcium oxide are mixed together and subjected to moderate shearing action to produce said dispersion.

(new) 36. The method of claim 24, wherein said calcium oxide is replaced in whole or in part by calcium hydroxide.

(new) 37. The method of claim 36, wherein 2-4 parts by weight of calcium hydroxide are substituted for each part of calcium oxide replaced.



INTERNATIONAL SEARCH REPORT

International Application No **PCT/US81/01371**

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ³				
According to International Patent Classification (IPC) or to both National Classification and IPC				
INT. CL. ³ A23K 1/22				
U.S. CL. 426/69,74,658,807				
II. FIELDS SEARCHED				
Minimum Documentation Searched ⁴				
Classification System	Classification Symbols			
U.S.	426/69,74,658,807,285			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵				
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴				
Category ⁶	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸		
X	US,A, 4,160,041, PUBLISHED 03 JULY 1979, SCHROEDER ET AL.	1-12,15,20-34		
A	US,A, 3,532,503, PUBLISHED 06 OCTOBER 1970, KVIESITIS.	13,16,17		
A	US,A, 4,252,831, PUBLISHED 24 FEBRUARY 1981, GLECKLER ET AL.	13,16,17		
A	US,A, 2,895,830, PUBLISHED 21 JULY 1959, ROE.	14		
A	US,A, 4,057,655, PUBLISHED 08 NOVEMBER 1977, OKADA ET AL.	18,19		
A	GB,A, 1,030,297, PUBLISHED 18 MAY 1966.	14		
<p>¹⁵ Special categories of cited documents:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> </td> <td style="width: 50%; border: none;"> <p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance</p> </td> </tr> </table>			<p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p>	<p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance</p>
<p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p>	<p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance</p>			
IV. CERTIFICATION				
Date of the Actual Completion of the International Search ¹⁹	Date of Mailing of this International Search Report ²			
09 DECEMBER 1981	06 JAN 1982			
International Searching Authority ¹	Signature of Authorized Officer ²⁰			
ISA/US				