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(54) Title: THE PROCESS FOR PRESERVING OF DAMP BIO MASS

(57) Abstract

Process to preserve moist cellmass, such as straw, hay, fresh fodder, seeds, whole grain (straw and grain in one), grain hull waste, by-products of potato industry, sugar-beet cuttings, products of the cellulose industry (cellulose, o-fibre), wood cells handled by various methods, softcells of energy forest production and bio mass in general, by adding urea and ureaphosphate most preferably in solid form, either in separate or common crystals to the mass to be handled. Other minerals or additives, needed by animals, may be included in the crystals. Thereby when preserving bio mass handled in said way the nitrogen and phosphor of urea-ureaphosphate react with the organic mass thereby forming nitrogen compounds suitable for digestion of the animals and the digestibility of the organic mass will be essentially improved.

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The process for preserving of damp bio mass.

The invention concerns a process to preserve moist cell-mass, such as straw, hay, fresh fodder, seeds, whole grain (straw and grain in one), grain hull waste, byproducts of potato industry, sugarbeet cuttings, products of the cellulose industry (cellulose, O-fibre), wood cells handled by various methods, softcells of energy forest production and bio mass in general, by adding urea and ureaphosphate in solid form, either in separate or common crystals, to the mass to be handled. Other minerals or additives, needed by animals, may be added in the crystals.

The use of ammonia has been known earlier as a material in handling straw feed. Its source has usually been liquid ammonia under pressure, sometimes 25 % solution of ammonia. Both materials have their own disadvantages, including toxidity and the transportation in high pressure vessels as for liquid ammonia.

The use of urea is known in feed preserv made of corn produce. Small quantities of urea are used primarily as stabilizers in preservative liquids. US-patent 3 063 839 relates to the use of urea in grass and to its drying afterwards. FI-patent 54225 relates to a process in which green flour containing ureaphosphoric acid is made by adding phosphor acidic urea fluid to fresh grass and drying it in high temperature.

In the researches and tests made by the applicant, it has become evident, that by adding urea in the harvesting phase of moist straw, hay or grass, the feed can be preserved and its feed value can be improved essentially and even better results are obtained if simultaneously with urea, ureaphosphate is used. The multiplication of microbes is prevented by starting the process in as

early phase of the harvesting as possible, which is of great importance to their quantity and so to the prevention of the dust lung disease, which is found in the cattletenders. The substance may be added in doses within the bales or within the bale layers or into loose material. The process saves energy, because the extra handlings and turning over becomes unnecessary. Especially great savings in energy are obtained in the whole grain preserving. Thus the feed grain is harvested in the ripening phase with grain and straw into the silo or is baled. The preservative can be added in connection with cutting or loading. The threshing of the grain and drying and milling following after that, which require lots of energy and investements, are left out. In addition to the fibre of straw, also the hull of the grain becomes more easily digestable, which assists in the utilization of the heart of the grain. The process enables the industry refining the afore mentioned coarse feed to obtain faultless raw material. Large amounts of so called softcells, leaves and yearlings are generated in the production of the energy forest, the preserving and improving of the feed value of which is solved by the process described before. The tests to preserve the byproducts of industry such as sugarbeat cuttings and potato pulp, have been successful. By adding urea-ureaphosphate mixture to cellmass, to the maximum retentivity, the corresponding quantity of nitrogen and phosphor needed in feeding, a condensate is obtained, which is useful raw material for feed industry. If needed, other minerals, additives and urea-enzymes may be added.

The period of use in industry connected with the agriculture is generally only a few months in a year. During the short season, in addition to the regular production, large amounts of cellmass byproduct, which in general has to be dried immediately, needs to be handled.

Because the capacity of the driers is to be measured to meet the production peaks, the investment costs form significant amounts. Due to the invention the moist cell-mass can be stored at the same time as its feed value improves. The drying can be arranged to be done as for the resources at a more advantageous time.

THE EFFECTIVE MECHANISM OF UREA AND UREAPHOSPHATE

Due to the ureaenzymes, urea converts to ammonia and carbon dioxide. Both materials improve preserving, because they limit the breathing of the cells and function of certain microbes. Ammonia reacts with fibrous mass improving the digestibility of it. As gaseous material, ammonia and carbon dioxide evenly spread to the material to be treated. Ureaenzyme is always present in a biomass as a result of microbe function. A part of urea reacts with the component parts of the cell when slowly acting, very useful nitrogen combinations for animals are generated.

The ambient temperature, moisture and degree of the acidity has an essential effect on the decomposition speed of the urea. In favourable conditions the decomposition occurs very quickly. For preserving of the straw the beginning of reactions fast enough in damp mass is of an importance. The fact that the decomposition continues for a long time is advantageous. The general rule of chemical reactions is valid also to the decomposition of urea. Ten degrees (C^{o}) rise in temperature doubles the reaction speed. So the warming up of the feed mass accelerates the disengagement of ammonia and carbon dioxide.

Ureaphosphate is acidic in nature and decomposes in moist mainly to urea and phosphoric acid. It also has a mould

growth preventing influence. Due to its acidity, it binds ammonia to the feedmass and promotes reactions between the fibrous materials of the feed and urea, thus improving the digestibility of the feed.

MIXTURE RATIO AND QUANTITY OF USE

The limits of practice in the urea-ureaphosphate composition "TR-granule" in accordance with the invention have been 3-30 % ureaphosphate and 97-70 % urea, although the ratio could be different. The quantity of use has varied from 3 % to 20 % of dry content of the feed in normal use. When preparing the condensates the maximum bonding capability of the cell mass has been utilized, in other words, the addition of the mixture corresponds to the amount of the dry content of the moist mass.

EXAMPLES OF ADAPTION

The following describes the practical results of adaptions of the method according to the invention.

EXAMPLE 1.
TREATMENT OF STRAW WITH UREA

In the baling phase urea was added to moist straw in amount of 5 % of the weight of the straw. The dry contents of straw was 72 %. The 5 % addition of urea corresponds 3 % addition of ammonia nitrogen (NH_4). The ability of preserving and feed analysis corresponded the results obtained wit liquid ammonia.

EXAMPLE 2.
TREATMENT OF STRAW WITH UREAPHOSPHATE-AMMONIA
When studying the efficiency of ureaphosphate as a bonding agent of the ammonia to the straw mass baled barley

of about 1000 kg was stacked to an oblong pile. The pile was devided into three areas. The one end was treated with 4 % ureaphosphate and the other end with 8 % ureaphosphate which was spred between the layers of the bale. To the middle area no ureaphosphate was added. The pile was covered by a plastic cover and was handled in a normal way with ammonia (40 kg/straw ton). Thus the same quantity of ammonia spred to areas treated with ureaphosphate and to the untreated one third. For comparison purpose an equivalent pile was prepared. Samples were analysed 3 months after the treatment. In the feed analysis, Table 1, it becomes evident, that the quantity of raw fibre in sample treated by ureaphosphate is essentially smaller than in those samples treated only by ammonia. This can be considered as a criteria for ripening of the straw or for the decomposition of fibre materials which are not easily digestible. The filling values of the fodder show clearly the same tendency.

In nitrogen values of the fodder, e.g. in protein strength becomes evident the nitrogen bonding effect of ureaphosphate. The treatment with ureaphosphate has increased the protein strength by 2.5 times as compared with the samples treated only with ammonia. By airing the samples to about 90 % of the weight of the dry content it was desired to find out the portion of ammonia which evaporates freely from the fodder. In the light of the results this seems to remain rather small also in cases where the nitrogen content of the fodder, due to the ureaphosphate, is rather high.

EXAMPLE 3.

TREATMENT OF WHOLE GRAIN WITH UREAPHOSPHATE-UREA MIXTURE COMPARED WITH AMMONIA TREATMENT

For the test, aired barley with its quick couch growth was harvested by a reel chaffer, portion of which was treated with ammonia and portion with ureaphosphate-urea mixture. The dry content of the harvested crop was about 30 %. Preserving was done in a normal way to a horizontal silo by packing with a tractor. Ammonia fodder was stocked to the rear end of the silo and was covered with a plastic cover. 40 kg liquid ammonia was used per one dry content ton of the fodder. Because the fodder was wet, closely spaced holes were made. In the pile having a surface area of 5 x 6 meters, 30 breathing holes were put in from above and each hole was prepared carefully by moving the breathing pipe vertically.

Ureaphosphate-urea fodder was prepared in the front end of the silo. The mixture was sown in the unloading section of the elevator in a self unloading trailer, whereby it was mixed up with the feed mass. The fodder was packed with a tractor, although it remained looser than the previous one. The pile was covered by a plastic cover similarly as in the ammonia treatment. The mixture constituants were 13 % ureaphosphate and 87 % urea. The total amount of ureaphosphate-urea mixture was 8,4 % from the dry material of the fodder.

Table 2 shows that the greatest differences are in nitrogen values. Also filling value seems to be better with the ureaphosphate-urea mixture. In-vitro-digestibilities are 67.4 % with ammonia fodder and 71.9 % with mixture fodder.

When the fodder piles were opened after 5,5 months for feeding tests, it was found, that the ammonia stack had

heated up and was spoiled, but the ureaphosphate-urea stack was well preserved. It is evident that ammonia cannot be spread sufficiently, but the most part of the ammonia will remain around the breathing hole. This was found also during this test, although the work was done most carefully and the quantity of holes was one hole per square meter.

EXAMPLE 4.

TREATMENT OF DAMP HAY WITH UREAPHOSPHATE-UREA MIXTURE

Plenty of rootgrass containing grass was preserved by treating it with ureaphosphate-urea mixture during baling. The untreated bale stacks warmed up, but cooled down when the bales were stacked again and a mixture consisting of 20 % of ureaphosphate and 80 % of urea was added between the layers. The mixture content used was 5 % from dry weight of the fodder.

In another test, straw stack of 15 000 kg, which was warmed up, was piled up again so that 20 % of ureaphosphate and 80 % of urea was added between the layers of the bales. The total amount of mixture was 2,5 % of the straw weight. The temperature went down and the straws preserved well. In neither case plastic nor other cover was used. The bale stacks were in a barn.

EXAMPLE 5.

TREATMENT OF FRESH FODDER WITH UREAPHOSPHATE-UREA MIXTURE

The limits of the method were tested by baling immediately after moving of green hay growth, the length of which was 30-40 cm. Treatment was done during baling. A small additional portion of ureaphosphate-urea mixture was added between the bale layers. The fodder did not get mouldy and the animals eat it with pleasure.

EXAMPLE 6.

TREATMENT OF DAMP GRAIN WITH UREAPHOSPHATE-UREA MIXTURE

In preserving damp grain a mixture proportion of 20 % of ureaphosphate and 80 % of urea was used. The dose quantity was 5 % mixture of the dry content of the fodder. In one case, the treatment was necessary to eliminate the mould already developed. Especially the softening of the hull portion of the grain and the improvement of digestibility was observed. In practice this is of great importance, being so that the hull covers the digestible portion of the grain, when a part of the grain goes through the alimentary canal without braking up. Further the hull part of the oat for instance consists of almost one fourth of the weight of the grain.

The softening of the hull of oat which comes as a waste of the grain milling industry, has been tried in practical scale in feeding meat cattle, with good results.

EXAMPLE 7.

TREATMENT OF BYPRODUCTS OF FOOD INDUSTRY WITH UREAPHOSPHATE-UREA MIXTURE

Potato pulp and sugarbeet cuttings, the dry content of which was 20 %, was treated for the purpose of preserving and preparing the nitrogen gasket. The quantities of use in the latter case were 10-30 % of the wet weight of the cellmass. The untreated samples were quickly spoilt, others have been preserved well.

EXAMPLE 8.

TREATMENT OF STRAW WITH UREAPHOSPHATE-UREA MIXTURE

Tables 3 and 4 show the effect of ammonia treatment and correspondingly ureaphosphate-urea treatment on the fodder

value of the straw. The results show that with the method according to the invention clearly better results are accomplished as far as the filling and nitrogen values are concerned.

EXAMPLE 9.

RESULT OF THE FEEDING TESTS WITH FODDER PREPARED WITH UREAPHOSPHATE-UREA MIXTURE

Fodders, prepared in accordance with the invention, have been fed both for meat and milk producing cattle. From the results can be drawn conclusions that it is no need to give special protein feed, but the animals can use the nitrogen combinations of the method for forming of the protein quite in a different manner than in a plain urea feeding for instance. A considerable part of the need of energy for animals becomes filled with the fodder prepared according to the invention. The health of the cattle has been good, the growth of the animals and the production and quality of milk has been normal. The gestation has been better than normal due to the phosphor of good quality received from feeding.

As shown above, the use of ureaphosphate-urea to preserve cell mass and to improve its feed value, solves many problems. It gives better results than the treatment with urea and is easier to accomplish than the treatment with urea-phosphoric acid (both of which are new except the cases mentioned on page 1). The addition of ureaphosphate-urea mixture in solid form to the damp bio mass is safe, advantageous and efficient.

COMBINED EFFECT OF UREAPHOSPHATE AND AMMONIA

Table 1.

Test started 25.8.1978. Samples collected 17.11.1978

Test member	Dry material %	Ash % from dm	Raw fibre % from dm	Raw grease % from dm	NH_4-N % from dm	Σ N % from dm	Raw protein % from dm	Extracts without nitrogen % from dm	Fodder unit value fu/ 100 kg	Compensation no kg/ fu	Filling value kg dm/fu	Protein strength g drp/ fu	P%
No treatment	88,94	9,05	45,22	1,14	0,07	0,90	5,62	38,97	18,55	5,39	4,80	78,6	
4 % NH_4	86,32	8,50	45,12	1,17	0,58	1,85	11,59	33,62	31,22	3,20	2,76	175,7	
4 % NH_4 pile 2	84,65	7,49	44,78	1,18	0,71	1,77	11,08	35,47	31,47	3,18	2,69	163,8	
4 % NH_4 matured in breeze	90,18				0,67								
4 % NH_4 + 4 % UF	64,95	9,56	34,76	1,16	1,69	5,39	33,68	20,84	28,03	3,57	2,32	429,1	
4 % NH_4 + 4 % UF matured in breeze	89,19				1,46								
4 % NH_4 + 8 % UF	81,27	11,18	35,11	1,38	1,85	6,03	37,68	14,65	34,31	2,91	2,37	490,8	
4 % NH_4 + 8 % UF matured in breeze	88,35				1,70								

Note:

drp = digestive raw protein
UF = ureaphosphate
dm = dry material
fu = fodder unit

Table 2.

EFFECT OF AMMONIA AND UREAPHOSPHATE-UREAMIXTURE ON BARLEY MATURED IN BREEZE AND HARVESTED BY A REEL CHAFFER

Fodder to be treated: barley with seeds and straw, plenty of quick couch growth
Used amount: NH_3 4 % from dry material
mixture 9 % from dry material, relation of mixture 1 ureaphosphate + 6.6. urea
Treated amount: NH_3 26760 kg wet material -360 kg NH_3
mixture 12860 kg wet material 50 kg UF 330 urea

Sample	Dry material %	Ash % from dm	Raw fibre % from dm	Raw grease % from dm	NH_4-N % from dm	Σ N % from dm	Raw protein % from dm	Extracts without nitrogen % from dm	Fodder unit value fu/ 100 kg	Compensation no kg/ fu	Filling value kg dm/fu	Protein strength g drp/ fu	P%
NH_3	30,86	14,32	29,80	1,65	2,53	4,41	27,56	26,67	13,41	7,46	2,30	348,9	0,36
Ureaphosphate mixture	35,36	11,81	31,34	1,77	4,89	7,32	45,75	9,33	15,92	6,28	2,22	558,8	0,92

Time of treatment: 24.8.1978
Date of collecting the sample: 26.10.1979

Table 3.

EFFECT OF AMMONIA AND UREAPHOSPHATE-UREAMIXTURE ON STRAW

	Dry material %	Ash % from dm	Raw fibre % from dm	Raw grease % from dm	NH_4-N % from dm	Σ N % from dm	Raw protein % from dm	Extracts without nitrogen % from dm	Fodder-unit value fu/ 100 kg	Compensation no kg/ fu	Filling value kg dm/fu	Protein strength g drp/ fu	P%
NH_3 'good'	51,58	4,95	56,18	0,80	0,85	2,48	15,51	22,56	16,08	6,22	3,21	273,6	0,09
Ureaphosphate 'good'	66,61	8,21	40,43	0,80	1,16	7,21	45,03	5,53	26,91	3,72	2,48	613,1	1,07
Ureaphosphate from the middle of the bale	53,23	6,02	42,13	0,88	3,76	6,16	38,51	12,46	21,56	4,62	2,46	522,9	1,05
Ureaphosphate the surface of the bale	32,09	7,69	43,05	0,77	4,11	6,20	38,76	9,73	12,44	8,04	2,58	550,0	1,17

Use amount: NH_3 3 % mixture (1 ureaphosphate + 2 urea) 6 %

Way of treatment: between the layers of the bale

Date of collecting the samples: 5.11.1979

Ripening period: NH_4 straw 9 weeks

ureaphosphate straw 5 weeks

Table 4.

EFFECT OF AMMONIA AND UREAPHOSPHATE-UREAMIXTURE ON STRAW

Sample	Dry material %	Ash % from dm	Raw fibre % from dm	Raw grease % from dm	NH_4-N % from dm	Σ N % from dm	Raw protein % from dm	Extracts without nitrogen % from dm	Fodder-unit value fu/ 100 kg	Compensation no kg/ fu	Filling value kg dm/fu	Protein strength g drp/ fu	P%
NH_3 3 % 30.8.	92,41	7,45	43,52	1,15	0,50	2,06	12,85	34,53	34,87	2,87	2,65	187,4	0,18
NH_3 3 % 24.8.	92,36	3,30	48,78	1,08	0,38	1,71	10,69	36,15	34,51	2,90	2,68	157,4	0,10
UF 6 % 20.9.	89,07	9,28	36,29	0,84	0,71	3,37	21,05	32,54	36,97	2,71	2,41	279,0	0,62
UF 6 % 2.10.	79,32	9,88	36,30	0,92	1,19	4,26	26,63	26,27	31,69	3,16	2,50	366,7	0,90
UF 6 % 2.10.	83,66	6,21	39,95	0,94	0,80	3,06	19,13	33,77	34,55	2,89	2,42	254,7	0,53
NH_3 11.9. 1 bottle	92,61	8,61	44,30	1,07	0,45	1,49	9,31	36,71	33,82	2,16	2,74	140,2	0,27
1.10. 1 -"-													
5.10. 1/2 "													

UF = ureaphosphate

Use amount: NH_3 3 %
mixture (1 ureaphosphate + 2 urea) 6 %

Way of treatment: between the layers of the bale

Date of collecting the sample: 22.10.1979

Patent Claim:

The process for preserving of damp bio mass, c h a r a c t e r i z e d in that ureaphosphate-urea mixture is added most preferably in solid form to damp cell mass, whereby when preserving bio mass handled in said way the nitrogen and phosphor of urea-ureaphosphate react with the organic mass thereby forming nitrogen compounds suitable for digestion of the animals and the digestibility of the organic mass will be essentially improved.

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI81/00001

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 3

A 23 K 3/03

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC 3	A 23 K 3/00, A 23 K 3/02, A 23 K 3/03
US Cl	426:52, 53, 54, 69, 321, 335
National Cl	53g 5/01

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	US, A, 3 180 735 published 1965, April 27, see column 2, lines 56, 59, H.W. Titus	1
X	US, A, 3 585 043 published 1971, June 15, see column 5, lines 20-23, J.C. Moore, A.B. Funk	1
A	US, A, 2 748 001 published 1956, May 29, see column 5, line 22, P.C. Anderson et al.	1
A	US, A, 2 808 332 published 1957, October 1, see column 4, lines 45-46, P.C. Anderson et al.	1
X	Chemical Abstracts, vol. 93 (1980), abstract No 131086a. Ann. Ist. Sper. Zootec. 1978, 11(1), 129-44 (Ital.)	1
X	Chemical Abstracts, vol. 92 (1980), abstract No 179351h Ved. Pr. Vysk. Ustavu Zivocisnej Vyroby Nitre 1979, 17, 11-18 (SLO)	1

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IV. CERTIFICATION

Date of the Actual Completion of the International Search [3]	Date of Mailing of this International Search Report [3]
1981-01-12	1981 -02- 19
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Swedish Patent Office	Agneta Ingefjärd

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, 16 with indication, where appropriate, of the relevant passages 17	Relevant to Claim No 18
X	Commonwealth Agricultural Bureaux (CAB) No 77847859 Animal Production 1976, 23 (2) 191-196 (Engl.)	1
X	Commonwealth Agricultural Bureaux (CAB) No 77978777 Vyskumny Ustav Zivocisnej Vyroby, Nitra Czechoslovakia Nas Chov. 1977, 2, 75-77 (SLO.)	1
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X	Commonwealth Agricultural Bureaux (CAB) No 80416669 Annali dell'Istituto Sperimentale per la Zootecnia 1978, 11 (1), 129-144 (Ital.)	1