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ENGLISH

United Nations Industrial Development Organization

Workshop on Fermentation Alcohol for Use as Fuel
and Chemical Feedstock in Developing Countries

Vienna, Austria, 26 - 30 March 1979

PRODUCTION, APPLICATION AND MARKETING OF CONCENTRATED MOLASSES-FERMENTATION-EFFLUENT (VINASSES)*

by

W. Lewicki**

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Corrigendum

Replace page 7 (Annex 1) of document ID/WG.293/22/Rev.1 by the text overleaf.

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LPCV, MPCV and HPCV ANALYSIS VALUES
(expressed on tel quel)

Indication of Analysis	LPCV	MPCV	HPCV
a) dry matter content	58-60%	65-72%	75-78%
b) total nitrogen (Kjeldahl/Devarda).....	1.1-1.2%	2.3-3.5%	6.8-7.2%
c) raw protein (Nx6.25).....	6.5- 15%	16-32%	33-50%
d) Betain	0-2%	6-10%	10-11%
e) raw ash (at 600°C).....	15-17%	18-24%	11.6-14%
f) potassium	4-4.5%	6.2-6.8%	2-3%
g) raw fiber	-	2.5-3.5%	0.2-0.4%
h) NNE	25-28%	25-27.5%	19.5-22%
i) digestible raw protein with beet pulp pellets	abt.35%	abt. 75%	abt. 95%
k) w. german starch value St.E./Kg tel quel	120-150	280-320	518
l) specific gravity	1.31	1.37	1.39
m) pH value in 10% solution	4.5-5	4.8-9.5	abt.5.9
n) remaining sugar expressed as invert.....	6-12%	3-4%	1-3%

* the total nitrogen of HPCV is divided in about 4.8 to 5 percent organic nitrogen and 2.0 to 2.2 percent inorganic nitrogen. The organic nitrogen consists of 1.7 to 2%N in form of acids, 1.5 to 1.6 percent as betain and 1.35 to 1.5 percent others.

(Annex 2)

Summary

Today's world-wide trend to convert agricultural products as cane, beet, manioc and grain as well as cane and beet molasses by fermentation into alcohol for human consumption, chemical, cosmetic and even automotive use as a consequence of the oil crises, leads to an increased availability of fermented agricultural by-products especially from beet and cane molasses. In West Europe they are called "Vinasses".

A rough production estimation by Prohama indicates 760.000 tons vinasses p/a for the 1978/79 campaign (October 1978/September 1979).

For better understanding the heterogenous vinasses market in Europe, the author suggests to introduce three categories of molasses by-products, depending on their protein content and their use:

LPCV - Low Protein Containing Vinasses (6.5 to 15% raw protein) as binders and appetizers in pig. poultry and ruminant feed with 2 to 3%.

MPCV - Middle Protein Ccntaining Vinasses (16 to 32% raw protein) for ruminant feed up to 10% and for straw decomposition on stubble fields 2 to 3 tons per ha.

HPCV - High Protein Containing Vinasses (33 to 50% raw protein) only for ruminant feed between 5 and 7.5 %.

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PRODUCTION, APPLICATION AND MARKETING OF CONCENTRATED * MOLASSES-FERMENTATION-EFFLUENT (VINASSES)

by

W. Lewicki **

Today's world-wide trend to convert agricultural products as cane, beet, manioc and grain as well as cane and beet molasses by fermentation into alcohol for human consumption, chemical, cosmetic and even automotive use as a consequence of the oil crisis, leads to an increased availability of fermented agricultural by-products especially from beet and cane molasses. In West Europe they are called "Vinasses".

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HPCV - High Protein Containing Vinasses (33 to 50% raw protein) only for ruminant feed between 5 and 7.5%

The distribution, marketing and use of molasses by-products in Europe requires specially trained technico-commercial nutritionists who have to preselect the different qualities for their customers. It requires separate shipment, storage and dosage facilities and forces the nutritionists to revise formulas, especially to compensate for the lack of sugar energy, to respect the mineral salts and the different protein sources within the balanced finished feed or daily ration.

West German feed tests proved that for ruminants max. 10% vinasses in the daily ration is possible; research for pig and poultry is still going on but no more than 3% is suggested so far.

The milk of dairy cows who consumed 1 kg vinasses per day showed no sensoric influence of vinasses.

Further the positive reaction of betain in the rumen, substituting additional cholin feeding, is mentioned.

With increased molasses fermentation not only for alcohol but also for mono-sodium glutamate, baker's yeast, citric acid, etc, the author feels that molasses by-products will be available more and more for the feed industry, not only in West Europe but also in the other parts of the world and it is now time to face this new challenge and to translate it into a profitable business.

As a consequence of the energy crisis, diversification of alcohol production from other sources than crude oil has become more and more important. Agricultural products as sugar beets and sugar cane, manioc, grains and molasses are the main raw materials for agricultural alcohol. These "solar energy collectors and storers", as Professor Vlitos calls them, are transformed by low energy requiring fermentation processes into various sorts of alcohol, both for human consumption and for industrial, pharmaceutical, chemical and automotive use. In some parts of the world, this alcohol is already converted into ethylene or used in mixture with gasoline, known as "carburante" and "gasohol".

Brazil, for example, has already successfully realized part of its alcohol program, using cane, cassava and cane molasses as raw material. Until the mid eighties production is to reach over 1 1/2 billion gallons of alcohol for automotive and chemical use in order to reduce crude oil imports. Other countries as Cuba, South Africa and the Philippines have similar goals. This shows us already today the world-wide trend in sugar cane growing areas. Recent reports urge still bigger programs to convert the "green oil" (cane and cane molasses) into alcohol. (Reference: Contribution on the Possibilities of producing Alcohol from Sugar Beets and Sugar Cane at the 27th Congress of the International Association of European Sugar Beet Growers).

As we are convinced about further successful development in this direction, we have dedicated our efforts to give our special attention and a helping hand in finding economically optimal solutions to translate alcohol fermentation by-products into marketable and profitable products by thermal and chemical treatment.

This goal can only be reached by giving you an idea about the present stage of development in production, application, use and marketing of already existing beet and cane molasses by-products, with special consideration of our european experience. We also give special attention to cane molasses by-products, which are far more difficult to use as feed compound or soil conditioner, due to their natural lack of nitrogen. The high gum content of pure cane molasses limits effluent concentration to 60 % d
With this paper we want to draw your attention to the necessity of developing economical outlet possibilities for the by-products in your own country or for export when it comes to the planning and realization of your big fermentation alcohol plants. It means to adapt your agriculture gradually to your concentrated, tailor-made, liquid beet and cane molasses by-products: VINASSES.

NAMES AND DESCRIPTION OF CANE AND BEET MOLASSES BY-PRODUCTS IN EUROPE

In the West European market you have a broad scale of about 30 different cane and beet molasses by-products, depending on the fermentation process (citric acid, mono-sodium-glutamate, alcohol, baker's yeast, etc.), as well as the evaporation process and, of course, the choice of molasses quality. Each producer has his own "excellent" molasses by-product. The industrial or trading companies have given brand names to distinguish their special products and slogans such as: "there is no better protein source" or "there is no better binder" are used.

In West Germany, we have the brand names "Citragil" (citric acid), "Protamelno" (high protein containing vinasses from a baritation process) and "Monex" (from a combined baker's yeast and distillery molasses fermentation process). In France, the following brand names are used: "Viprotal", "Proteinal" and "Strional" and in Holland "Alvicoll" and "Neprocoll". In Italy and Spain, beet vinasses is called "C.P.B.", which means "Concentrato Proteico de Barbabietola" (concentrated sugar beet protein). In Great Britain and in the States , the expression "CMS" (Consensed Molasses Solubles) is already well introduced.

Scientifically, all molasses by-products should be called "partly or fully desugarized cane or beet molasses" with addition of the special fermentation process from where it originates. We agree to this definition, suggested by Dr. Olbrich, Berlin.
Since the main parameter for valuation of vinasses in ruminant feed is the raw protein content I suggest, to better understanding, to classify available liquid beet and cane molasses by-products in three categories as follows:

LPCV - LOW PROTEIN CONTAINING VINASSES

These are mainly based on pure cane molasses or a mixture of mainly cane and less beet molasses by-products. These molasses by-products are less evaporated due to their high gum content (58 to 60 percent dry matter), have a raw protein content of 6.5 to 15 percent of which only 30 to 40 percent digestible, a remaining sugar content of 6 to 12 percent expressed as invert and an ash content between 15 and 17 percent and nearly no betain. These products have excellent binding properties, no ammoniacal nitrogen, and are used mainly in poultry, pig and ruminant feed as appetizer and binder with about 3 percent dosage. pH value 4.5 to 5.

MPCV - MIDDLE PROTEIN CONTAINING VINASSES

These are mainly untreated sugar beet molasses by-products, sometimes mixed with up to 30 percent cane vinasses and concentrated between 65 and 72 percent dry matter. The total raw protein content, only in form of organic nitrogen, is between 16 and 32 percent, depending on the raw material and production

process. They mainly come from alcohol and baker's yeast production but also from citric acid production. The betain content is between 6 and 10 percent, the raw ash content between 18 and 24 percent, potassium expressed as K about 6 percent and the digestible protein with beet pulp pellets approximately 75 percent. The pH value varies between 4,8 (acid) and and 9,5 (basic). These vinasses are mainly used in ruminant feed products in a dosage of 5 to 7 percent or sprayed on stubble fields for better decomposition of straw and for fertilizer use (2 to 3 mt / ha).

HPCV - HIGH PROTEIN CONTAINING VINASSES

These are partly depotassified beet vinasses and supplemented by anorganic ammonium protein through an expensive and protected chemical exchange process, moving out part of the potassium ions with ammonium ions, forming thus stable complex salts and having potash or potassium- sulphate or potassium-chloride dried as fertilizer. Therefore, the raw protein content is about 45 precent on tel quel. We include in this HPCV-group all beet molasses by-products between 33 and up to 50 percent and more raw protein. The low raw ash content of 8 to 14 percent, the remaining potassium content of 2 to 3 percent and the high digestible protein content of 95 percent with a DE of about 5,5 could make this product an excellent raw material for liquid feed supplements for ruminants. Unfortunately it is available only in restricted quantities and very expensive in comparison with LPCV and MPCV.

I should also mention a fourth group - the dehydrated and/or spray-dried beet or cane molasses by-products. In Europe, we have only a few producers, as the dried products are very expensive and highly hygroscopic and must be used immediately after opening the plastic bag. They are used mainly as silage or direct feeding with the daily ration in the stable.

USE OF BEET AND CANE MOLASSES BY-PRODUCTS IN WEST EUROPE

The Use of Beet and Cane Molasses By-Products in the Feed Industry:

Because of their molasses-like properties, these carriers are already used in large quantities in the european feed industry. In Holland, France, Belgium and Italy, they are mixed in all sorts of feed whereas in West Germany the use is restricted to ruminants only, so far.

The appetite stimulating effect of some kinds of vinasses, their low viscosity for easy dosing, good mixing and pumping properties as well as the whole range of mineral salts, amino acids and the presence of the so-called "Undefined Fermentation Factors" (UFF) have made them a valuable ingredient, especially for the european ruminant feed industry.

The feed manufacturer's nutritionist himself has to decide which quality and quantity he wants to use in his feeds. This decision however, is mostly made in cooperation with the consulting

service of the marketing or trading company, together with the producer, who normally proves the usefulness of his product by positive feeding test results, obtained in official or private research institutes. Therefore, there are not many publications on vinasses available in Europe.

Our farmers themselves use beet and cane molasses by-products only sporadically for direct ruminant feeding (free choice) or for silage in autumn.

The LPS production is hardly developed in Europe and only in France and Belgium realized with some 40 to 50.000 mt p/a. The reason is that farmers there are used to feed pelletized feedstuffs and are not equipped for liquid feed supplement use in winter as they have only small herds of 25 to 50 head and sufficient green grass during summer and hay in winter. That is why we currently do not see a future for the U.S. liquid feed system in Europe.

Besides the use as feedstuff, we have a large range of applications for all sorts of MPCV - Middle Protein Containg Vinasses - by spraying them on the soil as fertilizer and decomposition aid for straw on stubble fields.

Beet Molasses By-Products as Liquid and Organic Fertilizer Sprayed on Stubble Fields: EPANDAGE

In France about 80,000 tons of vinasses were sprayed this year during July through September on stubble fields, especially on future sugar beet fields in regions without cattle or dairy cows. With special spraying machinery, two to three metric tons (= 5 to 7.5 metric tons per acre) of beet molasses by-products is sprayed on the fields as liquid fertilizer and as decomposition aid for straw and stubbles.

With this practiced recycling we are following the 140 years old request by the German scientist and agro-chemist, Justus von Liebig, to return to the soil what the plants (beet or cane) have extracted, in order to maintain or improve the crop yield.

The application of beet vinasses on sugar beet fields is one of the natural ways of soil conditioning in Europe, as also the trace elements as well as essential fertilizing elements as potassium, magnesium and nitrogen are returned to the soil and improve also the microbial climate.

In Brazil unconcentrated cane molasses effluents are used successfully to irrigate and fertilize the cane plantations in a radius of 10 to 20 km from the factory in combined trucks/spraying machines. In the close neighbourhood a canal system is successfully used, but due to the lack of nitrogen and phosphorus, a supplementation of these important elements to the soil is necessary. The disadvantage of continuously spraying the fields with unconcentrated cane molasses effluent is that the potassium content is too high and especially in the ripening period it may have a detrimental effect on the sugar content of the cane and consequently on the sugar yield.

POTENTIAL OF WEST EUROPEAN VINASSES MARKET 1979

Parallel to an increased production of vinasses in West Europe we have registered an increased demand also for feedstuff and fertilizer use, so that in the long run we will have a balanced market in Europe. However, we think that quantities could be available for export.

We have estimated the total beet and cane molasses by-product availability in West Europe at about 760.000 mt for 1979. Breaking down this figure, we have the following production (all figures based on 65 percent dry matter):

Belgium	-	80.000 mt
France	-	210.000 mt
West Germany	-	76.000 mt
Scandinavia	-	24.000 mt
Holland	-	95.000 mt
Italy	-	150.000 mt
Spain	-	60.000 mt
United Kingdom	-	30.000 mt
Austria	-	35.000 mt
Total	-	760.000 mt

DISTRIBUTION AND MARKETING OF MOLASSES BY-PRODUCTS IN WEST EUROPE

Normally the produced vinasses are sold in the country of origin in a radius of 100 to 200 km from the evaporation plant. Special qualities, e.g. the high protein containing vinasses, allow a longer transport as they give better returns to the producer.

Vinasses is transported in barges, trucks and railcars and is available throughout the year. Normally contracts are concluded for a full period of 12 months or 24 months with a price fixing clause.

The prices ex factory vary, depending on the european country, the quality, the geographical region, transport costs and, of course, on the local market situation of protein containing agricultural by-products and fertilizers.

During the last five years, we have seen more stable prices for vinasses as fertilizer in comparison with the sales prices in the feed sector.

PARAMETERS AND ANALYTICAL KEY VALUES FOR THE VALUATION OF MOLASSES BY-PRODUCTS

The parameters for the valuation of the various beet and cane molasses by-products in West Europe depend whether the vinasses is used in animal feed, in technical applications (granulation aid in steel factories e.g.) or as fertilizer and straw decomposition aid.

The most important analytical key values are: dry matter, raw protein, potassium-, ash-, calcium-, sodium- and nitrate content but also the pH value of the product is essential. The physical behaviour, especially the binding properties, sedimentation, corrosiveness and viscosity under different temperatures is important and has to be checked before use. Vitamin and antibiotic stability have to be tested also when using vinasses as a LPS-carrier.

While cane vinasses is valued at about one third of the cane molasses price due to its low feed value, concentrated beet vinasses reaches already 50 to 60 % of the beet molasses price. Protein upgraded and depotassified vinasses as well as specially prepared liquid premixes generally reach prices slightly over the molasses prices.

WEST EUROPEAN FEEDING TESTS

Summarizing the various tests, especially from West Germany and the Netherlands, it has been proved that up to 10 percent vinasses can be added to the daily ration for ruminants after having balanced and coordinated especially the protein and potassium content with the rest of the daily ration.

It has been proved that vinasses influence positively the microbial climate in the rumen, not only by the amino acids in form of glutamic acid but also by the betain which is considered as an important nitrogen source for building up kreatin and phosphokreatin and further as a step to produce cholin. It is considered as a lipothrophic metabolyte which means that in its presence and due to its action the intake of lipids by the liver is improved.

West German feeding tests with dairy cows have shown that up to 1 kg vinasses per day has no sensoric effect on the milk.

I hope to have given you some additional ideas about the existence of these products in West Europe and that this information may help you in your decisions when you are faced with beet or cane molasses by-products in your market, both from import offers and home market production. Please feel free to contact us if you have any further questions or problems in this field.

LPCV, MPCV and HPCV ANALYSIS VALUES
(expressed on [illegible])

Indication of Analysis	LPCV	MPCV	HPCV
a) dry matter content	58-60%	65-72%	75-78%
b) total nitrogen * (Kjeldahl-Devarda)	1.1-1.2%	2.3-3.5%	6.8-7.2%
c) raw protein (N x 6.25)	6.5-15%	16-32%	33-50%
d) betaine	0-2%	6-10%	10-11%
e) raw ash (at 600° C)	15-17%	10-24%	11.6-14%
f) potassium	4-4.5%	6.2-6.8%	2-3%
g) raw fiber	–	2.5-3.5%	0.2-0.4%
h) NNL	25-28%	25-27.5%	19.5-22%
i) digestibility raw protein with beet pulp pellets	abt. 70%	abt. 75%	abt. 95%
k) [illegible] starch value (St. E.) kg/to [illegible]	120-150	200-420	518
l) specific gravity	1.31	1.37	1.39
m) pH value in 10% solution	4.5-5	4.8-9.5	abt. 5.9
n) [illegible]	6-12%	3-4%	1-3%

* the total nitrogen of HPCV is divided in about 4.6 to 5 percent organic nitrogen and 2.0 to 2.2 percent inorganic nitrogen. The organic nitrogen consists of 1.7 to 2% N in form of acids, 1.5 to 1.6 percent in betaine and [illegible] percent others.

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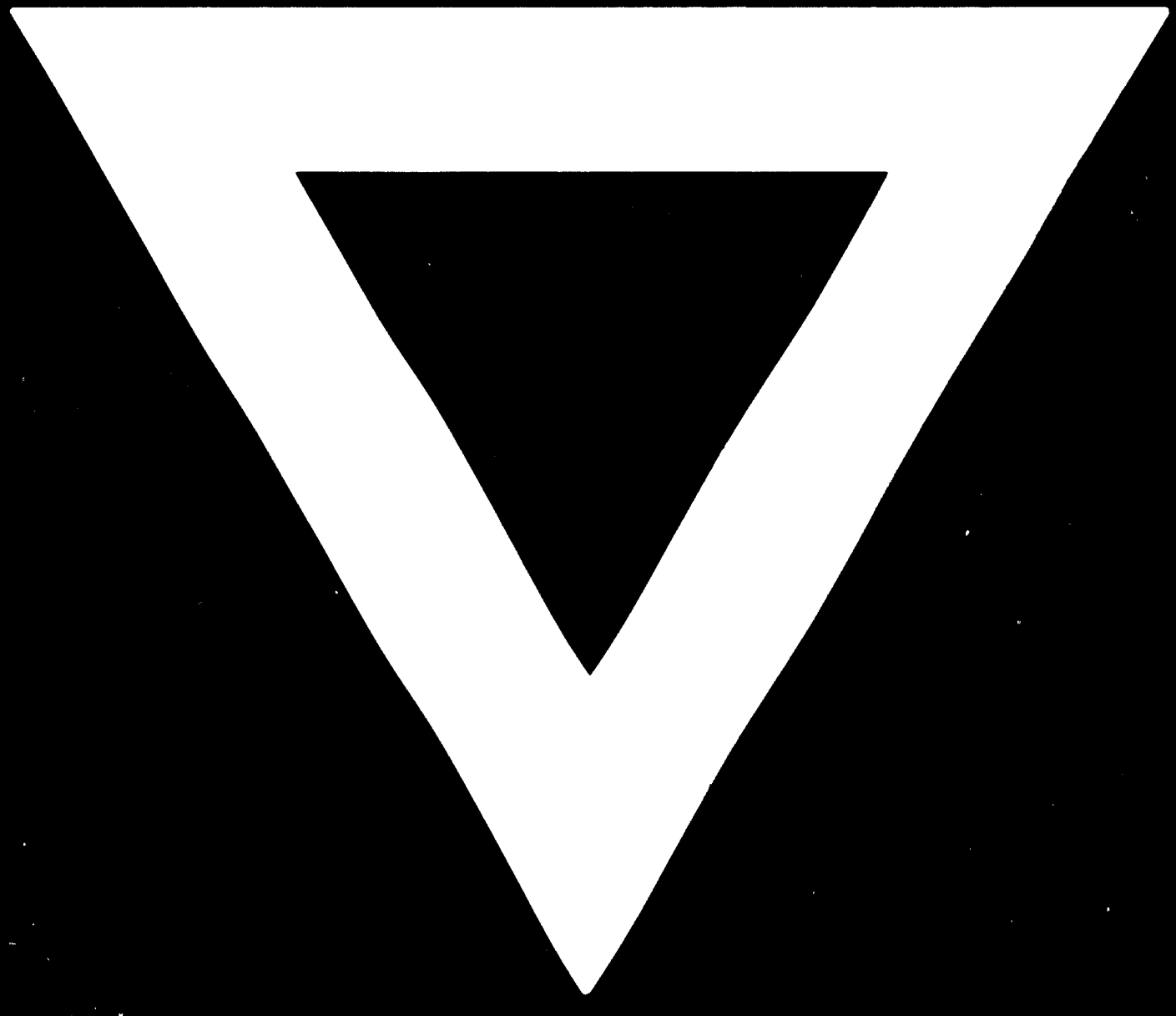

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