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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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VINASSES CONCENTRATION AND VINASSES UTILIZATION*

by

T.P. Melman**

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** Director, B.V. Zuid-Nederlandse Spiritusfabriek, Wittoucksingel 52, P.O. Box 6, Bergen op Zoom, Netherlands

Vinasses concentration and vinasses utilization.

According to the demands of the environmental protection which refers also to the waste water coming from alcohol production plants, new processes for the treatment of these wastes and new applications for the treated wastes had to be developed.

As a prototype of wastes causing environmental pollution can be considered those from plants where molasses is used as raw material.

The concentration of the vinasses has a history of 50 years, using the resulting concentrate for further production of various products (energy, fertilizer, feed).

Our company the B.V. Zuid-Nederlandse Spiritusfabriek, Bergen op Zoom, Netherlands, are producers of molasses-alcohol since 1899.

We are using continuous fermentation (8 hours fermentation time), vinasses concentration and aerobic treatment of the waste water.

Next year we will start with an anaerobic treatment plant for the rest waste water.

The production-capacity is approximately 9.000 l. alcohol/hour or ± 700.000 hl. alcohol/year, which means a biological water-pollution-potential of a city with more than 1,5 million inhabitants.

With the above mentioned measures the biological water-pollution problem is reduced with ± 90%.

We have since 1952 experience with the concentration of waste water coming from the production of molasses-alcohol.

During the first twenty years we used the concentrated vinasses for incineration and recovery of inorganic salts, mainly potassium-salts.

Since 1971 we are selling the concentrated vinasses to the feed-industry.

It is my intention to tell you about this taste experience.

The name vinasses in this story is used for the slobs from an alcohol distillery where molasses is used as raw material.

Our company has the following brand names of beet-vinasses:

Alvicoll : is the concentrated vinasses till 70% dry matter.

Neprocoll : is the concentrated vinasses till 70% dry matter after depotassification.

1. Concentration of vinasses.

In spite of the most different designs, the apparatus used for the concentration of the waste water from the production of molasses-alcohol, caused difficulties due to a pollution of the heating surface. Depending on the molasses and the end concentration, cleaning periods in most different intervals were necessary. In this respect cane-molasses stillage needs longer cleaning periods and shorter intervals than beet-molasses stillage.

We have experience in our two alcohol-factories with a circulation evaporation and with a film-evaporation based on Vogelbusch design.

The cleaning time of a circulation evaporator is much longer than that of the film-evaporation.

The main costs-factor is the energy consumption. In our case we use about one ton of steam for the evaporation of 5 tons of water.

2. Utilization of vinasses.

The application of concentrated vinasses in the feed industry is based on the following properties:

a. binding properties,

b. nutritiv value.

2.1 The binding properties.

The main outlet for the concentrated slobs in the Netherlands is application in mixed-feed-pellets. In this respect the viscosity of the concentrated slobs is of importance. A concentration to 70% dry matter for beet-vinasses and 65% dry matter for cane-vinasses is necessary for this application.

An investigation to establish the influence of molasses and concentrated beet-vinasses on the pellets of mixed feed was made by the Dutch Research Institute T.N.O. in 1971 by G.R. v. Bastelaere. The main-results of this investigation are:

1. Capacity per hour.

With the feed mixtures, which are known as "easy to press", beet-vinasses shows a higher capacity of pellet-production than beet-molasses. This was not proved with feed-mixtures which are known as "difficult to press".

2. The quality of the pellet.

Molasses as well as concentrated beet-vinasses have a positive influence on the quality of the cooled pellets. This result was not proved by feed-mixtures which are known as "difficult to press".

A mixture of concentrated beet-vinasses- and molasses, ratio 1 : 2, gave about the same results.

3. Mixing properties.

The concentrated beet-vinasses is easy to mix with the feed compounds. Molasses is in this respect more difficult to handle.

Conclusion: Concerning binding properties vinasses is a good substitute for molasses.

2.2. The nutritiv value of vinasses.

2.2.1. Composition.

Between the composition of cane-and beet-vinasses exist remarkable differences. The mean composition is shown in the next table (g/kg).

Table I

	moisture	ash	crude protein	other carbo-hydrates
beetvinasses	500	185	231	284
cane vinasses	377	129	49	445

(figures from the Dutch Feedingtable - 1977; CVB 1977).

Both types of vinasses has a high ash content. The main part of the ash content is potassium (beetvinasses ± 9% k and cane-vinasses ± 4,5% k). Moreover there is a difference between protein and carbohydrate content of the both types of vinasses.

2.2.2. Digestibility.

Results of experiments about the digestibility of beet- and cane-vinasses are also published by the Dutch Feedingtable 1977. They published the following figures:

Table II

Digestibility in % (cattle + horses).

	crude protein	other carbohydrates
beet-vinasses	85	98
cane-vinasses	10	75

These results show a favourable digestibility of crude protein and other carbohydrates for beet-vinasses.

Experiments with livestock.

We had the feeling that the feeding value of vinasses is underestimated. With the proverb: "The proof of the pudding is in the eating" in mind, we mention the following experiments:

2.2.3. Beef-cattle.

Over a period of three years tests were carried out in the housing period, on a farm in the province of Groningen on various protein supplements for beef-cattle.
The results of these tests have not yet been published.

The experiments were carried out by our Research Institute in cooperation with the Governemental Institute for Cattle-Husbandry.
The test diets contained:

a. no supplementary protein,
b. soya meal,
c. soya meal and beet-vinasses,
d. beet-vinasses,
e. betaine,
f. urea.

The basic feed, given ad lib., was dried pulp, and in once case dried maize silage. One kilogram of dry matter (Wilted silage or straw) was always given as roughage. The diet was supplemented with vitamins and minerals. To achieve a higer ratio of starch value to digestible crude proteïn as the animals got heavier, a fixed amount of proteïn was given from the beginning of the test.
An utilization-coefficient of 80% was used for vinasses to convert crude proteïn (N) into digestible crude proteïn, and one of 70% for urea and betaine.
The animals were kept on grid floors with five, six or seven per pen.

The results can be summarized:

1. The growth differences between bulls receiving soya meal as a proteïn source and those receiving beet-vinasses (digestability 80%) are very small.
2. Beet-vinasses should not constitute more than 15 - 20% of the diet. If more is given the animals gain weight less rapidly than on soya.
3. In the three tests it was proved that the beet-vinasses contained 214, 202 and 197 grammes of digestible proteïn per kg.
4. Betaine as proteïn-source gave a clear increase in growth compared with the negative control group.
5. The feed conversion per kilogramm of growth was always best in the animals, which grew fastest.
6. The meat-quality was not noticeable affected by the various proteïn supplements.
7. Digestion problems did not occur, but the manure of animals receiving large amounts of beet-vinasses was lightly thinner. The animals' health was good and was not affected by the kind of proteïn given.

In this respect it is interesting to mention the publication of the "Zoo-technisch Centrum van de Universiteit te Leuven" of A. de Vuyst, A. Moreels and R. Arnould.

This study was made on 40 growing cattle to investigate if vinasses can be utilized in their rations. The results obtained appeared to be very favourable.
By mixing 30,29% of vinasses in the feed-concentrate (which corresponds with 12,90% in the total ration) there was 5,6% increase in the rate of animalgrowth compared to the control group.
This means at the same time a reasonable reduction of the feeding costs per kilogramm of weight gained.

2.2.4. Dairy-cattle.

In our country the main part of the vinasses is used in feed compounds for dairy cattle.
Our company tested this application together with the Governemental Agricultural Advisor in the province of Friesland.
On 5 farms the application of dried pulp with respectively 10% Alvicoll, 10% Neprocoll and 10% molasses was tested during 8 weeks. The control group received the normal ration.
In this test the dairy-cattle received till 1 kilogramm vinasses per day.

Results:

1. The mean milk-production was 30 kilogramm of milk per cow per day or more.
   There was no significant difference between the different rations.
2. The production milk fatt per cow was better in the groups which received Alvicoll and Neprocoll than in the groups "molasses".
3. The different groups showed no significant difference in the protein content of the milk.
4. The different groups showed no differences in weight.
5. During the test period no negative taste or smell of the milk was observed.

Conclusion.

There is no objection against substitution of molasses by Alvicoll and Neprocoll in the compounds for dairy cattle.

2.2.5. Vinasses in the ratio's for pigs.

Very interesting were the results of a feed-test made by our Research Institute (I.R.S.) in cooperation with the experimental station of the Dutch cooperative feed-industry "De Schothorst", with the use of vinasses in pig-feed.

The purpose was to compare the application possibilities of beet and cane-vinasses for pigs with beet-en cane-molasses.

In the test, with 96 pigs, 8 trial-feeds were compared.

The mean test-results are given for the following comparisons (table III):

- 4% molasses and vinasses with regard to 8%.
- Beet-molasses and beet-vinasses with regard to cane-molasses and cane-vinasses.
- cane and beet-molasses with regard to cane and beet-vinasses.

Table III.

Data about the mean growth and feed-conversion of the different feed-compositions.

	molasses + vinasses		beet-molasses and vinasses	cane-molasses and vinasses	molasses	vinasses
	4%	8%				
growth (g/day)						
0- 4 weeks	571	571	569	573	568	574
0- 8 weeks	675	678	673	681	673	681
0-12 weeks	750	760	753	756	755	755
total period	771	780	777	774	773	778
feed-conversion (energy value/kg growth)*						
0- 4 weeks	2.57	2.55	2.57	2.54	2.56	2.55
0- 8 weeks	2.69	2.66	2.70	2.66	2.69	2.67
0-12 weeks	2.87	2.83	2.85	2.85	2.84	2.86
total period	3.12	3.08	3.08	3.11	3.10	3.09

* energy value = $\frac{\text{kcal/kg feed}}{2100}$

Summary-

The results concerning growth, feed-intake and slaughter-characteristics show for molasses and vinasses the same results, provided that the lower nutritional value of vinasses is compensated.

Based on the experimental results we can conclude that making up 8% vinasses in feed for slaughter-pigs will not have a negative influence on the growth, feed-conversion and slaughter-quality.

2.2.6. Nutritional value and costs.

Formerly the animals were allowed to roam free and gather what ever forage they could have. Feed stuffs are now brought to the animals, with each ingredient analysed for its nutritional value and costs.

These feeding-operations use, pratically all, computer orientsd linear programming least cost formulation techniquss.

Based on the market price for feed-ingredients of 15/12/1978 and the nutritional value mentioned in the "Dutch Feedingtable" (CVB 1977), linear programming results in the following cost limits in a normal feed compound:

cane-vinasses may cost Hfl. 1,— per 100 kg or ± 0,5 $/100 kg

beet-vinasses may cost Hfl.25,— per 100 kg or ± 12,5 $/100 kg.

The differences in composition and digestibility of the above mentioned feed ingredients show a considerable price difference between beet - and cane-vinasses.

This difference is also expressed in today's marketprice for vinasses in the Netherlands. The price level of cane-vinasses is about 20 - 30% and of beetvinasses 60 - 65% of the molasses-marketprices.

By the Dutch feed-industry vinasses is used in the rations to the following extend:

cattle	8 - 10%
pigs	3 - 5%
broilers	2%

Vinasses has now become a well established feed-ingredient in the Dutch Feed-industry.

2.2.7. Market-characteristics

The mixed or compound feed-industry in the Netherlands is particularly large. Approximately 14 million tons are produced annually, which means a ratio of one ton of mixed feed for each inhabitant.

The European Community and Japan have a mixed feed to population ratio from one to five. In the USA the ratio is about one to one.

In developing countries the ratio is much lower; in Jamaica 1 to 20; in Columbia 1 to 37.

An important key to profitable marketing of vinasses is to keep the transport and handling costs low, therefore the consumption of this product should be found nearby the production-unit. Areas with a high density of population and high ratio of mixed feed for each inhabitant give the best chances for the feed-application of vinasses.

Moreover there is another drawback for vinasses-production. The energy costs and consumption for the concentration increasing energy-cost will have an important negative influence on the cost-price.

3. Other applications

We mentioned till now one outlet for vinasses, where it is used mixed with dry feed for cattle and pigs.

In the USA an increasing amount of vinasses is also being used in liquid rations.

Here it is used as a means of introducing new protein nitrogen (urea). Urea in a liquid form is combined with molasses and/or vinasses. Of importance is the growth rate of the liquid feed market in the USA from 200,000 tons in 1970, till approximately 2 million tons in 1975.

Further applications and outlet for vinasses (fertilizer, methane) will undoubtfully be considered during this meeting.

Due to the exceptional high biological water pollution potential the producer of molasses-alcohol is condemned to find a solution for this problem.

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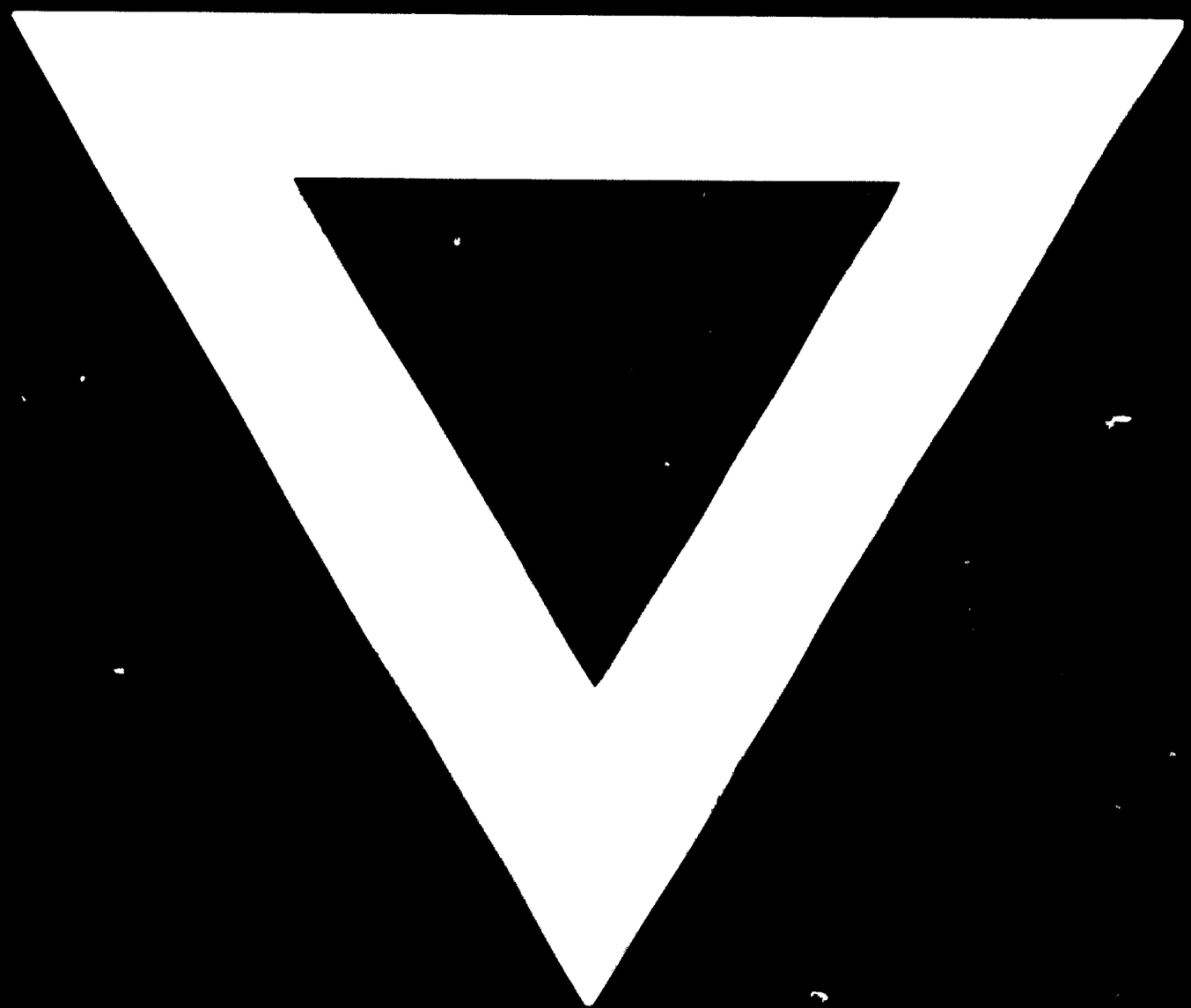

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