Alberta Dairy Management
PREPARED FOR AND DISTRIBUTED BY THE DAIRY EXTENSION ADVISORY GROUP

# Spontaneous Oxidized Flavour in Milk

For a few months, starting in January every year, a number of dairy producers' calls for advice deal with one particular problem. Although specific details may vary, the caller usually tells the same story: "The milk hauler has rejected my milk! I don't think there is anything wrong with it, but he says it tastes oxidized. And I've already dumped four (or eight) milkings. What can I do?"

Since oxidized flavour increases with the age of the milk, the best way to determine whether or not raw milk has a tendency to oxidize is to refrigerate a sample for 96 hours before tasting it. Some people refer to the oxidized flavour as a tallowy or metallic taste, and children seem to be able to detect the "cardboard-like" flavour readily. It hits quickly on the front of the tongue, but disappears when the milk is swallowed.

Spontaneous Oxidized Flavour (SOF) in milk is fairly common in Alberta, with the incidence almost three times greater in Southern Alberta than in Northern Alberta. A survey carried out in 1988, and repeated in 1989, showed that about 15% of the milk shipped in Alberta tended to be oxidized (see table 1).

Samples for this survey were collected randomly from farms in Northern and Southern Alberta. They were then stored at or below five degrees Celsius, in the dark, for three days after pick-up. A panel of three tasters flavour-graded the milk. When two of the three tasters agreed on a decision, it was accepted. However, in nearly all cases, if an abnormal flavour was detected it was by all three.

Oxidized flavours can develop spontaneously, or can be induced by light (eg. in bright retail store coolers). On occasion, milk in farm bulk tanks or silo tanks will develop an oxidized flavour for no apparent reason. While it is not always possible to be certain what induced the SOF in raw milk, it is a certainty that the SOF renders it unsuitable for consumption. SOF results from an imbalance between pro- and anti-oxidants in milk, producing chemical and physical changes to the milk fat globule membrane.

Although there is no simple solution to the problem of SOF, the following preventative / corrective measures should be considered:

- All milk contact surfaces of milking equipment must be free of fat and other deposits. Any deposit left in the bulk tank, pipeline, milking units or pumps will oxidize readily.
- Iron, sulphur or copper in the water supply used to wash and sanitize milking equipment can cause oxidized flavours. As little as 0.1 ppm copper, sulphur or iron may cause a problem. Unless another water supply is available, treatment may be necessary.
- Iron or copper water pipes in combination with acid water, may lead to oxidized flavoured milk. Acid water removes small quantities of the metals from the pipes and deposits the metal onto the stainless steel milk lines. In areas where the water has a pH of less than 7.0, copper water pipes should not be used in the milkhouse.
- Use an iodine sanitizer rather than a chlorine one if milk is oxidized. Chlorine causes precipitation of the metals.
- Provide some fresh forage to cows during summer and fall. Fresh forage contains high levels of beta carotene and vitamin E. Cows that are fed stored forages year round may require supplementation with vitamin E on a regular basis.

| Survey | Northern Alberta | Southern Alberta | Province |
|---|---|---|---|
| winter 1988 | | | |
| # of samples | 193 | 124 | 317 |
| % oxidized | 7.8 | 28.2 | 15.8 |
| winter 1989 | | | |
| # of samples | 202 | 180 | 382 |
| % oxidized | 7.9 | 22.8 | 15.0 |

*Table 1 : The results of two winter surveys to determine the incidence of Spontaneous Oxidized Flavours in Alberta milk.*

• Factors which increase the proportion of unsaturated fatty acids in milk increase the susceptibility of milk to oxidized flavour. The feeding of added fat, such as vegetable oils, should be discontinued to determine if it is inducing the oxidized flavour.

• Overfeeding grain and underfeeding forages can be a problem. Low fat tests are sometimes associated with oxidized flavour.

## Vitamin E supplementation

SOF has been attributed to low levels of vitamin E in stored feeds. Vitamin E is a generic name for compounds called tocopherols which, in combination with selenium, regulate oxidative processes. Grass and other green feeds are rich in tocopherol, which is reasonably well preserved in silage but lost almost entirely during hay-making.

Table 2 shows some characteristics of herds with normal and oxidized flavoured milk. It is interesting to note that cows with milk susceptible to oxidization were younger, were at an earlier stage of lactation and tended to give more milk. There was no significant difference between the alpha-tocopherol levels of the normal and oxidized milk. Other research has also shown that oxidized flavour and concentration of alpha-tocopherol in milk are not well related and that the transfer of dietary vitamin E to milk is low. However, increasing vitamin E intake is often effective in reducing the severity of oxidized flavour when it is already present.

In a recent Canadian study (published in 1993), intramuscular injections of alpha-tocopherol were used in an attempt to correct SOF. A single injection

| | NO | OX |
|---|---|---|
| Number of cows | 141 | 72 |
| Average age (years) | 4.8 | 4.3 |
| Milk yield (kg) | 25.1 | 28.8 |
| Days in milk | 170 | 134 |
| Oxidized flavour score § | 0 | 40.4 |
| α-tocopherol level (µg/g milk fat) | 16.3 | 18.8 |

§ on a scale of 0 (not oxidized) to 140

*Table 2 : Characteristics of cows from four commercial herds without* (NO) *or with* (OX) *oxidized flavoured milk prior to treatments.*

| | IU of α-tocopherol, intamuscular | | |
|---|---|---|---|
| week | 0 | 1500 | 3000 |
| | --- mg per gram of milk fat --- | | |
| 1 | 20.8 | 34.1 | 47.5 |
| 2 | 23.1 | 40.2 | 51.0 |
| 3 | 17.7 | 35.1 | 40.8 |

*Table 3 : Milk levels of alpha-tocopherol after three weekly intramuscular injections.*

of 1500 IU (international units) of alpha-tocopherol increased the milk tocopherol level by more than 50%. Results of three weekly injections of 1500 and 3000 IU are shown in table 3.

The response in milk alpha-tocopherol concentration to injection was rapid, and sufficient to increase the resistance of milk to SOF. Maximal milk levels of tocopherol were observed about 3 days after each injection. This research demonstrates the advantage of injectable tocopherol (as opposed to oral) in increasing levels of milk alpha-tocopherol, for control of SOF. However, within 6 days of the last injection, milk levels of tocopherol had declined to less than half their maximum values.

## Recommendations

In herds where SOF is a problem, a single injection of 3000 IU alpha-tocopherol in combination with a daily oral supplementation of 3000 IU for all milking cows, should rapidly reduce the intensity of oxidized flavoured milk (compared with oral supplementation alone). Oral supplementation in combination with the injection may also extend the resistance of milk to oxidation, compared with injection alone. After 2 to 3 weeks, the daily oral supplementation should be reduced to 1000 - 1500 IU for each cow, and should continue for the remainder of the winter.

Milk quality is an important factor in the sale and consumption of milk. The maintenance of milk quality starts at the farm and requires constant vigilance. Consumers want milk that tastes good and lasts longer. Satisfied consumers purchase more dairy products, ultimately resulting in greater returns to the dairy producer.

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