Redusere avrenning fra ferskfisk transport på lastebiler

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Figure 1. Example of meltwater draining during salmon transport 30 minutes after loading. The semi-trailer was pre-cooled and operating at 0 °C. Drainage shown here was limited to uphill sections and turns. The truck was caught in a routine inspection of the Norwegian Public Roads Administration shortly after where the inspector noticed no water draining.

Problem

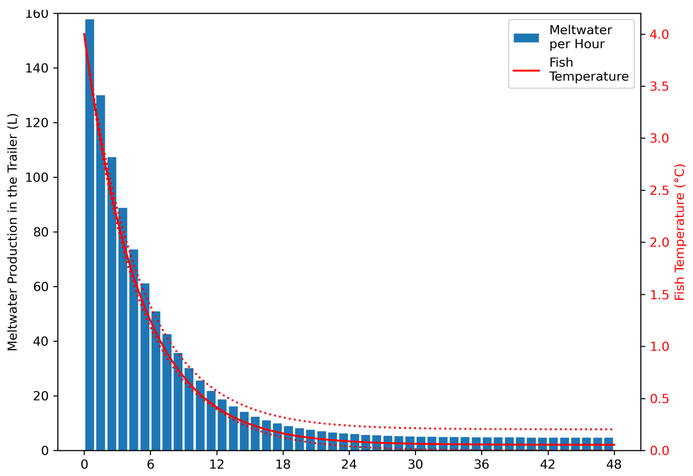
By law, fresh fish is transported on ice in the EEA. This system is tried and proven and works perfectly except that upward of 1000 L of meltwater drain onto the road from a typical trailer load (Figure 1). This is most noticeable near packing and slaughterhouses, on ferries, and on certain roads (e.g. Laksevegen Fv. 714 in Trøndelag). This is a nuisance, publicity issue, and a matter of road safety.

Figure 2. Example of top-iced whole gutted salmon ready for road transport. Amount of ice used depends on facility, customer, and season. Both salmon and whitefish are transported by road in EPS **boxes with drainage holes** for meltwater.

Figure 3. EPS boxes stored in semi-trailer, usually 33 pallets of 27 boxes each. Precise pallet alignment differs between loads.

Solution To-Date

The Norwegian Public Roads Administration started to address meltwater drainage onto the roads in 2012 by systematically stopping leaking trucks until the driver manages to stop the leak. Avoiding delays in transportation is to-date the only tangible incentive for the industry to address meltwater drainage. In current practice it is up to the transportation company and the driver to deal with this issue. While there are companies operating some specially designed semi-trailers with a 255 L meltwater storage tank, most transportation takes place in regular cooled delivery trucks, e.g. the same used by grocery stores. The most common strategy used by drivers of such trucks to stop the leakage of meltwater is to temporarily lower the temperature to -20 °C to freeze the doors shut.



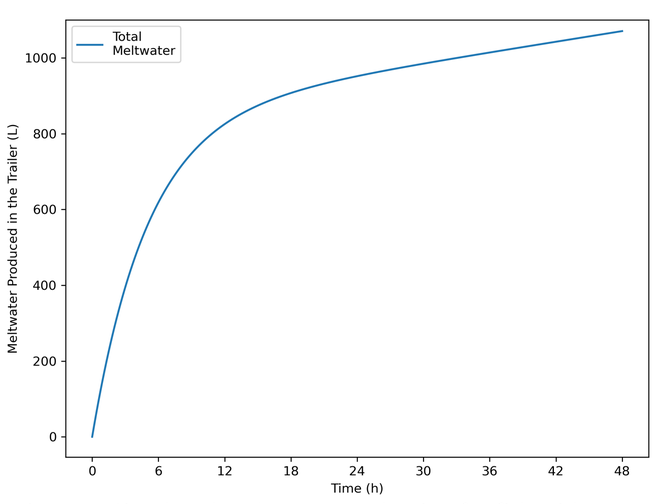


Figure 4. Simulated meltwater production for fish with initial temperature 4 °C and semi-trailer temperature of 1 °C. Above shows that meltwater production is dominated by fish temperature during the first day. Below shows cumulative meltwater production. Realistic initial fish temperatures range from 2 to 9 °C. Note that the first few hours may be at the loading facility rather than in the semi-trailer.

Temperature Analysis

Ice melts because either fish or the environment are at a temperature above the melting point of ice. In practice, fish is packed on ice at temperatures between +2 °C and the current temperature of the fjord (e.g. +9 °C). There is no legal temperature limit for the temperature of fish during transportation. The cooling system of the truck will not be able to suppress meltwater generation from fish warmer than 0 °C since about 30% of the EPS boxes are not in contact with air (Figure 3). Large meltwater volumes are generated during the first 24 hours due to warm fish (Figure 4).

Solution

Any solution to the meltwater problem in Norway will lead to expenses and may require changed customer expectations. As such, changes will probably have to be implemented nation-wide. Approaches include: Extend the period of time between packing and road transport to allow for proper cooling of the fish. Superchill fish. Use watertight airfreight boxes. Collect meltwater (Figure 5) and establish drainage points that also work in winter.

Figure 5. Example of meltwater collection system used in Iceland. Tanks differ in size and design.

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