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23 TRANSPORT AND TRANSFORMATION OF UREA USED AS A DE-ICING AGENT AT A REGIONAL AIRPORT, SOUTHEAST SWEDEN

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ABSTRACT

Urea, NH_2-CO-NH_2, is used to de-ice runways at northern airports. In order to reduce the nitrogen load to the coastal zone resulting from urea deicing activities at Kalmar Airport, southeast Sweden, a wetland was constructed in 1996. In this study, the transport and transformation of urea, from the airport runways to the constructed wetland, has been investigated, and the wetland nitrogen reduction has been evaluated. Monthly sampling at the wetland inlet and the wetland outlet, giving annual transports of total-N, have been compared with daily transports of urea and total-N, based on high frequency sampling during urea application and runoff events. Annual transport of total-N during 1998 shows a reduction of 8 ton (36 % of incoming tot-N load), during 1999 a reduction of 2,5 ton (6,3 %) and during 2000 a total-N reduction of 4,2 ton (14 %). During a high frequency sampling period, Jan – March 2001, 25 % of the applied deicing urea-N were transported to the wetland inlet as urea-N, indicating that most of the urea was transformed during the transport from airport runways to the wetland. According to calculations of cumulative urea-N loads at the wetland inlet and the wetland outlet during February and March 2001, 40 % of the incoming urea-N was transformed in the wetland system. The estimated average urea transformation capacity for the wetland was during this period 3,0 mg urea-N$*m^{-2}*h^{-1}$. There were no indications of nitrogen reduction in the wetland during February and March 2001, since the cumulative total-N load at the wetland outlet was 1000 kg higher than the cumulative load at the inlet. This was consistent with the transports for 1998, 1999 and 2000, with several occasions with higher load of total-N at the outlet than at the inlet during Jan-March. During January and March the urea concentration dynamics at the wetland inlet was correlated with water flow (r^2=0,55, p<0,001) air temperature (r^2=0,36, p<0,001) and precipitation (r^2 =0,06, p=0,02), while during February several ice periods complicated the concentration dynamics and no significant correlations with water flow, temperature or precipitation were found.