Environmentally Friendly Alternatives to Standard Road Salts

Gootzeit, Jack (School: Waconia High School)

Common chloride-based road salts pollute the environment, including vegetation and infrastructure; an eco-friendly compound able to melt ice is critical. I tested thirteen different substances on 100mL of ice and measured the amount of water melted. The compounds NaCl, $CaCl_2$, $MgCl_2$, and $C_2H_3NaO_2$ were most effective, although five of the other compounds ($C_4H_6O_5$, $C_4H_6O_6$, $C_6H_8O_7$, CH_4N_2O, C_3H_8O) also melted the ice adequately. To test corrosiveness, I used four common metals in infrastructure (steel, copper, aluminum, and stainless steel). I submerged the metals in 10% solutions of the compounds tested and assessed both the speed and extent of corrosion of the metals over fourteen days. The standard chloride-based salts all started oxidizing steel and copper immediately and extensively, while the three organic acids had significantly less visible effects. Next, I exposed plants to increasing strengths of the studied solutions over three weeks. The plants watered with solutions of Calcium chloride, Sodium chloride, Urea, and Sodium acetate deteriorated the most, while the plants exposed to the organic acids showed minimal adverse effects. Finally, I repeated my initial experiment to melt ice, this time by using 1:1 mixtures of the organic acids with standard road salts (NaCl, $CaCl_2$, $MgCl_2$, and $C_2H_3NaO_2$), I determined that we can decrease environmental exposure to chloride-based road salts by 50% without any statistical difference in the amount of ice melted. In conclusion, combining organic acids such as Malic, Tartaric, or Citric acid with standard chloride-based road salts will dramatically reduce environmental toxicity caused by current deicing practices.

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