

Mathematical Modelling of Evaporation of Water Using Steam - Unitary Model Analysis

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Abstract

Multiple effect evaporators use steam of temperature 120-200°C as a source of heat to evaporate water from solutions. Multiple effect evaporators are widely used by the Food, Desalination and Waste water treatment industry to concentrate solutions which otherwise cannot be concentrated by heating due to scaling and other issues like sugarcane juice whose nature can be altered by the application of heat directly.

In the present study as a proof of concept, multiphysics modelling has been done to demonstrate the phenomenon of evaporation of water with steam. Unit dimensional 2D analysis of phase change was carried out using COMSOL Multiphysics® software. It was observed that in 3 hours and 20 minutes, steam of 150°C enclosed in dimension 0.5 m × 0.1m with insulated walls evaporated water of 25°C in dimension 0.5 m × 0.02 m. The study has been extended to analyze the evaporation phenomenon with varying steam temperature, water properties and dimensions.

Figures used in the abstract

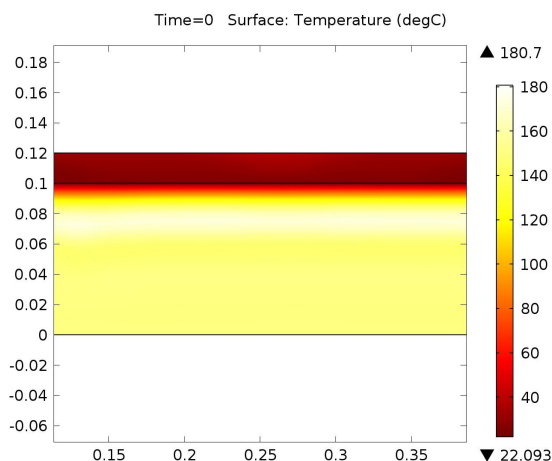


Figure 1: Temperature at t=0s.

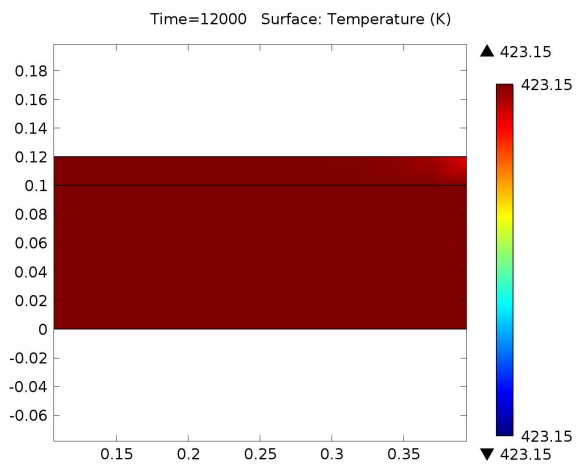


Figure 2: Temperature at $t=12000s$.