

Sustainable drinking water distillation

Design and testing of a compressor for optimizing energy efficiency in drinking water treatment

Graduate



Muhamed Ameti



Clemens Mösl

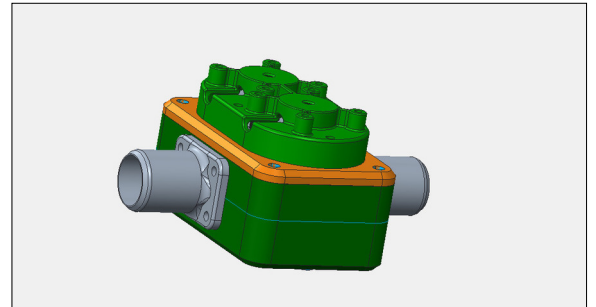
Introduction: Water is an indispensable resource for survival. However, numerous global challenges remain, including water shortages, pollution, and extreme weather events exacerbated by climate change. To address these issues, we need efficient, reliable, and sustainable water treatment processes. Investing in research and development in this field is crucial to meeting rising demand while protecting valuable resources. Vapour compression distillation is a process in which water vapour is compressed by a compressor and then condensed. The heat released during condensation is then used to support the evaporation process in an energy-efficient manner. The problem, however, was that no suitable compressor could be found to deliver the required steam mass flow of a few cubic metres per hour under the specified operating conditions. This technological gap currently represents one of the main barriers to implementing vapour compression distillation on a smaller scale.

Definition of Task: The aim of this thesis was to develop and test a compressor to verify whether the specified requirements were met, identify potential areas for improvement, and establish the value of further research. Performance maps were recorded and the achievable quality levels evaluated. The investigation of different configurations provided useful insights into the system's limitations and potential.

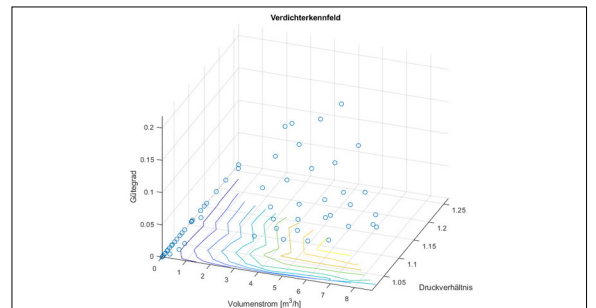
Result: During the tests, various motors, differently scaled gear pairs and gear housings made of different materials were used. Different operating points were set on the compressor. Overall, the measurement results demonstrate promising approaches and confirm the basic functionality of the developed compressor. Based on the efficiencies achieved and

the optimization opportunities identified, further research appears worthwhile in order to exploit the system's full potential and enable its long-term use in water treatment. In particular, refining the compressor design and adapting it to varying operating conditions could significantly improve both performance and energy efficiency.

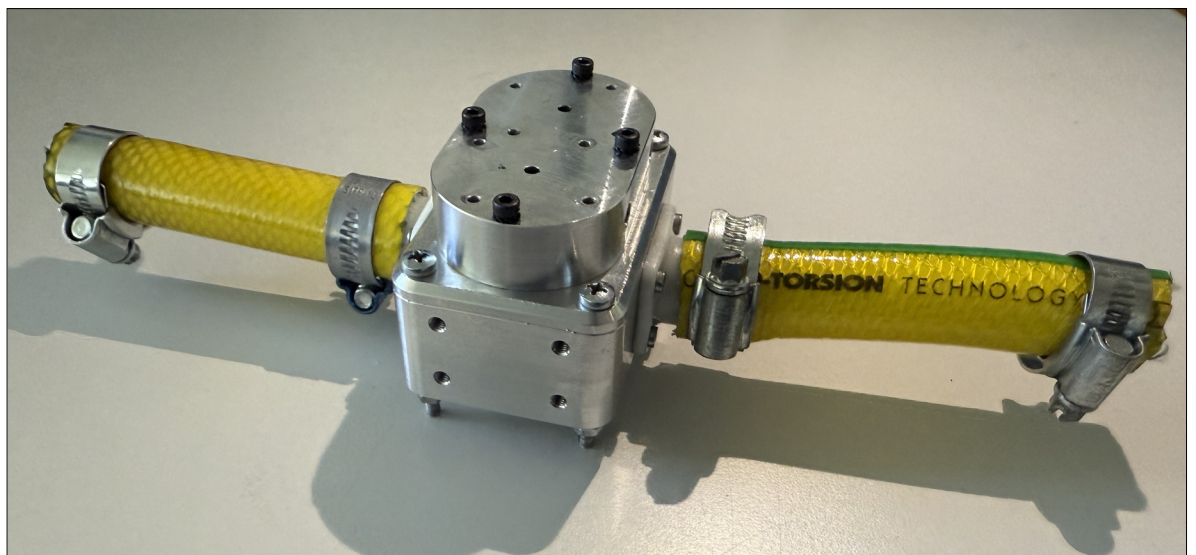
Compressor CAD Own presentation



Performance map analysis Own presentation



Compressor Own presentation



Advisor Prof. Stefan Bertsch

Co-Examiner PhD Leon Brendel

Subject Area Mechanical Engineering