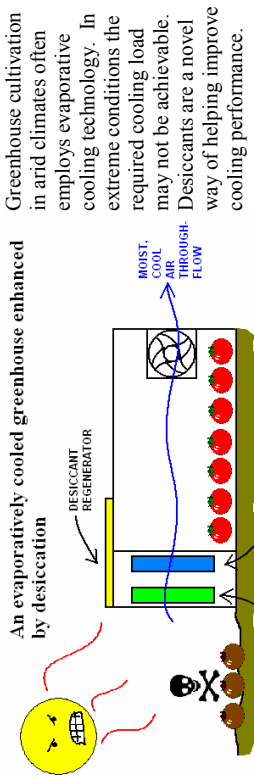


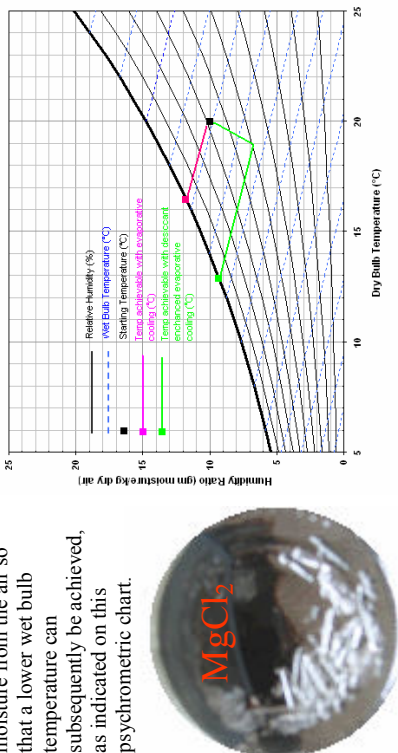
Evaluation of New Design Concepts for Passive and Solar Cooling of Commercial Greenhouses in Hot Climates

P.R.Knowles and P.A.Davies, School of Engineering, University of Warwick, 2005

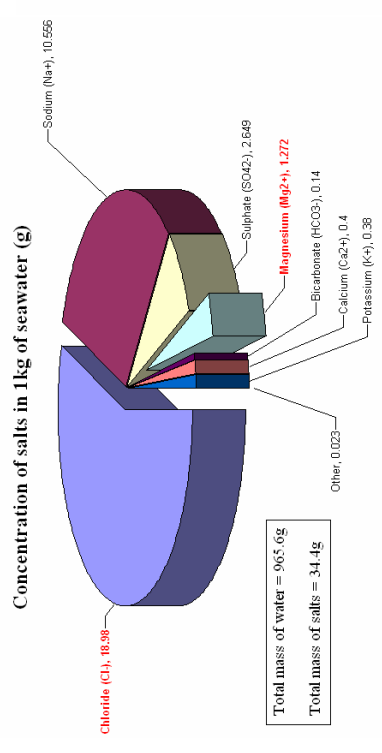


An evaporatively cooled greenhouse enhanced by desiccation employs evaporative cooling technology. In extreme conditions the required cooling load may not be achievable. Desiccants are a novel way of helping improve cooling performance.

Desiccants remove moisture from the air so that a lower wet bulb temperature can subsequently be achieved, as indicated on this psychrometric chart.



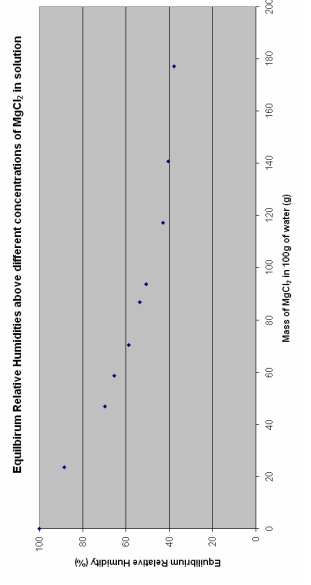
Salt solutions can often be used as desiccants due to their hygroscopic nature. Little research has been done into the applications of Magnesium Chloride ($MgCl_2$) as a desiccant. However, its presence in seawater makes it an economically attractive candidate.



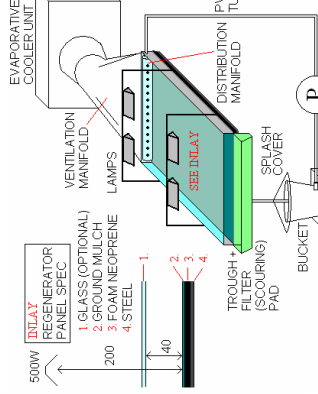
Two test rigs were designed and built. The first to explore the desiccating properties of different concentrations of $MgCl_2$ solution. The second to model how the solution would be utilised in the greenhouse. The $MgCl_2$ must be regenerated in a solar still, so the second model was also used to test this aspect.



The first rig circulates saturated air through $MgCl_2$ solution until an equilibrium humidity is reached.

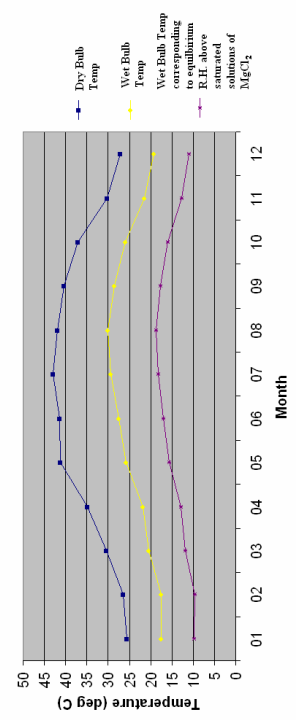


The above results suggest that saturated solutions of $MgCl_2$ can achieve below 40% R.H. This is supported by literature.



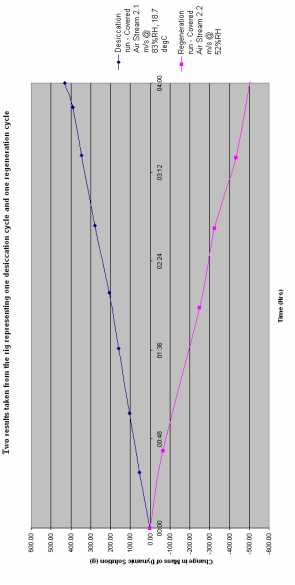
The second rig can either humidify or dehumidify an air stream by recirculating $MgCl_2$ solution over a trickling bed. The mass of solution in the system will increase or decrease depending on whether the rig is desiccating or regenerating, respectively.

Comparing the ideal potential of $MgCl_2$ as a desiccating enhancement to the evaporative cooling process, against the ambient monthly average maximum dry and wet bulb temperatures, for Abu Dhabi during 2002



Evidently $MgCl_2$ has the potential to desiccate an airflow and can then be fully regenerated for reuse. It was found that:

- An uncovered regenerator is more effective
- Regeneration efficiencies of 35% can be achieved
- Desiccation improves with smaller channel heights



URSS - Thoughts

The project has provided a useful insight into the world of research. My own undergraduate course has been very reading based, so performing a practical project has helped restore the balance. I previously worried that upon starting to work I might find out I actually know nothing. The URSS scheme has left me feeling slightly more prepared, as I know that the transferable project management skills I have learnt will be applicable in all walks of life, not just academic research. I thank all involved for granting me this rare opportunity.

Based on our findings, the potential cooling enhancement offered by $MgCl_2$ to a greenhouse in the Middle East is assessed.