Thermochemical Fluids in Greenhouse Farming

Methods to control the humidity in greenhouse farming

Crops transpiration produce water vapour inside greenhouses which need to be dehumidified to maintain suitable humidity [1]. The main humidity control methods used in greenhouses are ventilation, heating, condensation on cold surfaces and adsorption by hygroscopic materials [2]. In greenhouses of warm regions, as Mediterranean countries, ventilation is the most common method used due to its low cost. In colder climates, as Continental Europe, heating systems are used to reduce relative humidity increasing air temperature, but without modify absolute humidity.

The use of heat exchanger with cold surfaces for dehumidification allow to capture and re-use the latent heat released in condensation [2]. A heat pump can be used as a dehumidifier to prevent condensation on the crop [3]. In cold areas, the use of a heat pump can reduce 3-8 times the energy consumed by venting-heating dehumidification [3] and to increase 2–3 times the coefficient of performance of conventional air-conditioning systems [4].

The use of hygroscopic fluid salt solutions (called thermo-chemical fluid, TCF) also allows to reduce absolute air humidity by adsorption of vapour and convert the latent heat of condensation to sensible heat used for heating the greenhouse [2]. The difference of absolute humidity between air inside the greenhouse and outside is the main factor affecting the desiccant dehumidification [4]. Water vapour adsorption onto silica-gel, activated carbon powder and activated carbon fibre can be used for climate control with solar operated air-conditioning system [5]. An aqueous magnesium chloride solution ($MgCl_2$) has been used in TheGreefa project (better performance/cost ratio) for the air control in the greenhouses.

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