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Numerical Analysis of Heat and Mass Transfer in an Adsorbent Bed for Different Working Pairs

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Abstract : Solar radiation is by far the largest and the most world's abundant, clean, and permanent energy source. In recent years, many promising technologies have been developed to harness the sun's energy. These technologies help in environmental protection, economizing energy, and sustainable development, which are the major issues of the world. One of these important technologies is the solar refrigerating machines that make use of either absorption or adsorption technologies. In this present work, the adsorbent bed is modelized and optimized using different working pairs, such as zeolite-water, silica gel-water, activated carbon-ammonia, calcium chlorid-ammonia, activated carbon fiber- methanol and activated carbon AC35-methanol. The results show that the enhancement of the heat and mass transfer depends on the properties of the working pair; the performances of the adsorption cycle are essentially influenced by the choice of the adsorbent-adsorbate pair. The system can operate successfully for optimal parameters such as the evaporator, condenser, and generating temperatures. The activated carbon is the best adsorbent due to its high surface area and micropore volume.

Keywords : adsorbent bed, heat and mass transfer, numerical analysis, working pairs
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