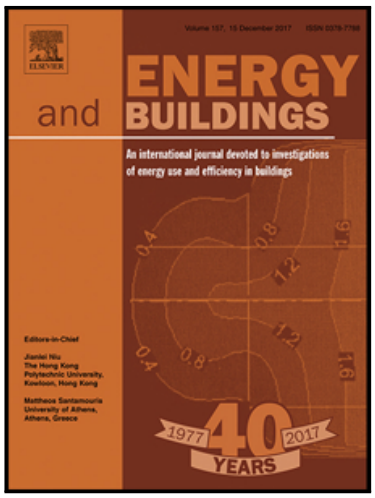

Cross-flowing displacement ventilation system for conveyor belts in the food industry

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Cross-flowing displacement ventilation system for conveyor belts in the food industry

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A B S T R A C T

In the following paper a local air conditioning concept for conveyor belts in the packaging sector of chocolate production is described, comprehensively analyzed and evaluated with respect to its suitability for a use case. For this purpose, extensive laboratory investigations were carried out and energy savings and numerical flow simulations were calculated. Often the entire hall in the packaging area of chocolate production must be strictly air-conditioned to fixed limits to avoid the appearance of condensation effects or melting of the product. Using the approach of conditioning only where it is necessary, high energy saving potentials are achievable since temperature and humidity limits in the hall can be significantly increased.

1. Introduction and problem description

In the field of building air conditioning, high energy saving potentials can be raised in many ways [1-3]. In addition to control engineering improvements and the further development of the various components of an air conditioning system, also different air duct concepts offer considerable saving potentials [4,5]. Above all, packaging halls of temperature-sensitive products are ideal for analyzing and implementing novel air guidance concepts, as the packaging process usually takes place on open conveyor belts.

In the application case chocolate bars from the cooling passage reaches the conveyor belt in the packaging area at a temperature of around 14 to 15 °C and thus heats up slowly. Since deformations of chocolate already occur at 18 °C and to avoid condensation effects on the product and quality problems with the packaging cartonnage the entire packaging area must be air-conditioned to 18 °C and 50% relative humidity [4]. The strict temperature and humidity specifications lead to high energy consumption in the hall air conditioning. The approach of local air conditioning pursues the goal of air conditioning only an area, where it is really needed and thus makes it possible to increase the flexibility of hall climate control [6,7]. Therefore, air-conditioning variants are being developed, which enable air conditioning around the product-carrying conveyor belt in the packaging area. For the rest of the hall, the fixed air conditioning limits can thus be significantly extended and based, for example, on the limits of the comfort field according to Fanger and others. The scientific research of Wagner [4,8], who investigated a full encapsulation around the chocolate bar carrying conveyor belt, yielded high energy savings in the area of hall air conditioning. Another approach to local air conditioning in the form of cross-flowing displacement ventilation, which flows laterally on the conveyor belt, allows free access to the product at all times and significantly reduces the area to be