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Lines of Constant Skin Temperature with Varying Skin Wettedness

Tohru MOCHIDA
Department of Environmental and Sanitary Engineering,
Hokkaido University, Sapporo, Japan

The purpose of the present paper is to clarify the behavior of wettedness at constant average skin temperature and to examine its effect on the line of equal average skin temperature drawn on a psychrometric chart. Experiments were carried out to determine the values of wettedness under constant average skin temperatures using sitting/resting nude subjects. From the analysis of the present experimental data, the following conclusions were found regarding the change of wettedness under constant average skin temperatures.

1. There is a positive correlation between wettedness and environmental humidity and a negative correlation between wettedness and air temperature.
2. There is a positive correlation between the evaporative heat loss from the skin surface and air temperature and a negative correlation between the evaporative heat loss and environmental humidity.
3. There is a negative correlation between wettedness and evaporative heat loss.
4. Wettedness is not constant but takes varying values (i. e., corresponding to each average skin temperature, both the maximum and the minimum wettedness values occur).

Based on these conclusions, the theoretical locus of equal average skin temperature is not a straight line but is a curved line plotted on the psychrometric chart. The curve means that the effect of environmental humidity on thermal sensation is not constant but differs even on the line of constant average skin temperature.

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Dynamic Changes in Spatial Microbial Distribution in Mixed-Population Biofilms: Experimental Results and Model Simulation

Satoshi OKABE*, Kikuko HIRATA** and Yoshimasa WATANABE*
*Department of Sanitary and Environmental Engineering,
Faculty of Engineering, Hokkaido University
**Pacific Consultants Co. Ltd.

Dynamic changes in spatial microbial distribution in mixed-population biofilms were experimentally determined using a microslicer technique and simulated by s biofilm accumulation model (BAM). Experimental results were compared with the model simulation. The biofilms cultured in partially submerged rotating biological contactors (RBC) with synthetic wastewater were used as test materials. Experimental results showed that an increase of substrate loading rate (i. e., organic carbon and NH_4-N) resulted in the microbial stratification in the biofilms. Heterotrophs defeated nitrifiers and dominated in the outer biofilm, whereas nitrifiers were diluted out in the outer biofilm and forced into the inner biofilms. At higher organic loading rates, a stronger stratified microbial spatial distribution was observed, which imposed a severe internal oxygen diffusion limitation on nitrifiers and resulted in the deterioration of nitrification efficiency. Model simulations described a general trend of the stratified biofilm structure. However, the actual stratification was stronger than the simulated results. For implication in the reactor design, when the specific carbon loading rate exceeds a certain limit, nitrification will be deteriorated or require a long start-up period due to the interspecies competition resulting in oxygen diffusion limitation. The extend of microbial stratification in the biofilm is especially important for determination of feasibility of nitrification in the presence of organic matters.