

Parametric Study of a Washing Machine to Develop an Energy Efficient Program Regarding the Enhanced Washing Efficiency Index and Micro Organism Removal Performance

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Abstract : Development of Energy Efficient Programs (EEP) is one of the most significant trends in the wet appliance industry of the recent years. Thanks to the EEP, the energy consumption of a washing machine as one of the most energy-consuming home appliances can shrink considerably, while its washing performance and the textile hygiene should remain almost unchanged. Here in, the goal of the present study is to achieve an optimum EEP algorithm providing excellent textile hygiene results as well as cleaning performance in a domestic washing machine. In this regard, steam-pretreated cold wash approach with a combination of innovative algorithm solution in a relatively short washing cycle duration was implemented. For the parametric study, steam exposure time, washing load, total water consumption, main-washing time, and spinning rpm as the significant parameters affecting the textile hygiene and cleaning performance were investigated within a Design of Experiment study using Minitab 2021 statistical program. For the textile hygiene studies, specific loads containing the contaminated cotton carriers with *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* bacteria were washed. Then, the microbial removal performance of the designed programs was expressed as log reduction calculated as a difference of microbial count per ml of the liquids in which the cotton carriers before and after washing. For the cleaning performance studies, tests were carried out with various types of detergents and EMPA Standard Stain Strip. According to the results, the optimum EEP program provided an excellent hygiene performance of more than 2 log reduction of microorganism and a perfect Washing Efficiency Index (Iw) of 1.035, which is greater than the value specified by EU ecodesign regulation 2019/2023.

Keywords : washing machine, energy efficient programs, hygiene, washing efficiency index, microorganism, *escherichia coli*, *staphylococcus aureus*, *pseudomonas aeruginosa*, laundry

Conference Title : ICCCPPEB 2022 : International Conference on Chemistry, Chemical, Process Engineering and Biotechnology

Conference Location : Istanbul, Türkiye

Conference Dates : October 20-21, 2022