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Novel Sustainable Approaches for Complex Soil Removal in Cold Water

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PURPOSE OF THE ABSTRACT

The most significant environmental impact in the process of washing clothes is the energy used to heat the water in a washing machine. Life Cycle Assessment (LCA) shows that the biggest impact on CO2 emission by far is due to the water temperature selected when doing laundry, temperature accounts for up to 90% of the energy needed to do the wash load. Putting this into further perspective, if all wash loads in Europe were washed at 30°C as opposed to 40°C almost 3.5million tonnes of CO2 would be saved per year. Unremoved grease and body soils from fabrics are also a significant factor in customer dissatisfaction. This issue is exacerbated by reduced temperatures during the washing cycle as this contributes to the hardening of lipid-based soils and a drop in the efficiency of surfactants. Additionally, sebum can pose further difficulties due to its reattachment to the fibers during the washing. Improving soil removal at low temperatures without the need of increased surfactant concentrations can help reduce Scope 1 and Scope 3 emissions. Furthermore, preventing the sebum from reattaching to the fibers can also lead to better results from cold washing. Enzymes such as lipases and esterases are known to be used in detergents and have been the subject of much research in the past decades. However, such enzymes have certain limitations in terms of the range of lipids they can target not covering all the substrates present in grease. Targeting relatively minor but rate-limiting grease could provide a breakthrough in terms of the efficiency of cold washing. This project will focus on discovering novel, cold-adapted enzymes that can degrade sebum. Enzymes of interest will be identified from already sequenced psychrophiles and psychrophilic metagenomes. They will be cloned and over-expressed in E. coli and characterised to investigate their potential in a detergent. The structure of these proteins will also be solved to aide potential mutagenic studies to improve stability, activity or change specificity. The project will also explore the use of proteins as a textile surface modification technology in order to achieve soil release benefits on cotton through disrupting the ability of greases to penetrate cotton fibers thus enhancing cold water cleaning. The aim will be to provide surface coating only during the washing cycle after which the proteins would detach from the fabrics.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

Enzyme Discovery | Psychrophile | Biocatalysis

BIBLIOGRAPHY