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# Understanding Enzyme Mechanisms Under Low Moisture Conditions for Laundry Detergent Developments

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## PURPOSE OF THE ABSTRACT

It has long been understood that water is an essential requirement to maintain protein stability, mediate folding and aid catalysis. Although previous research has shown enzymes such as lyases or esterases can operate under low if not zero hydration, the overall understanding of how catalysis and folding occur with minimal water has not been thoroughly explored. In collaboration with Procter and Gamble, we aim to identify enzymes capable of degrading food stains on garments under low moisture conditions before washing. Therefore, reducing the need for long wash cycles at high temperatures whilst still maintaining effective stain removal. Successful stain removal from low moisture enzymes would not only be a break though, in the scientific laundry field, but the product developed using this technology will also aim to reduce carbon emissions from wash cycles and help save energy costs for consumers due to shorter washing time.

To distinguish enzymes that can catalyse reactions with water absent, their folding and active site mechanisms will need to be understood. We are going to understand the mechanism of these enzymes, dissecting the structure/activity relationship under these challenged circumstances. We will explore biocatalysts from microorganisms commonly known to function in low or dry conditions such as enzymes from xerophilic bacteria. To fully understand this catalytic mechanism, we are using organic solvents as starting point to mimic the low water conditions and screen for the right enzymatic activities. In addition, the structure and residues specific to this hydrophobic activity are being investigated using protein engineering and proteomics to identify which of the enzymes are surface-placed proteins in their respective xerophilic bacteria. Finally, in this project we face the challenge to develop the correct enzymatic assay. For that, we have targeted starch stains as this glycan has been shown to be highly concentrated in laundry baskets.

## FIGURES

### FIGURE 1

### FIGURE 2


## KEYWORDS

glycoside hydrolases | dry environments | sustainable detergents | enzymology


## BIBLIOGRAPHY