GLUTEN ALLERGENS REMOVAL FROM FOOD CONTACT SURFACES. PROTEASE AND AMYLASE INFLUENCE

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SUMMARY

This study investigates the effectiveness of enzyme-containing detergents to reduce gluten allergenicity on several surfaces previously contaminated with gluten-containing flour. Allergen quantification was conducted using **ELISA** analysis, evaluating the impact of enzyme-containing detergent solutions on the allergenicity of cleaned surfaces.

BACKGROUND

Food allergies (FA) are a significant public health concern worldwide, affecting approximately 8% of children and 10% of adults. Most frequent allergic reactions and anaphylaxis in patients with food allergies occur predominantly at home (50%) and are often related to pre-packaged products (48%) (Warren et al., 2024)

The implementation of **Allergen Control Plans (ACPs)** within **HACCP** systems is crucial, focusing on the prevention of cross-contact and the validation of cleaning procedures (Galan-Malo et al., 2017).

Despite recommendations on effective cleaning protocols, research on allergen removal methods, including the use of enzymatic detergents, remains insufficient. This study aims to evaluate **the effectiveness of surfactant solutions containing amylase and protease in the removal of gluten allergens from steel, silicone, and nylon surfaces** to improve food allergen control.

METHODS AND MATERIALS

MATERIALS

- Stainless Steel
- Silicone
- Nylon

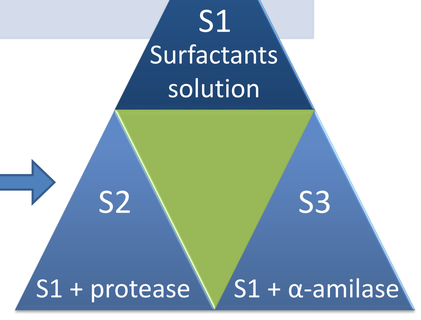
SURFACTANTS SOLUTION

- Buffer pH = 8
- Linear alkylbenzene sulfonate, 1 g/L
- Ethoxylated fatty alcohol (Findet© 1214N/23), 0.5 g/L
- Alkylpolyglucoside (Glucopon© 600CS), 0.5 g/L

SOIL

- Wheat flour (29% w/w in water, Harinera del Mar, Spain)

CLEANING SOLUTIONS



RESULTS

Figure 1 compares the allergens removal with S2 and S3 vs. solution S1, showing that formulations containing enzymes increase gluten removal. The detergent solution with protease (S2) is particularly effective, especially on silicone surfaces, where it achieves a relative residual allergenicity value of 1.0±0.5%. The solution with amylase (S3) is less effective, particularly on stainless steel and nylon. Protease enzymes are known to denature gluten proteins, breaking down gliadin and glutenin, reducing their size, and making them more soluble and easier to remove. Wheat gluten binds to proteases mainly through non-covalent interactions at specific sites, promoting changes in its molecular structure and intermolecular forces (Li et al., 2024). Recent research also shows that the presence of LAS increases the efficacy of proteolytic activity to effectively hydrolyse gluten (Fuciños et al., 2019), contributing to the remarkable effectiveness of S2 formulation.

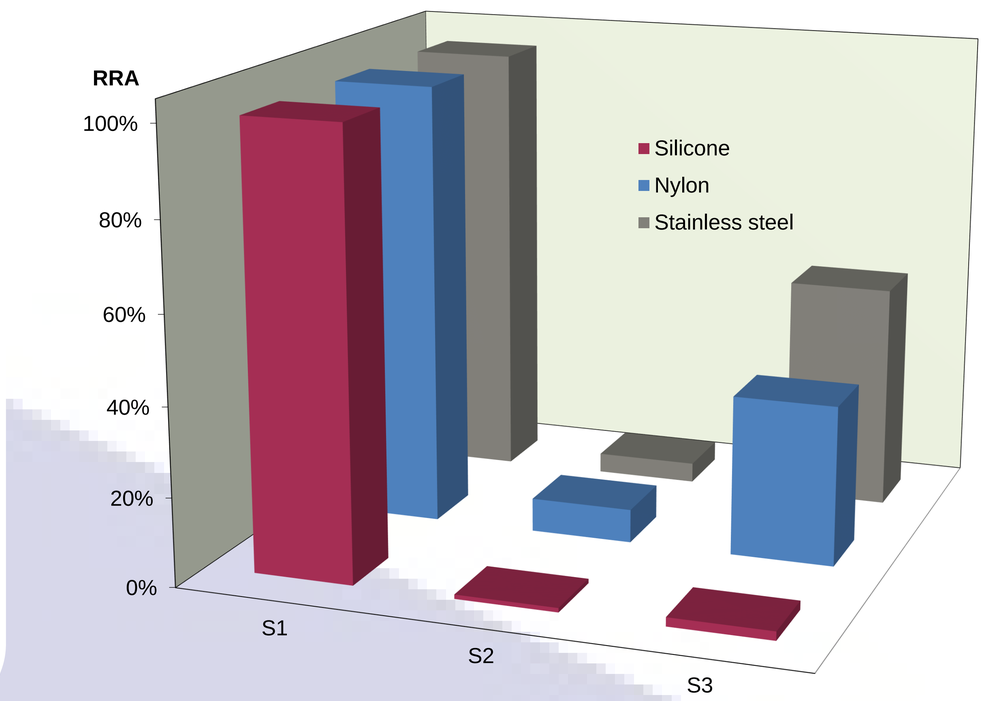


Figure 1. Influence of cleaning solutions (S1, S2, S3) in gluten allergens removal. RRA: ratio of the gluten mass per surface unit area after enzyme cleaning related to post-cleaning with the enzyme-free solution.

REFERENCES

- *Fuciños et al. (2019) Effectiveness of proteolytic enzymes to remove gluten residues and feasibility of incorporating them into cleaning products for industrial purposes. Food Research International. 120, 167-177.*
- *Galan-Malo et al. (2017) Detection of egg and milk residues on working surfaces by ELISA and lateral flow immunoassay tests. Food Control. 74, 45-53.*
- *Li et al. (2024) Insight into the solubilization mechanism of wheat gluten by protease modification from conformational change and molecular interaction perspective. Food Chem 447, 138992.*
- *Warren et al.(2024) The clinical burden of food allergies: Insights from the Food Allergy Research & Education (FARE) Patient Registry. World Allergy Organization Journal. 17:100889.*

CONCLUSIONS

The results demonstrated a significant gluten allergen reduction ability of detergents formulated with proteases or amylases on stainless steel, silicone, and nylon surfaces.

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