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Acrylamide reduction in fried potato slices and strips by using asparaginase in combination with conventional blanching

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In this research, acrylamide reduction in potato chips was investigated in relation to blanching and asparaginase immersion treatments before final frying. Potatoes slices (Verdi variety, diameter: 40 mm, thickness: 2.0 mm) were fried at 170 °C for 5 min (final moisture content of ~2.0 g/100 g). Prior to frying, potato slices were treated in one of the following ways: (i) Rinsing in distilled water (control I); (ii) Rinsing in distilled water plus blanching in hot water at 85 °C for 3.5 min; (iii) Rinsing in distilled water plus immersion in an asparaginase solution (10000 ASNU/L) at 50 °C for 20 min; (iv) Rinsing in distilled water plus blanching in hot water at 85 °C for 3.5 min plus immersion in an asparaginase solution (10000 ASNU/L) at 50 °C for 20 min; (v) Rinsing in distilled water plus blanching in hot water at 85 °C for 3.5 min plus immersion in distilled water at 50 °C for 20 min (control II). Blanching in hot water (ii) was almost as effective as asparaginase potato immersion (iii) in order to diminish acrylamide formation in potato chips (acrylamide reduction was ~17% of the initial acrylamide concentration). When potato slices were blanched before asparaginase immersion, the acrylamide content of the resultant potato chips was reduced considerably by almost 90%. We have demonstrated that blanching of potato slices plus asparaginase treatment is an effective combination for acrylamide mitigation during frying. It seems to be that blanching provokes changes in the microstructure of potato tissue leading to an easier and more effective diffusion of asparaginase.

On the other hand, par-fried potatoes of Bintje variety were prepared by cutting strips (0.8×0.8×5cm) which were blanched at 75°C for 10min. Unblanched strips were used as the control. Control or blanched strips were then dried at 85°C for 10 min and immediately partially fried at 175°C for 1min. Finally, frozen par-fried potatoes were fried at 175°C for 3min to obtain French fries. Pre-drying of raw or blanched potato strips did not generate acrylamide formation as expected. Partial frying of pre-dried control potato strips generated 370μg/kg of acrylamide and the final frying determined French fries with 2075μg/kg of acrylamide. When control potato strips were treated with a 10000 ASNU/l asparaginase solution at 40°C for 20min, the acrylamide formation in French fries was reduced by 30%. When blanched potato strips were treated in the same way, the produced French fries have 60% less acrylamide content than blanched strips without the enzyme treatment. Soaking of blanched potato strips (75°C, 10min) in an 10000 ASNU/l asparaginase solution at 40°C for 20min is an effective way to reduce acrylamide formation after frying by reducing the amount of one of its important precursors such as asparagine.