

Investigation of 3-APA in food and its relationship with acrylamide. Phase 1: Literature review

Area of research interest: [Chemical hazards in food and feed](#)

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Conducted by: Premier Analytical Services

Background

Recent studies have demonstrated that 3-aminopropionamide (3-APA) is a transient intermediate in acrylamide (AA) formation from thermally induced asparagine / carbohydrate systems (when the amino acid asparagine and sugars are subjected to high temperatures). Furthermore, it may also be formed during the storage of foods by an enzymatic decarboxylation of asparagine, and this mechanism may account for its occurrence in ware potatoes. The occurrence of 3-APA in foods is of concern because laboratory studies have shown that it can generate AA in relatively high yields (compared to asparagine) when heated. Hence foods that contain 3-APA and are subjected to additional thermal processing might be considered as an additional source of AA.

Research Approach

The initial review addressed the following: the occurrence of 3-APA in foods and foods at risk; the mechanism(s) of formation of 3-APA in foods and its relationship to acrylamide; the toxicological potential of 3-APA with particular reference to acrylamide; the likely impacts on consumer exposure to AA; methods of analysis for 3-APA; knowledge gaps and recommendations for further work.

Results

3-APA is a transient intermediate in acrylamide (AA) formation, it may also be formed during the storage of foods such as ware (fresh) potatoes by an enzymatic decarboxylation of asparagine, this mechanism may account for its occurrence in ware potatoes. The occurrence of 3-APA in foods is of concern because laboratory studies have shown that it can generate high levels AA when heated.

The literature review reported:

- On the basis of recent studies, 3-APA must be considered an important precursor of AA, including in some raw materials. However, data on 3-APA in foods is lacking. To date, chocolate, raw potatoes and roasted cocoa beans would appear to contain significant amounts
- The contribution of 3-APA in ware potatoes to AA generated (previously attributed to changes in sugar concentrations) has not yet been quantified
- It is not possible to assess toxicological potential of 3-APA with any confidence on the information currently available. But 3-APA is a potent precursor of AA and therefore its

presence in foods which might be subject to further thermal processing may be of particular interest

- Current methods of analysis for 3-APA require the formation of a stable sulfonamide derivate (using dansyl chloride) for detection by LC-MS/MS and appear to be applicable to a wide range of foods. The direct determination of 3-APA, also using LC-MS/MS, appears attractive and may also afford the simultaneous determination of AA. However, the latter methods have been developed for use with pure reference chemicals and have not yet been developed for more complex matrices

This review indicates some potential areas of interest for future work that could enhance the understanding of acrylamide formation and mitigation possibilities, particularly:

- the potential of 3-APA to contribute to acrylamide formation in food (such as stored potatoes) compared to formation from asparagine and sugars;

and of 3-APA in precooked foods to be a potential source of acrylamide in food that may be subject to secondary thermal processing (heating or cooking).

Research report

England, Northern Ireland and Wales

PDF

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